UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANISATION

EDUCATION AND INFORMATICS

PROCEEDINGS OF THE SECOND INTERNATIONAL CONGRESS

Moscow 96

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UNESCO INSTITUTE FOR INFORMATION TECHNOLOGIES IN EDUCATION

"THE ORGANISATION OF THE CONGRESS WAS CONDITIONED BY THE NECESSITY TO PROMOTE WIDE INTERNATIONAL CO-OPERATION IN ORDER TO REFLECT OBJECTIVES AND TO DEFINE VARIOUS NEEDS OF THE MEMBER STATES IN THIS FIELD, WHICH BECOMES MORE AND MORE SIGNIFICANT."

FEDERICO MAYOR
DIRECTOR - GENERAL OF UNESCO

R. MOREL
22.7.00

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

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CONGRESS

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UNESCO INSTITUTE
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PREFACE

TO THE SERIES OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

Information and scientific knowledge are the most important strategic resources of mankind progress on the eve of the third millenium. Informatization of education is a key condition for increasing the role and the influence of intellectual activities in transition of the world society from industrial to information era. This explains attention that is being given in the last years by governments, national and international organizations to the use of new information and communication technologies (NITs) in education.

In accordance with resolution 1.18 of the 27th Session of the General Conference (October-November 1993), the 2nd International Congress on Education and Informatics was organized and held by the UNESCO in cooperation with the Government of the Russian Federation. The key topic in the work of this Congress was *policy in the educational area and new technologies.*

The 1st UNESCO Congress "Education and Informatics", held in Paris in 1989 and focused on *Strengthening of international cooperation* in this field, underlined the need for *"using collective experience and joint exploitation of limited resources in the sphere of new information tecnologies in education"*. As a consequence, expansion of international cooperation was recommended in this area.

In the letter about the 2nd Congress, disseminated by the UNESCO head-quarter in January 1996, the UNESCO General Director F. Mayor pointed out that considerable progress achieved in the last few years in information and communication technologies resulted in a quick change of computer hardware and software generations and their merging, in an innovatory manner, with other technologies. As a result, unprecedented combinations of information facilities have emerged, which have led to the formation of "information community". The appearance of "information supermains" calls for the critical revision of the state of the art and perspectives of development of education systems, which is particularly needed due to the leading development of technologies as compared to the possibilities of their application in education of all levels.

No country, even that with the most advanced education system, is able alone to cope effectively with problems involved in education at the threshold of the 21st century. The UNESCO Congress contributed to the development of international contacts in the education sphere, as well as correction and coordination of national education systems. The main topic of the Congress was *the problem of national and international policy in the field of education based on new information technologies and the choice of organizational and technological forms of implementation of this policy.*

The modern strategy in education is being built with regard for new educational technologies and legal and legislative principles which form the basis for particular decisions and results. As a consequence, the word "education" in the Congress name was put at the first place.

Since the organizers of the Congress proceeded from the priority of education, it is not by accident that Russia, with its internationally recognized achievements in education, was chosen as a country to hold the Congress. At the Moscow Congress Russia represented not only the country-organizer of this global meeting, but also one of the most advanced countries in the field of education and application of new technologies for education development.

The Moscow Congress was preceded by great organizational work related, in particular, to the determination of the team of participants and observers, invited lecturers to appear at plenary sessions and commission meetings, and preparation of reports and abstracts.

The Congress became an extraordinary event in the life of the world society, an international forum for discussing and solving the problems of education and informatics, which will determine in many respects the pathways of mankind in the 21st century. At the same time, it became a marked event in the life of Russia and the Russian education system and an important step on the road to integration of the world education systems.

More than 1200 representatives of governments, science and business from many countries, specialized UN institutions, government and non-government international organizations took part in the Congress. Researchers, professors and lecturers from educational institutions, representatives of industry, experts on informatics and communications engaged in using NITs in education were among the participants of the Congress.

The plenary sessions, commission meetings, and seminars of practical education were devoted to analysis of national, regional, and international achievements and experience in introducing and using NITs in education systems. New developments in the sphere of NITs and their use in education systems were examined; international, regional and national policies in the use of NITs in the education sphere were discussed, and recommendations for international cooperation were given. Success of the Moscow Congress helped to reach the agreement between the UNESCO and Russia on joint work in organization and development of two important institutions - the World Technological University and the UNESCO Institute for Information Technologies in Education.

The work of the Congress was conducted under the program and along the lines suggested by the International Program Committee (IPC) and the Russian Organizing Committee (ROC).

Each day of the Congress work started with a plenary session at which the invited lecturer made the main report on the predetermined theme. This main report was followed by other reports in three Commissions where the following basic themes were discussed:

- *Commission I:* Trends and experiences in the introduction and application of ICTs in education systems;
- *Commission II:* Latest developments in ICTs in education;
- *Commission III:* Cooperation for the use ICTs in education.

Outstanding scientists - experts in education and informatics - were chosen by the UNESCO as the Chiefs of Commissions: Director of Higher School of Foreign Languages Katerina Martcheva (Bulgaria); President of the French National Commission on Intergovernment Programs on Informatics Pierre Mathelot (France); Coordinator of the UNDP/UNESCO project, representative of the Computerized Information Systems Co., Dr. Mohamed Noor Burhan (Syria). Prominent scientists and specialists from many countries were invited to participate in discussions.

The following topics were discussed at the Commission meetings:

- *Policy:* Development of national plans, strategies for changes on the level of educational institutions, strategies for developing perspective plans and programs;
- *Technologies:* Informatics, computerized education, and "traditional" education technologies, multimedia and telematics;
- *Teachers:* Modern practice in using new technologies, training and improvement of professional skill of teachers, their new role in education;
- *Students:* Educational facilities, new role of students, new education methods in educational institutions;
- *Social, economic, and cultural aspects* of using new information technologies;
- *Through themes:* Permanent, open, and distant education; estimation of the influence of NITs; the UNESCO and international cooperation.

It should be noted that the priorities of the above-listed topics have been changed in the course of discussion of these topics: the problems of using NITs by students and teachers were put at the first positions; the second place was given to the development and application of education technologies; social, economical, and cultural aspects of the problem moved to the third place; and the fourth position was given to strategy in the sphere of education and new technologies. Of all through themes only those relating to international cooperation were left because the remaining questions could be effectively treated as part of other themes. As a result, in the Congress Recommendations the themes were arranged in the following order:

- *Theme 1:* Students;
- *Theme 2:* Teachers;
- *Theme 3:* Technologies;
- *Theme 4:* Social, economic, and cultural issues;
- *Theme 5*: Educational Policies;
- *Theme 6:* International Cooperation.

This order was also followed in preparation of the Congress Proceedings for publication.

Along with plenary sessions and commission meetings, 12 seminars of practical education were held at the Congress. Their participants discussed the following topics:

- Information super high way and education (*Part I:* Perspectives and issues of development of worldwide and regional unified information systems for education; *Part II:* From information literacy toward information culture);
- Psychological and pedagogical effects and medical implications of using modern information and communication technologies;
- Program environment: perspectives of active use;
- Knowledge and experience transfer with the use of information and telecommunication technologies;
- National policies in the sphere of technological transfer;
- Individual distant education;
- Analysis of UNESCO/IFIP (International Federation for Information Processing) documents published in 1994-1995 (*Part I:* Informatics for secondary education; *Part II:* Module educational program on informatics);
- Logic, informatics, and education;
- Information technologies and humanitarian education;
- Development of primary and secondary education with the use of modern information technologies and distant education methods;
- Medicine: new approach to gaining and improving knowledge;
- Formation of integrated worldwide database systems and knowledge on planets of the Solar system and their use in research works and education.

The chiefs of seminars were well-known scientists, teachers, and organizers of education. Among them were: David Walker (Great Britain), adviser; Peter Waker (South Africa), adviser in the Interware Co.; Alain Meyer (France), Director of the Teleeducation Center of the National Conservatorium of Arts and Skill; Tom van Weert (the Netherlands), Director of the School of Informatics at the Mathematics and Informatics Department of the University of Nijmegen; Harald Schütz (Germany), researcher in the Deutsche Welle Internet Co.; K.K. Kolin (Russia), First Vice-Director on Science in the Institute of Informatics, RAS; Yu.N. Afanasiev (Russia), Rector of the Russian State University of Humanities; A.L. Semenov (Russia), Vice-Chairman of the Moscow Education Department, Head of the Moscow Institute for Improvement of Professional Skill of Education Specialists; N.N. Evtikhiev (Russia), Rector of the Moscow Staten Institute of Radio Engineering, Electronics and Automation; Yu.I. Ivlev (Russia), Head of the Logic Department of the Philosophical Faculty of the Moscow State University.

The directions of work of the Moscow Congress and topics listed above show how extensive and diverse was the spectrum of problems examined at the Congress, while the names of the Commission and Seminar Chiefs and participants of discussions indicate its high scientific, political and organizational level.

In parallel to the Congress, the International Exhibition - Fair was organized where the most recent exhibits in the area of new information technologies were shown: training systems, education and methodical complexes, multimedia technologies, programs and courses for distant education, telecommunication facilities and technologies of global computer networks, information filling of servers, etc. 80 educational organizations and 24 firms, including leading computer companies such as IBM, Apple, Novell, Oracle, Informix, took part in the exhibition. It demonstrated the efficiency of using NITs in education and high rate of NIT development in Russian institutes of higher education.

The 2nd International Conference on Distant Education (under the title "Open and Distant Education - Strategy of Development" was confined to the Moscow UNESCO Congress. It was organized by the International Education Association and the International Council on Distant Education and supported by the Higher Education State Committee and the Russian Ministry of Science and Technoly Policy. The main objective was to discuss the role of distant education in modern society and the main trends in its development.

The time of the Congress work coincided with the 50-year anniversary of manufacturing the first computer. The international symposium "50 years of information era" held simultaneously with the Moscow Congress was devoted to this remarkable event. This symposium was organized by the Pennsylvania university (the USA), The International Trustee Foundation of the Tsiolkovskii State University of Aviation Technology, the Russian Academy of Sciences, the State Committee for Higher Education, and the Information Policy Committee with the President of the Russian Federation. Participants of this symposium discussed a 50-year history of informatization and the use of information systems in education, industry, aerospace technology, and in the life of various countries.

All above-listed undertakings allowed participants of the Congress, in spite of rather dense schedule, to become acquainted with latest achievements of various countries, including Russia, in the fields to which the Congress was devoted - education and informatics in their interplay.

A great many documents, reports, communications, abstracts, and other materials worked out and obtained as a result of the Congress work are of prime importance for the world community. It was recognized necessary to issue these materials as a series of the Congress Proceedings.

The Russian Organizing Committee, in accord with the UNESCO Secretariat, entrusted analysis, selection, and preparation of the Congress materials for publication to the International Center of Systems Analysis of Higher Education and Science Problems (the UNESCO associated center), the head organization on the Russian side, which provided preparation and work of the Moscow Congress. The result of the Congress work will be the volumes of the Congress proceedings prepared in the three official Congress languages of the Congress- English, French, and Russian. These volumes will include the following materials:

- Volume I. *GENERAL DOCUMENTS OF THE CONGRESS;*
- Volume II. *NATIONAL REPORTS*;
- Volume III. *REPORTS AND SPEECHES*;
- Volume IV. *REPORTS' THESES* .

The arrangement of materials in these volumes will comply with the above basic topics of the Congress.

Because materials of these volumes had initially a different degree of readiness for publication, each volume will be issued as the work on particular volume is completed.

I express my conviction that the materials published will be of great interest for all persons engaged in the education sphere and in the use of information and communication technologies.

I would like to underline the importance of the publication of these materials in view of the fact that the Moscow Congress is by no means the last one and all the materials will therefore provide a good basis for organizing the next UNESCO congresses.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE
FOR THE 2nd INTERNATIONAL CONGRESS
"EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION
OF THE RUSSIAN FEDERATION,

V. G. KINELEV

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL CONGRESS

VOLUME I

GENERAL DOCUMENTS OF THE CONGRESS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 1st VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the 1st volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics", held in Moscow, on July 1-5, 1996.

This volume includes, first, the main documents prepared by the Congress organizers before the onset of the Congress, which served as a basis for its organization. These documents were then distributed among the Congress participants and formed the basis for discussion and decision making. Second, the volume incorporates two main documents: Declaration and Recommendations worked out by the Congress *as a result* of its work. And third, the volume contains the UNESCO Final Report in which *the content and main results* of the Congress work are presented in the concentrated form.

The Final Report on the Congress work, prepared in the complete form by the UNESCO Secretariat and published as an independent document, consists of two parts: (1) the main part (preface, introduction, brief account of the content and results of the work of Commisions and seminars, appearances at the Opening and Closing Ceremonies and at the first and final plenary sessions); (2) 12 Appendices including the aforementioned materials prepared before the Congress onset and adopted as a result of its work, as well as the lists of participants and observers.

The editors considered it necessary to include in the 1st volume only the main part, without Appendices, because the latter entered the volume as independent documents.

The lists of participants are given in this volume in the same form as in the Final Report: separately presented is the list of participants from all countries except Russia and separately the list of Russian participants and observers.

When forming these lists, we met with certain problems in translating names and surnames of participants and titles of organizations from one language to another. To simplify the edition, the lists of participants in the French version of the volume are given in the English language.

The significance of the Moscow Congress as a representative international forum called to outline the pathways for education development and to find the possibilities of using new information technologies in this area was underlined in the greetings to the Congress participants received from the UNESCO General Director F. Mayor and the President of the Russian Federation B.N. Yeltsin.

Two basic documents - the Main Working Document and the Congress Program - constituted the system-forming basis for preparation and work of the Moscow Congress. Both documents were prepared by the International Program Committee which included outstanding experts in the field of education and informatics from various countries and continents (The list of the members of this Committee is given in this volume.) These documents have been discussed at four regional meetings of experts: at Austin (Texas, USA) for countries of North and South America and Caribbean region; for European countries at St. Petersburg and for Asian and Pacific Ocean countries at Vladivostok (Russia), and at Dakar (Senegal) for African countries. Also, six subregional meetings were held from 1991 to 1996: at Harare (Zimbabwe, 1993); Yalta (Ukraine, 1994); Enschede (the Netherlands, 1994); Sofia (Bulgaria, 1994); Moscow and Novosibirsk (Russia, 1991 and 1996).

Participants of these forums put forward their suggestions concerning the organization and work of the Congress and the content of the Main Working Document and the Congress Program. These documents represent, therefore, the result of cooperative effort of many researchers, professors and lecturers, teachers and specialists in information and communication, and representatives from industry.

In the opinion of compilers of this volume, the Report on Basic Lines in the UNESCO activity in the field of education and information in the time elapsed from the First International Congress on Informatics and Education held in Paris in 1989 is of special interest. This report summarizes the work performed by the UNESCO in collaboration with relevant national and international organizations, agencies and professional associations along the following lines:

- Introduction of information technologies in schools, universities, and institutes of informal education;

• Information technologies and the role of teachers;

• Progress of informatics in education;

• Information technologies as a means of education control;

• Information technologies for developing distant and open education.

This Report is of interest, first of all, because its content is in full agreement with some lines in the work of the Moscow Congress and because it enables one to estimate progress achieved by the world society over the period between the two congresses.

The volume also incorporates the "Analytical Review of the Problem "Education and Informatics (Concepts, Current State, Perspectives)" prepared for organizers and participants of the Congress by the group of independent experts - specialists from Russia in this field. This review presents different views of the problems discussed at the Congress. It follows logic in constructing the theme of the Congress and examines the current state of the subject in Russia as compared to other countries in the directions corresponding to the theme of this international forum. Based on their own experience and taking into account the available native achievements, the authors of this review put forth their viewpoint on each line in the work of the Congress.

Proceeding from common principles in forming the volumes of the Congress Proceedings, the compilers and editors attempted to preserve, where possible, original texts and avoided, as a rule, editorial corrections and, moreover, corrections in the content. At the same time, some lingual nuances, which were difficult to circumvent, are possible in the issue of materials in the three official Congress of the languages - English, French, and Russian.

The editors will be grateful to authors and readers for amendments and suggestions. Your references will help to continue the discussion started at the Congress, to unify terminology and concepts, and to increase exchange of information in this area. The importance of publication of these materials is also determined by the fact that this Congress is by no means the last one and all materials will serve as a good basis for organizing future UNESCO congresses on education and informatics. They can be a great help in the build-up of the UNESCO Institute for Information Technologies organized in Moscow in accord with the Congress recommendations.

Analysis, selection, and preparation of this volume for publication were carried out by the UNESCO Institute for Information Technologies in Education and by the International Center of Systems Analysis of Higher Education and Science Problems (The UNESCO associated center). References, notices and suggestions from our readers will be accepted with thanks by the Editorial Board. They should be sent to the Center's address: 117918, Moscow, GSP-1, Mal. Kaluzhskaya ul. 1, The Center's General Director, Academician of the Russian Education Academy, Manushin Eduard Anatol'evich.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE
FOR THE 2nd INTERNATIONAL CONGRESS
"EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION
OF THE RUSSIAN FEDERATION,

V. G. KINELEV

ADDRESS

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

BY **COLIN N. POWER**
ASSISTANT DIRECTOR-GENERAL
FOR EDUCATION, UNESCO

Mr. Kinelev,
Mr. Sadovnichy,
Professor Bauknecht.
Distinguished Participants,
Ladies and Gentlemen,

It is a great pleasure for me to welcome you to this Congress, the Second International Congress on "Education and Informatics", on behalf of the Director-General of UNESCO, Mr. Federico Mayor.

Very sadly he is unable to be here and so I am now filling in for him. Yesterday in Guatemala and El Salvador he became ill and, unfortunately, cannot be with you. He very much wanted to show his solidarity with the people of Russia at this historic point in their history and also his solidarity with the countries and the organizations represented here.

As you know, he has a deep interest in the theme of this Conference and is committed to ensure that all have access to knowledge and information, scientific, technological, for the benefit of all. UNESCO is devoted to the promotion of the sharing of expertise and knowledge.

It is indicative of the worldwide interest in the new information and communication technologies that we have approximately 1,000 participants and observers at this conference, representing 70 Member States of UNESCO, many UN organizations, intergovernmental and nongovernmental organizations and the private sector which produces the hardware and the educational software we need to make our dreams of an enriched learning environment for all a reality.

As you know, the first International Congress on 'Education and Informatics' was organized in 1989 at UNESCO's Headquarters, in Paris. It was one of my first duties as Assistant Director-General for Education to oversee the planning and development of that Congress. In the seven years that have passed, tremendous developments have taken place in the information and communication technologies. Indeed, it is a measure of the rapidity of these changes that terms such as the Internet and the World Wide Web were not even mentioned during the first Congress.

The function of this morning's session is to open this conference, so I will not give a long speech. But I do want to suggest that the new information technologies present us with a formidable challenge to our sense of equity, justice and of solidarity around the world. It is important to note that UNESCO's international congresses are truly international, that is, they include representation from the poorest countries in the world as well as the richest, those who do not have access to the technologies as well as those who are at their cutting edge. It provides us, then, with an unrealized opportunity for the sharing of knowledge and for promotion of understanding between peoples and of cultures.

It is appropriate that this Congress should be taking place in Russia with its long and distinguished tradition of scientific and technological development and of education. In this connection, I would wish to reiterate the tribute which the Director-General paid to the Government of the Russian Federation at the ceremony in Moscow, last April, on the centenary of the birth of the chemical physicist Nikolai Semenov, and assure the Russian Federation of UNESCO's continuing support for its efforts to preserve and to develop Russia's outstanding scientific, technological and intellectual heritage. The Director-General asked me to inform you that he is following with great admiration the process of democratization here in Russia, which is liberating the moral and intellectual potential necessary for the development of the country and of a culture of peace throughout this world. Education is essential to this democratization process, to development and to peace. The new information technologies, equitably shared and properly employed, can enhance the potential of education to shape a broader future for us all.

I wish to conclude by expressing once again our gratitude to the host country for its leadership and for the impeccable preparation of this conference, and to the Moscow State University for generously agreeing to host it. I should pay tribute as well to the International and the Russian Organizing Committees of the Congress, and especially to you, Mr. Kinelev, for the enormous efforts which you personally have put into the preparation of this very large and complex conference. It is now up to us, Ladies and Gentlemen, to ensure that the Congress does provide us with guidelines for the policies and the actions needed in order to ensure that the new information technologies serve the cause of lifelong education for all, which is the central platform of UNESCO's programme.

Thank you.

ADDRESS

TO THE PARTICIPANTS OF UNESCO'S SECOND INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

I warmly welcome the participants to UNESCO's Second International Congress on Education and Informatics, which is now opening in Moscow.

You represent the governments and scientific and business communities of many countries, United Nations Specialized Agencies and other international organizations. I am convinced that such a representative forum will be able to indicate how to develop education and identify opportunities for using new information technologies in this field.

The Congress has particular resonance because it is taking place on the cusp of two centuries and two millennia. The decisions taken today will influence the lot of humanity in the future.

It is significant that your intellectual forum is working under the auspices of UNESCO. This international organization has rightly earned respect for its substantial contribution to consolidating the efforts of education, science and culture professionals and creating the conditions for the sustained development of the world community.

I would like to wish the participants in the Congress good luck and success in their valuable work, and peace and prosperity to their countries and peoples!

BORIS YELTSIN

PRESIDENT
OF THE RUSSIAN FEDERATION

GENERAL INFORMATION

ON THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

INTRODUCTION

In accordance with Resolution 1.18 of the twenty-seventh Session of the General Conference (October-November 1993), UNESCO, in co-operation with the Russian Federation, will organize its Second International Congress on ***Education and Informatics*** *- Educational Policies and New Technologies (EI'96) to be held in Moscow from 1 to 5 July 1996. The first Congress, which was held in 1989 at the UNESCO Headquarters, stressed the need 'to benefit from collective experience and the sharing of scarce resources in the field of new information technologies (NITs) in education' and, to this effect, recommended that international co-operation be strengthened.*

Today co-operation is even more needed than ever before. In recent years, remarkable development has taken place in information and communication technologies, whereby hardware and software 'generations' have rapidly succeeded each other and, in a most innovative manner, converged with other technologies. Unforeseen media combinations have emerged to shape the 'information society' and to challenge those living in it. In the midst of the 'information superhighways', education is challenged to re-examine its position critically, especially since technologies seem to develop faster than education has capacity to make use of them.

OBJECTIVES

The Congress, which offers an international forum to discuss the future of education and informatics, will *analyse* national, regional and international trends and experiences in the introduction and use of NITs in educational systems, *review* the latest developments in NITs and *examine* their application in education: *discuss* international, regional and national policies for the use of NITs in education; and *make recommendations* for international co-operation.

OUTPUTS

As results of its work, the Congress is expected to produce:

- a general declaration or manifesto;
- recommendations to Member States and to the Director-General of UNESCO;
- proposals for regional and international co-operation.

PROGRAMME AND THEMES

The Congress will pursue its objectives through the following programme and themes proposed by the International Programme Committee (I PC) in co-operation with the Russian Organizing Committee (ROC).

Each Congress day will begin with a *plenary session* in which a *keynote speaker* makes the main presentation on the chosen theme, followed by presentations and discussions in three commissions with the following general orientations:

- *Commission 1:* Trends and experiences in the introduction and use of NITs in educational systems:
- *Commission II-.* Latest developments in NITs and their application in education:
- *Commission III:* Policies and co-operation for the use of NITs in education.

The themes proposed to be discussed in the *commissions* include:

- *Policies* (Developing National Plans. Strategies for Change at Institutional Level, Strategies for a Future-Proofed Curriculum):
- *Technologies* (Computer Science, Computer Enhanced Instruction and "Traditional" Educational Technologies, Multimedia and Telematics);
- *Teachers* (Current Practices with New Technologies, Pre- and In-service Teacher Training, New Roles for Teachers):
- *Learners* (Learning Tools, New Roles for Learners, New Options for Learning inside and outside Educational Institutions):
- *Social, Economic and Cultural Issues*
- *Transverse Themes* (Lifelong, Open and Distance Learning, Measuring the Impact. UNESCO and International Co-operation).

The themes proposed for the *workshops* on 4th and 5th July 1996 include:

- Information Superhighways and Education;
- Medical and Psychological Consequences:
- The Software Environment - a Perspective for Effective involvement:

	1 July	2 July	3 July	4 July	5 July
9:00-10:30	**Opening**	**Theme 2** *Plenary*	**Theme 4** *Plenary*	**Theme 6** *Plenary*	**Workshops**
10:30-12:30	*Plenary* Keynote speeches	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	Demonstrations, exhibitions, visits
12:30-14:00	**L**	**U**	**N**	**C**	**H**
14:00-15:30	**Theme 1** *Plenary*	**Theme 3** *Plenary*	**Theme 5** *Plenary*	**Workshops**	*Plenary* Closing speeches Declaration and Recommendations **Closure**
16:00-18:00	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	Demonstrations, exhibitions, visits	

- Transfer of Knowledge and Skills through Information and Communication Technologies;
- National Policies - Transfer of Technologies:
- individual Distance Training (for the French-speaking countries):
- Analysis of UNESCO/IFIP documents, published by UNESCO in 1994-1995:
  - Informatics for Secondary Education *(A Curriculum for Schools);*
  - A Modular Curriculum in Computer Science.

PARTICIPANTS AND OBSERVERS

As is common for international congresses of Category IV, UNESCO will invite the participants and observers in their personal capacity, at the proposal of its Member States, representatives/observers of UN specialized agencies, other intergovernmental organizations, international non-governmental organizations, professional associations, as well as public and private institutions working in related fields. The participants and observers will include decision-makers, researchers, teacher trainers, industrial trainers, university professors, teachers and information and communication specialists interested in the application of NITs in education. In conformity with the regulations for international congresses, the participants and observers are expected to cover their travel and accommodation expenses. The Russian Organizing Committee will make arrangements through Aeroflot, the designated official carrier for the Congress, for reduced air fares. The participants will also benefit from reduced hotel room prices.

EXHIBITION

In conjunction with the Congress, a major exhibition will be organized, in which ministries educational institutions, research centres, publishers, as well as private companies involved in the development and application of NITs in education are welcome to participate. Those interested in presenting their projects or products at the exhibition are invited to contact the Secretariat of the Russian Organizing Committee (see address on p. 3).

LANGUAGES

Simultaneous interpretation in three languages (English, French, and Russian) will be available for the plenary and commission sessions.

PREPARATORY CONFERENCE AND EXPERT MEETINGS

In preparation for the Congress, the following conference and expert meetings are scheduled: a conference in Novosibirsk (19-22 March 1996, in the Russian language), and regional expert meetings, namely, in Austin (Texas, USA, 9-1101.1996) for North and Latin America as well as for the Caribbean countries: in St. Petersburg (25-26.02.1996) for the Europe Region: in Vladivostok (10-1405.1996) for Asia and Pacific countries, and in Dakar (March 1996) for Africa.

SIR/MADAM,

UNESCO is pleased to invite you to participate in the preparation of the above Congress by:

- *Commenting on the proposed programme of the Congress:*
- *Proposing candidates for keynote speakers so as to allow the International Programme Committee to select from a wide geographical representation.*
-

The comments and proposals should reach the UNESCO Secretariat by 15 February 1996.

- *Preparing a National Report (maximum 20 pages on a floppy disk) which should give an overview of the state-of-the-art of NITs in your educational system, including priorities in your national plan concerning the introduction of NITs in various forms and at various levels of education (primary school, secondary school, higher education, teacher/instructor training, industrial training and retraining etc.): the level of computer hardware and software provision, including in educational administration: any policy towards standardisation; the use made of broadcast technologies in education; the factors limiting progress in the adoption of new technologies in education, including insufficient numbers of trained staff, any inadequacy in the infrastructure of service utilities (electricity supply, broadcasting, telephone services, telematics etc.): participation in international programmes concerning the use of NITs and the benefit you may derive from it.*

Your National Report should reach the UNESCO Secretariat by 15 March 1996.

- *Preparing a paper which might be selected to be presented as a contribution to the discussions in the commissions. The paper should be prepared on a floppy disk and should not exceed five pages.*

The paper should reach the UNESCO Secretariat by 31 March 1996.

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PROGRAMME

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

TIMETABLE

	1 July	2 July	3 July	4 July	5 July
9:00- 10:30	**Opening**	**Theme 2** *Plenary*	**Theme 4** *Plenary*	**Theme 6** *Plenary*	**Workshops**
10:30- 12:30	*Plenary* Keynote speeches	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	Demonstrations, exhibitions, visits
12:30- 14:00	L	U	N	C	H
14:00- 15:30	**Theme 1** *Plenary*	**Theme 3** *Plenary*	**Theme 5** *Plenary*	**Workshops**	*Plenary* Closing speeches Declaration and Recommendations **Closure**
16:00- 18:00	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	*Commissions* I II III Presentations Discussions	Demonstrations, exhibitions, visits	

MONDAY, 1 JULY 1996

9.00-10.25 hrs. - Opening Ceremony (Grand Hall)

Addresses by:

- Mr. Vladimir G. Kinelev, Deputy Chairman of the Government, Chairman of the State Committee for Higher Education of the Russian Federation
- Mr. Colin N. Power, Assistant Director-General for Education of UNESCO
- Mr. Kurt Bauknecht, President, International Federation for Information Processing
- Mr. Armando Rocha Trindade, President, International Council for Distance Education
- Mr. Viktor A. Sadovnichy, Rector, Moscow State University

10.25-10.30 hrs.- Break

10.30-12.30 hrs. - Plenary (Grand Hall)

- Election of the President
- Adoption of the Rules of Procedure
- Election of the other members of the Bureau and members of the Drafting Group
- Keynote speakers:
- Mr. Vladimir G. Kinelev, Deputy Chairman of the Government, Chairman of the State Committee for Higher Education (Russian Federation), *Education and Civilization*
- Mr. Colin N. Power, Assistant Director-General for Education (UNESCO), *New Perspectives for Learning in the Information Age*
- Dr. Norio Matsumae, President, Tokai University (Japan), *New Directions in Education*

12.30-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - Plenary (Grand Hall)

Theme 1: Learners

Speakers:

• Acad. Blagovest Sendov, President of Parliament (Bulgaria), *Learners in a Global Knowledge Space: Towards Global Wisdom*

• Mr. Tahar Hafaied, Directeur, Institut National de Bureautique et Micro-Informatique (Tunisia), *Training in the Context of New Information and Communication Technologies*

15.30-16.00 hrs.- Break

16.00-18.00 hrs.- Commissions:

Commission I: Room 01 - Main Building of Moscow State University

Theme 1.1

Speakers:

• Prof. Sergei S. Goncharov, Deputy Director, Research Institute for the Mathematical and Informational Basis of Education (Russian Federation), *Peculiarities of Usage of New Information Technologies in Secondary and University Education*

• Mr. Francis Moret, Centre Suisse de Technologie de l'Information dans l'Enseignement (Switzerland), *Compulsory Education and the Secondary Level*

Discussion:

• Prof. Yasen N. Zasursky (Russian Federation)

• Dr. Mohamad Noor Burhan (Syria)

• Prof. Gia G. Gvaramia (Georgia)

Commission II: Room 02 - Main Building of Moscow State University

Theme 1.2

Speakers:

• Mr. Predrag Pale, Deputy Minister of Science, Ministry of Science and Technology (Croatia), *Can Education Save the World?*

• Mrs Yaffa Vigodsky, Head of Division, Ministry of Education, Culture and Sport (Israel), *Tomorrow '98: The Computerization of the Educational System*

Discussion:

• Prof. Yuri A. Pervin (Russian Federation)

• Mr. Alain Chaptal (France)

Commission III: Room 611- Main Building of Moscow State University

Theme 1.3

Speakers:

• Mrs. Anne Marrec, Directrice générale, Téléuniversité (Canada), *The "Neurone-Student" in a Reconfigured Education System*

• Mr Peter Baumgartner, Institute for Interdisciplinary Research and Further Education (Austria), *Evaluation of Technology-Based Learning. A Social Science Approach to Quality Assurance in Education*

Discussion:

• Prof. Viktor A. Bolotov (Russian Federation)

• Mr. Tamás Káldi (Hungary)

TUESDAY, 2 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 2: Teachers

Speakers:

• Mr. Kunming Qian, Deputy Director, Distance Education Center of Central TV University (People's Republic of China), *New Information Technology and Teachers*

• Prof. Alexei L. Semenov, Vice-Chairman, Moscow Department of Education (Russian Federation), *The Teacher in a National and Regional Perspective of the Informatization of Education*

10.30-11.00 hrs. - Break

11.00-13.00 hrs. - Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 2.1

Speakers:

• Dr. Betty Collis, Faculty of Educational Science and Technology, University of Twente (The Netherlands), *Teachers and Telematics: Lessons from Experience with Computer Implementation*

• Mr. Gérard Lisée, Président, Comité exécutif de STÉFI, Université de Montréal (Canada), *Development and Experimentation of Education Services Using Information Superhighway Infrastructures*

Discussion:

• Dr. Sergei A. Khristochevsky (Russian Federation)

• Prof. Bengt Bengtsson (Sweden)

Commission II: Room 02 - Main Building of Moscow State University

Theme 2.2

Speakers:

• Prof. Jenny Sendova, Institute of Mathematics and Informatics (Bulgaria), *Enhancing the Teacher's Creativity by Exploratory Computer Environments*

• Mr. David A. Thomas, Montana State University (USA), *Internet-based Inservice Teacher Training in Montana*

Discussion:

• Acad. Alexander A. Samarsky (Russian Federation)

Commission III: Room 611- Main Building of Moscow State University

Theme 2.3

• Mr. A.Y. Montgomery, Head of Department, Royal Melbourne Institute of Technology (Australia), *Development of "Multi Media" Teaching and Learning Environments*

• Prof. Paul Resta, Director, Learning Technology Centre, University of Texas at Austin (USA), *Building a Community of Learners: New Tools for Collaborative Learning*

Discussion:

• Mr. Yves Brunsvick (France)

• Prof. V. L. Matrosov (Russian Federation)

13.00-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - Plenary (Grand Hall)

Theme 3: Technologies

Speakers:

• Prof. Jean-Pierre Arnaud, Conservatoire National des Arts et Métiers (France), *Which Technologies for Education? New Education Technologies at the Time of Deployment*

• Mr. Rockley L. Miller, President, Future Systems Incorporated (USA), *A Matter of Mathematics: The Impact of Moore's Law on the Future of Education, Training and Global Communication*

15.30-16.00 hrs.Break

16.00-18.00 hrs.Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 3.1

Speakers:

• Prof. Sandra Wills, Director, Educational Media Services, University of Wollongong (Australia), *Interface to Interactivity: Technologies and Techniques*

• Dr. Hartmut Grebe, Consultant (Germany), *Is Technology the Answer for Our Changing Educational Means? Yes, but only If...*

Discussion:

• Acad. Oleg M. Belotserkovsky (Russian Federation)

• Dr. Gerhard Eisfeld (Germany)

Commission II: Room 02 - Main Building of Moscow State University

Theme 3.2

Speakers:

• Prof. Dines Bjørner, Director, International Institute for Software Technology, UN University, *Teaching the Laws of Informatics and Its Applications*

• Prof. Igor A. Mizin, Director of the Institute of Problems of Informatics, Academy of Sciences (Russian Federation), *Present and Future Trends in the Development of Telecommunication Technologies in the Field of Education and Science*

Discussion:

• Prof. Ivan N. Pustinsky (Russian Federation)

• Mr. Eric Garnier (France)

Commission III: Room 611- Main Building of Moscow State University

Theme 3.3

Speakers:

• Dr. Ella Kiesi, Head of the Unit of Educational Technology, National Board of Education (Finland), *Regional Co-operation in the Construction of Information Networks*

• Dr. Alexei M. Dovgyallo, Deputy Director, UNESCO/IIP Research and Training Centre, V.M. Glushkov Institute of Cybernetics of the Academy of Sciences (Ukraine), *Communication and Information Technologies Infrastructures in a Country in Transition*

Discussion:

• Dr. Valery A. Vasenin (Russian Federation)

• Prof. P. D. Kukharchik (Belarus)

WEDNESDAY, 3 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 4: Social, Economic and Cultural Issues

Speakers:

• Dr. P.A. Motsoaledi, Minister of Education, Northern Province (South Africa), *The Penetration of New Information Technologies into Developing Countries: Cultural Hegemony or Mutual Exchange*

• Dr. Heinz-Werner Poelchau, Ministerial Counsellor (Germany), *New Information Technologies as a Challenge for General and Vocational Training: Chances for International Co-operation*

10.30-11.00 hrs. - Break

11.00-13.00 hrs.- Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 4.1

Speakers:

•Prof. Yuri N. Afanasiev, Rector Russia State University of Humanities (Russian Federation), *New Information Technologies in Humanities Education*

• Dr. Siegfried Hermann, Bundesinstitut für den wissenschaftlichen Film (Austria), *Scientific Film in Education*

Discussion:

• Prof. Yuri M. Arsky, Viktor T. Trofimov (Russian Federation)

• Prof. Esengheldy U. Medeuov (Kazakhstan)

Commission II: Room 02 - Main Building of Moscow State University

Theme 4.2

Speakers:

• Mr. Régis Poubelle, Directeur de PDO MEDIA (France), *Electronic Publishing on Optical Support and Education*

• Dr. Nikolai I. Listopad, Director, Ministry of Education and Science, Prof. S.V. Kritsky (Belarus), *Use of Telecommunications in the Field of Education and Science*

Discussion:

• Prof. Alain Meyer (France)

• Prof. Konstantin K. Kolin (Russian Federation)

Commission III: Room 611 - Main Building of Moscow State University

Theme 4.3

Speakers:

• Mrs. Jeanne Girardot, Présidente, Internews Europe-France), *International Community of the Hearing Impaired: Education and New Technologies*

• Prof. V. A. Zhuravlyov, Rector, Udmurt State University (Russian Federation), *Introduction of New Information Technologies in Higher Education in the Context of Difficult Financial Conditions*

Discussion:

• Mr. Paulin Mbalanda Kisoka (Zaire)

• Prof. Viktor L. Mironov (Russian Federation)

13.00-14.00 hrs. - Lunch Break

14.00-15.30 hrs. - PlenaryGrand Hall

Theme 5: Educational Policies

Speakers:

• Prof. José A. Valente, Coordinator, Núcleo de Informática Aplicada à Educação, Universidade Estadual de Campinas (Brazil), *The Role of Computers in Education: Achievement and Comprehension*

• Prof. T. Plomp, University of Twente (The Netherlands), *Worldwide Information and Communication Technology in Education Study*

15.30-16.00 hrs.Break

16.00-18.00 hrs.Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 5.1

• Mr. Gilles Braun, Ministère de l'Education Nationale (France), *New Technologies in the French Educational System*

• Mr. Jan Wibe, Centre for Continuing Education (Norway), *Distance Education in the Nordic Countries*

Discussion:

• Prof. Alexander G. Asmolov (Russian Federation)

• Prof. Roumen Nikolov (Bulgaria)

Commission II: Room 02 - Main Building of Moscow State University

Theme 5.2

Speakers:

• Mr. German Escorcia, IBM-CLIE (Mexico), *Preparing Children for a Knowledge-Based Society: Latin American Experiences Using Megatools to Develop Megabilities*

• Prof. Ludavit Molnár, Slovak Technical University (Slovakia), *Transforming Curricula in the Transforming Countries*

Discussion:

• Acad. Stanislav V. Yemelianov (Russian Federation)

• Mr. Gerald McConaghy (Canada)

Commission III: Room 611 - Main Building of Moscow State University

Theme 5.3

Speakers:

• Mr. Mohammad Larijani, Director, Institute for Studies in Theoretical Physics and Mathematics (Iran), *Modern Technologies in Education and Science*

• Mr. Mushobekwa Kalimba wa Katana, Ministre de l'Enseignement Supérieur, Universitaire et de la Recherche Scientifique (Zaire), *Policies in the Computerization of Education in African Countries*

Discussion:

• Prof. Vladimir E. Tretiakov (Russian Federation)

• Mr. Don Ferguson (New Zealand)

THURSDAY, 4 JULY 1996

9.00-10.30 hrs. - Plenary (Grand Hall)

Theme 6: International Co-operation

Speakers:

• Mr. H. Yushkiavitshus, Assistant Director-General for Communication, Information and Informatics (UNESCO), *UNESCO Intergovernmental Programmes in the Field of Communication, Information and Informatics*

• Prof. Armando Rocha Trindade, President, International Council for Distance Education, *International Co-operation in Open and Distance Learning*

• Mr. Wim Jansen, Task Force Educational Software and Multimedia (European Commission), *Multimedia for Education and Training*

10.30-11.00 hrs. - Break

11.00-13.00 hrs. - Commissions

Commission I: Room 01 - Main Building of Moscow State University

Theme 6.1

Speakers:

• Prof. Peter Bollerslev, Chairman of TC-3 (IFIP), *Information Technologies and Education in IFIP Activities*

• Mr. Mike Aston, Director, The Advisory Unit: Computers in Education (UK), *The Impact of New Technologies in the Schools of Europe and the G7 Nations*

Discussion

Commission II: Room 02 - Main Building of Moscow State University

Theme 6.2

Speakers:

• Prof. Jean A. Vergnes, Université d'Aix-Marseille (France), *On Education and Use of Information Technologies*

• Prof. Ivan Stanchev, IPC Scientific Secretary (The Netherlands), *Flexible and Distance Learning through Telematic Networks*

Discussion

Commission III: Room 611 - Main Building of Moscow State University

Theme 6.3

Speakers:

• Prof. Valery S. Meskov, Vice-Chairman, Russian State Committee for Higher Education (Russian Federation), *International Projects: Creation and Development of a Common Distance Education System*

• Mr. John Middleton, Economic Development Institute (World Bank), *Looking Sideways*

Discussion:

• Dr. Vitaly Boyko (Russian Federation)

• Prof. Gennady Ryabov (ILO)

13.00 -14.00 hrs - .Lunch Break

14.00-18.00 hrs. - Workshops, demonstrations, exhibitions, visits

FRIDAY, 5 JULY 1996

9.00-13.00 hrs. - Workshops, demonstrations, exhibitions, visits

14.00-15.30 hrs. - PlenaryGrand Hall

Speakers:

- Acad. Yury L. Ershov, Co-Chairman of the EI'96 International Programme Committee (Russian Federation)
- Prof. Jef Moonen, Co-Chairman of the EI'96 International Programme Committee (The Netherlands)
- Prof. Arkady Golubkov, Chairman of Presidential Committee for Informatization (Russian Federation)

15.30-16.00 hrs. - Break

16.00-17.30 hrs. - Summing up the Results of the Congress

- Oral Report on Workshops
- Oral Report on the Work of the Commissions
- Oral Report by the Rapporteur-General
- Adoption of the Declaration and Recommendations

17.30-18.00 hrs. - Closing Ceremony

- Mr. Colin N. Power, Assistant Director-General for Education (UNESCO)
- Mr. Viktor A. Sadovnichy, Rector, Moscow State University

	THEMES OF WORKSHOPS	CHAIRPERSONS	DATE	TIME	PLACE
1	Information Superhighways and Education:	Prof. Konstantin K. Kolin, *Institute of Problems of Informatics (Russian Federation)*			
	Part I: Perspectives and Problems Related to the Development of World and Regional Common Information Space for the Field of Education	Mr. Harald Schütz, *Deutsche Welle (Germany)* Dr. Shota Sh. Chipashvili, *Institute of Problems of Informatics (Russian Federation)*	4 July	14.00-16.30	Main Building, Room 01
	Part II: From Information Literacy to Information Culture	Dr. Sergei A. Khristochevski, *Institute of Problems of Informatics (Russian Federation)*	5 July		Main Building, Room 01
2	The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies	Prof. Irena V. Robert, *Institute of General Secondary Education of the Russian Academy of Sciences (Russian Federation)* Prof. Alexei M. Bolshakov, *Sechenov Moscow Medical Academy (Russian Federation)*	4 July	14.00-18.00	Grand Hall
3	The Software Environment - A Perspective for Effective Involvement	Mr. David Walker, *Consultant (UK)*	5 July	9.00-12.00	Main Building, Room 02
4	Transfer of Knowledge and Skills through Information and Communication Technologies	Prof. Alexei L. Semenov, *Vice-Chairman, Moscow Department of Education (Russian Federation);* Dr. Heinz-Werner Poelchau, *Ministerial Counselor;* Mr. Harald Schütz, *Deutsche Welle (Germany);* Dr. Elena I. Bulin-Sokolova, Dr. P.A. Yakushkin, *Institute of New Educational Technologies (Russian Federation)*	4 July	14.00-18.00	Main Building, Room 611
5	National Policies - Transfer of Technologies	Mr. Peter Waker, Consultant, Interware (South Africa)	4 July	14.00-18.00	Main Building, Room 02

	THEMES OF WORKSHOPS	CHAIRPERSONS	DATE	TIME	PLACE
6	Individual Distance Training	Mr. Alain Meyer, Directeur, *Conservatoire National des Arts et Métiers (France)*	5 July	9.00-12.00	Main Building, Room 611
7	Analysis of UNESCO/IFIP Documents Published by UNESCO in 1994-1995	Prof. Tom van Weert, *University of Nijmegen (The Netherlands)*			
	Part I: Informatics for Secondary Education (A Curriculum for Schools)		5 July	9.00-10.30	Grand Hall
	Part II: A Modular Curriculum in Computer Science		5 July	11.00-12.30	Grand Hall
8	Logics, Informatics, Education	Prof. Yury V. Ivlev, *Philosophical Faculty, Moscow State University (Russian Federation)*	4 July 5 July	14.30-18.00 9.00-12.30	First Building of the Humanities Faculties Room 1157
9	Information Technologies and Humanities Education	Prof. Yury N. Afanasiev, *Russian State University ofr the Humanities (Russian Federation)*	4 July	14.30-18.00	Russian State University for the Humanities
10	Development of Pre-University Education via Modern Information Technologies and Methods	Prof. N. N. Evtikhiev, *Moscow State Institute for Radioengineering, Electronics and Automation* Prof. N. I. Klyatova, *Moscow City Palace for Children and Youth Creativity* Prof. V. A. Mordvinov, *Moscow Institute for Radioengineering, Electronics and Automatics (Russian Federation)*	4 July	14.30-18.00	Moscow City Palace for Children and Youth Creativity
11	Medicine: New Approaches to Knowledge Acquisition and Improvement	Prof. Oleg S. Medvedev, *Faculty of Fundamental Medicine, Moscow State University* Dr. Mikhail Y. Natenzon, *Institute of Aerospace Research, Russian Academy of Sciences*	4 July	14.00-16.00	Main Building, Room 1029
		Dr. Vladimir I. Tarnopolsky, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)*		16.30-18.00	Medical Centre "GAZPROM"
12	Forming Integrated World Data Bases and Knowledge about the Planets of the Solar System and Their Use in Research and Education	Dr. Vladimir I. Tarnopolsky, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)* Dr. Mikhail Y. Natenzon, *Institute of Aerospace Research, Russian Academy of Sciences (Russian Federation)*	5 July	9.00-12.30	Main Building, Room 1806

MAIN WORKING DOCUMENT

INTRODUCTION

The rapid development of information and communication technologies and their application present the world community not only with opportunities but also with new challenges. The evolution towards the so-called "information highway" and their associated economic, social, cultural and educational effects could lead to considerable changes in forms of governance, creativity, co-operation, sharing of ideas and knowledge and daily life. It will also call for wider participation and action on the part of national, regional and international organizations and agencies. Under its Constitution, UNESCO is required "to collaborate in the work of advancing the mutual knowledge and understanding of peoples, through all means of mass communication and to that end recommend such international agreements as may be necessary to promote the free flow of ideas by word and image", "give fresh impulse to popular education and to the spread of culture " and "maintain, increase and diffuse knowledge". With regard to information and communication technologies, that mission today embodies three main functions:

(i)promoting the application of information and communication technologies for the free flow of information, innovation and effective management in education, science, culture and the media;

(ii)encouraging international co-operation on legal, ethical and educational issues raised through the social and cultural implications of information and communication technologies; and

(iii)assisting Member States, particularly developing countries, in building information and communication capacities, benefiting from new applications of information and communication technologies, and ensuring that those technologies do not lead to exclusion among and within societies.

The urgency of the national, regional and international action in this field has been greatly accentuated by the constantly accelerating rate of change in the technologies relating to information presentation, access and exchange. A growing flood of data is potentially available anywhere in the world. The digital technology revolution, integrating text, graphics, video, voice, and music in digital form, is providing powerful new tools for the representation and communication of knowledge and tools for learning. Their use has been greatly enhanced by the fact that devices cost less and are more powerful; more countries have plans and budgets for provision and for teacher training in some stage of execution; and the Internet allows technology and knowledge transfer to the benefit of all levels of education. More teachers at all levels of education have some opportunity to experience training, or even just computer use, and the cascade process of dissemination- both formal and informal - has led to an ever increasing understanding of the potential of computer related strategies as a cost beneficial solution to some learning problems. More software, courseware, research and case study material now exists and is being shared or purchased internationally.

The International Commission on Education for the Twenty-first Century stressed in its report (*Learning: The Treasure Within, 1996*) that "... these technologies are in the process of accomplishing nothing short of a revolution before our eyes, one that is affecting activities connected with production and work just as much as those connected with education and training." Technology has enabled students in isolated areas of the world to access information resources and expertise unavailable locally. It has provided new tools for cognitive learning, intellectual collaboration and problem solving. It has enabled children to work with other children across the globe through computer-mediated communications and develop new levels of cultural insight and understanding. It has opened new perspectives for the education of the handicapped. It has enabled adults to receive job retraining and professional development opportunities through new distance learning technologies. In addition, the new multimedia technologies have provided unique and powerful ways to convey difficult and abstract concepts. Research in cognitive learning is providing new insights and strategies for facilitating student learning and new and different ways in which technological tools and information resources may be integrated into the learning environment. In short, from pre-school to higher education, learning will never be the same.

Probably the most radical change that information and communication technologies bring to learning is the abolition of distance. By freeing learners from the constraints of time and place, it can potentially offer new and more flexible learning opportunities. Distance learning, which has rapidly spread all over the world, is widely used at all levels of education, including higher education. UNESCO's "Policy Paper for Change and Development in Higher Education" urged higher education institutions to make greater use of the advantages offered by the advancement of communication technologies. As a result of such developments, not only have large-scale "mega-universities" emerged as alternative delivery systems, but also the distinction between traditional and distance universities has become blurred.

While the developments in information and communication technologies in many ways challenge the society in general and its educational provision in particular, they do not affect everyone in the same manner. The methodologies of the "information society" are not universally available. The "superhighways" that allow information access and exchange are not open to all. There has been a growing gap between developed and developing countries in their ability to access and use technology. This gap, which was viewed with concern at the 1989 Congress, has widened in the intervening years, and developing countries are perhaps even further disadvantaged in technology access and use than they were seven years ago. For a great number of developing countries, technologies generally available in developed countries, such as telephone, television and even electricity, are still beyond their reach. Therefore, full participation of developing countries in the "information society" and in the use of opportunities offered by information and communication technologies are crucial issues to be faced today. Undoubtedly, this inequity in access to information technologies exists not only among countries but also within countries. The International Commission on Education for the 21st Century felt that there is a real danger of societies with fast and slow tracks, depending on individuals' ability to access technology. It considered that the emergence of information societies is a challenge to both democracy and education, and that the two aspects are closely integrated. Therein lies also humankind's quest for peace. New perspectives, strategies, skills, and knowledge, as well as new levels of cultural understanding will be required in order to surmount the growing array of complex social, political, economic and ecological issues confronting all countries. The educational systems of the world, with the assistance of communication technologies, must play a key role in developing the human potential needed to address these challenges.

It was the rapid development of communication technologies, the increasing awareness of their great potential at the service of education and the concern about the inequity in access to technologies between developed and developing countries that encouraged the resolution at the 27th Session of UNESCO's General Conference to convene the Second UNESCO International Congress on Education and Informatics to provide decision-makers, educators and technology specialists with an opportunity to:

- *discuss the latest developments in New Information Technologies (NITs) and their implications for education and training;*
- *explore current trends and pedagogical issues in the application of technology in different educational and training systems;*
- *discuss effective strategies as well as pitfalls in the planning and implementation of NITs in education and training;*
- *examine important policy issues and opportunities for regional and global collaboration in the use of NITs to improve learning and teaching.*

The Congress is designed to help decision-makers and educators understand the ways technology may enhance the teaching-learning process and the ways in which students can acquire the knowledge and skills needed for the next century. A number of current efforts to restructure educational systems include technology as an important component of a national strategy. What the various strategies share is the need to modernise the systems of educational provision and expand the access of millions of adults and young people to education through communication technologies, including open and distance education. This accords with UNESCO's leading principle of "Lifelong Learning for All" and its "Learning Without Frontiers" programme. Here, it is particularly important for decision-makers to understand how technology can impact on learning in the context of the culture, the curriculum, educational system goals, and evaluation criteria, as well as to realise the costs and projected benefits of the technology implementation.

The Congress will focus on current needs and applications of NITs as well as emerging issues, directions and scenarios as we approach the 21st Century. Its programme will aim to reflect the needs and interests of its delegates:- decision makers, researchers, teacher trainers, industrial trainers, university professors, teachers, information and communication specialists, and technologists and system designers interested in the application of NITs in education and training. The programme at times is divided, for convenience, into three commissions, running in parallel. *Commission I* will reflect trends and experiences in the introduction and use of NITs in educational and training systems. *Commission II* will be concerned with the latest developments in NITs and their application in education and training. *Commission III* will be concerned with policies for and co-operation in the use of NITs in education and training. While it is envisaged that the first commission will be of particular interest to teaching/training practitioners, the second to technologists and developers, and the third to decision makers, participants will be free to choose which commissions they attend each day.

THEMES OF THE SECOND INTERNATIONAL CONGRESS

The Congress is organised around six major themes that will provide a framework for focusing the discussions of important issues related to the application of NITs in education and training. The outputs from the theme-related discussions will be used by the Congress to produce a general declaration, develop recommendations to UNESCO and its Member States, and formulate proposals for regional and international co-operation.

THEME 1: LEARNERS

The shift from the teacher as information dispenser towards the role of mentor, guide and manager of learning requires, in turn, more responsibility on the part learners in the learning process. Moves toward more constructivist and collaborative learning environments are resulting in changes in the role of students. These new environments require that the learners become more self-directed and take greater responsibility for their learning. Although this is more true in some cultures than in others, it is important to understand both the benefits as well as the stresses that result from the new learner roles. It is also important to understand better how technology may support or detract from these new roles.

Technology provides learners with an array of new tools and resources to facilitate cognitive activity. There are, however, wide variations in the type and level of access to technological tools by different groups of learners within educational systems. With limited resources, it is difficult for policy makers and educators to decide the level of technology access that should be provided to primary, secondary, vocational, and higher education, students. It is important to understand how change can be accomplished in educational institutions to allow learners to take advantage of the new options for learning (television, video, radio, the Internet, video-conferencing etc.) - from open classrooms to open universities and other forms of continuing education. In fact, lifelong learning is of increasing importance, also because of the significant changes taking place in the nature or work. While technology has reduced the need for certain jobs it has also created a number of jobs that require new knowledge and work skills. It has also changed the demands and skills needed for many existing occupations. To accommodate these changes individuals must continuously learn new skills and acquire new knowledge. NITs may help address this need in providing educational and training opportunities to adults through distance learning, open education and by providing learning opportunities in contexts other than schools and at times and places convenient to the learner.

Among the questions that may be addressed at the Congress are:

(a)*Learning Tools.* We all remember inspiring teachers who in some way influenced our lives. From the learners' viewpoint how can we be sure that new technologies do not impede this special process? In what ways can the curriculum become more than the old content delivered by new media? Can learning become too dependent on the computer? What would be the effects of this? How can the design of learning tools - the user interface, graphic presentation, readability - enhance equity of tool provision and use?

(b) *New Roles for the Learner.* What stresses do the new roles (having more responsibility for their own learning, the move towards a more constructivist learning and collaborative working) put onto learners? How do new technologies enhance or detract from these changes? Is it possible to maintain any equity between students who have access to technology on a regular basis and those who do not have this access? Is there any evidence indicating the learning roles which are most favoured by the learner and those which are most productive?

(c)*New Options for Learning.* How can change be accomplished in educational institutions to allow learners to take advantage of the new options for learning (television, video, radio, the Internet, video-conferencing etc.)? How can distance learning techniques best help the learner who cannot attend a traditional institution for learning? How does the learner make these choices, particularly at the post-secondary level? Is distance learning necessarily the second best option (compared with face-to-face learning)? What are the circumstances that make it the best option for the learner? How can we best make use of NITs for the education of the handicapped?

THEME 2: TEACHERS

13.The new information and communication technologies provide both new opportunities and challenges for teachers. The NITs can be used to serve as a catalyst to help change the role of teachers from information dispenser to that of guide, mentor, knowledge navigator, consultant and even co-learner with the student. They can also be used to support traditional teaching modes and practices. A critical variable in the effective use of the NITs is the knowledge and skill of the teacher in the application and integration of the technologies into instruction. Pre-service teacher education programmes are needed that not only prepare teachers to use the current generation of technologies but also to accommodate and even develop new technologies in the future. To accomplish this goal requires that the teacher preparation institutions provide adequate student and faculty access to the technologies. In order that they can model the use and integrate technologies into the pre-service curriculum, the faculty must also be provided with training and support. A critical need also exists to enhance the technology skills of existing teachers. In-service professional development programmes are needed to provide technology training opportunities and technical support. Improved programme documentation, teacher-oriented computer-based programmes and the new distance learning technologies may assist in this effort. Without effective teacher training, investments in technology will bear little fruit.

Among the teacher-related issues and questions to be addressed in the Congress are:

(a)*Current Practice with New Technologies.* What makes for successful teaching using new technologies? How is this success gauged? What characterises a successful teacher's use of NITs? Does particular software use seem to promote success? Are the characteristics for successful teaching with new technologies the same in all sectors of education - primary, secondary, higher, vocational and informal adult teaching? Is the use of film, television and radio in teaching strategies less valued when computers are introduced? If it is, should it be? How do we best teach information skills to students? Information overload results from the unlimited access to information that new technologies can bring the learner. How do we teach selection, indexing, alternative presentations and evaluation of information? Since access to information is at the root of much of what is being discussed, how can efforts in this area be co-ordinated and how can standards be arrived at?

(b)*Teacher Training: Pre- and In-service.* How are teachers best being prepared (pre-service) and supported (in-service) to use new technologies in their teaching roles? How are they best supported technically? Can ongoing professional support, for example by Telematics, be incorporated into overall policy and funding for teacher education? How will a remote trainer, providing training through Telematics be able to match the policy, provision and support available locally?

(c)*New Roles for Teachers.* The role of the teacher is said to be shifting from that of an instructor to that of an organiser and guide. Do new technologies hinder or support this shift? Is this movement the same in all sectors of education and training? To what extent does culture shape this expectation of change in the teachers' roles? What are the stresses that the teacher must confront with regard to these new roles?

THEME 3: TECHNOLOGIES

The new information technologies are evolving very quickly. Since the First Congress of 1989 remarkable progress has been made in the development of informatics and communications technologies and their use in education and training. We have seen the development of several generations of increasingly more powerful educational hardware and software at lower cost. We have also seen the rapid and largely unforeseen development of global networking. For example, the Internet has grown so rapidly that there are thousands of databases and information resources available on a global basis, and an array of new navigation and search tools to help users find needed information. The rate of development of NITs has continued to accelerate each year. There is a general trend to use technology to accommodate better the individual needs of users. Translated into an educational perspective, this trend refers to the use of NITs in order to support further individualisation, differentiation and user (learner and teacher) control. This trend must, however, be embedded in a pedagogical approach which should focus on the improvement in the involvement of the main actors in the teaching-learning process (learners and teachers), and the integration of the enormous range of information gathering possibilities and communications with peers, through the use of Telematics, into the curriculum.

The expanding use of computer-related technologies in education has focused increased attention on the most appropriate ways of assessing the impact of NITs on learning. Although traditional assessment methods and criteria will continue to be used, new assessment models and methods are being developed to understand better the effects of the new technology-based tools and environments for cognitive activities.

In exploring both current and emerging trends, some of the questions that must be asked are:

(a)*Computer Science, Computer Enhanced Instruction and "Traditional" Educational Technologies.* What sort of students need to learn *about* the technologies (as opposed to *with* the technologies) at the various stages of education? How are software and hardware changing? Does the CD-ROM, for example, change how we teach? What is the place of educational television? How can we make television more interactive? To what extent is research on artificial intelligence and intelligent tutoring systems contributing to learning and instruction? Do the models of the learning process apply universally? Are there decision points for policy makers?

(b)*Multimedia.* We need to examine what is now possible in multimedia and gauge what contributions multimedia makes/could make to the educational process. The analysis of cost v. educational gain needs to be considered. Is this simply a technology enriching what would otherwise be delivered by traditional teaching methods, or does it add a new dimension and new possibilities to the educational process? Is there an equity issue? How can more expensive equipment be made available with best results? (The following strategies might be considered: centres visited by students; mobile equipment e.g. computer bus classrooms; or equipment only in experimental or "magnet", schools.)

(c)*Telematics.* Communications on, for example, the Internet can bring the work of an expert or a rare information resource to a widely dispersed set of students comparatively cheaply. Telematics has given rise to new international curriculum projects which have, incidentally, brought students from different countries together to work on projects. However, the telephone is still a rare and often a costly resource, even in the world's richest countries. Is there a primary focus for Telematics investment (high school students? students in higher education? handicapped students? teachers in-service? adult learners?) ? How can technologies such as packet-radio and satellite transmission economically compensate for poor terrestrial networks? As all jobs change and the requirements for employment in them change, there is an ever increasing need for retraining. This life-long learning is becoming heavily reliant on new technologies and bringing with it new challenges to the traditional educational system. To what extent can mechanisms be put in place to share the expertise needed to produce this training, even between commercial rivals and different countries?

THEME 4:
SOCIAL, ECONOMIC AND CULTURAL ISSUES

It seems evident that the current developments in NITs have and will continue to have a strong impact not only on education but on social, economic and cultural development in general. The concern which has already been expressed about the growing gap between developed and developing countries in their ability to access and use information technology is here accompanied by another concern, emanating from the fact that the new technologies are emerging primarily from the developed world. The content and form of the messages they carry typically reflect the cultural values, methodology and interests of that world. There is the danger that the technologies, for all their worth, may result in the homogenisation and loss of culture and language among many peoples of the world. For example, media such as television, radio and films have resulted in massive and continuous exposure of peoples to the language, cultural values and information of other cultures with few opportunities for reinforcement of their own heritage. The expansion of the Internet and other internationally accessible communication networks tend to stress generality at the expense of specificity, adding to the concern about the loss of native culture. Many of its essential aspects including language, folklore, oral histories, traditions, and food may be lost in the flood tide of Western and other dominant cultures.

In addition, there is a lack of culturally appropriate educational resources in schools serving some students. Western culture curriculum and instructional methods often fail to support or reinforce other cultural values, history and knowledge. Consequently, for many children, education has sometimes meant alienation from their cultural identity. There is a critical need for appropriate cultural materials to infuse and integrate into existing instructional programmes and to create new instructional programmes to better serve all peoples.

Technology now provides powerful and easy to use tools to enable communities to develop their own culturally appropriate curriculum resources. In addition, through multimedia databases, telecommunications networks, television and radio, it is possible to provide wide access to such materials and information. The proliferation of digital electronic libraries and the complex webs and links between nodes and layers of information is having an impact on society. Materials (for good or bad) in digital form that reside in any one place are now available globally and can be accessed 24 hours a day. This has an impact on economic, medical, social and educational structures.

The developments in NITs have dramatically reduced the size of the world. Local events have suddenly become global events in which it is possible to be psychologically and emotionally present while being physically far away. Technology has delivered a potential means for the promotion of peace and international understanding but also for disinformation and propaganda. It is at the cross-roads of these two possible options that education has to stand in its quest for peace.

Among the questions that may be addressed at the Congress are:

(a)*Economic Issues*. All national policies for the introduction and support of new technologies are tempered by the availability of funding. The amount of the available budget for education which is spent on new technologies is often more dependent on the advocacy of the enthusiast than on data. This is in part because of the paucity of data. This can be true at all levels of decision making from the national to the institutional. Practitioners at the institutional level complain of the lack of any long term planning for the financial support for new developments. New plans are adopted but have to be abandoned for want of continued financing. The time it takes to get results from a change of methods is not always appreciated by policy makers, and practitioners are often slow to produce evidence on which policy can be made. What ways are there to ensure that finance provided for change doesn't get wasted? How can technology support lifelong learning in different economic and socio-cultural scenarios?

(b)*Social and Cross Cultural Issues*. Are new technologies increasing or decreasing inequities among groups in society? Can the effects of national wealth, language, gender and culture be overcome through the use of technology in striving to provide some equality of educational opportunity worldwide? Are new technologies further advantaging the more elite educational institutions? To what extent should a global aspect of learning be limited by local political decisions? How can the development of appropriate resources be fostered in order to, at least, protect and, at best, reinforce native cultures.

(c)Peace and International Understanding. Are the new technologies *per se* contributing to peace and international understanding? What may be some of their positive and negative effects? What is the long-term effect of the Internet, and, specifically, electronic mail and bulletin boards? How should international agencies make use of NITs to promote their programmes for peace and international understanding?

THEME 5: EDUCATIONAL POLICIES

As the use of NITs in education is a matter of societal, cultural and financial choice, the issue is central to the concern of governments and their decision makers. Within the limits of delegated institutional autonomy, it can be an issue at every level of education and training. Yet the formulation of the respective policies for the utilisation of NITs is rarely based on the same criteria in developed and developing countries. The financial constraints faced by the developed countries bear no comparison with those of the developing countries which often cannot afford to set up an adequate infrastructure necessary for the successful use of NITs in education. Therefore, the technology is determined by the scarcity of resources which limits the options available to the policy makers.

In formulating educational policy related to the implementation of NITs, policy-makers are challenged by questions about the appropriate role and function of technology within the context of their educational system. Some view technology as a necessary component of a quality educational experience and have had curricula redesigned to provide students with technology-related skills and knowledge needed for the next century. Others are more interested in how technology may increase the productivity, efficiency and effectiveness of their educational systems, or they emphasise the use of technology for extra or external school activities such as radio, television and tele-learning. And still others emphasise the use of technology as a catalyst to help transform the learning environments within the school.

Whatever the national choices concerning the use of NITs in education may be, it appears evident that the matter does not deal only with technology but also with the question as to how knowledge and information will be accessed in the future. As the teacher is increasingly being transformed into a mentor, guide and manager of learning, his or her previous role as the information dispenser is being taken over by technology. How to ensure a pedagogically successful interaction between the two is the aim - not the promotion of technology *per se.* The mere fact that technology exists is, in itself, no sufficient reason for governments to invest in it. This is a central issue of educational policies.

The Congress will examine these technology-related policy issues and address questions such as:

(a) *Developing National Plans and Policies.* To what extent is it possible to learn from other countries successes and failures in designing national policies for the introduction and support of new technologies in education? Can/should policies be developed for more than one sector of education at a time? How can the success of individual centrally initiated policies be determined in the light of learner performance. teacher performance, and cost benefit? How can each successive layer of education - school, college, employment training - be made to be responsive to what has gone on before? What ways tend to ensure this continuity of practice? In what ways can central administration facilitate a liaison between employers, the community and students to the benefit of each group and the nation?

(b)*Strategies to Bring about Change at Institutional Level.* How do central decisions alter what goes on at institutional level? To what extent can institutions learn from each other? To what extent does the uncertainty of funding lead to poor decision- making? Are there ways in which central policy can still allow institutional autonomy? Are the issues the same for training as for education? To what extent can there be/should there be policies in place to promote equity between institutions? How can training and support be promoted nationally, regionally, and at institutional level so that, for example, the training does not create a demand for technology that cannot be realised? Are there examples that we can share of policies that allow for the support for individuals and institutions to change? Do NITs themselves help in this?

(c)*Strategies for a Future-Proofed Curriculum.* To what extent can any curriculum or examination systems remain independent of the new technologies as they develop? For example, the development of telephone-related technologies, like the Internet, have changed the way students *could* search for information, and the computer has enabled a widening variety of ways through which they could present this information. These changes make it possible to change the curriculum as more skills are made accessible. Should we be making decisions that accommodate these ever changing scenes? If so, how? How can we design strategies that allow for periodic updating of equipment, curriculum, teachers and the community? How can decision-makers stay informed in order to be able to make these decisions with confidence? After more than a decade of computer-related technologies in education (and considerably longer with broadcast technologies), increasing attention is being given to their impact on learning and other aspects of educational productivity. How can the impact of new technologies on learning be measured in terms of educational benefits, efficiency and effectiveness so that public calls for accountability are satisfied? Can this research have any universal relevance? How can we help each other to have the data necessary on which we can each build our policies?

THEME 6: INTERNATIONAL CO-OPERATION

The rapid development of NITs has not only created unforeseen opportunity for global communications but also has made it more necessary than ever before. As everything is linked to everything else, fewer and fewer activities can be done alone. Isolation and information are internally contradictory. It is the new interconnectedness of everything that presupposes international co-operation which then has to be viewed in the broad context of what the international community together, rather than this or that country alone, can accomplish in a field that is of existential importance to humankind.

In the promotion of NITs for education, UNESCO assumes an internationally important position. In its present Medium-Term Strategy for 1996-2001 (28 C/4) and the Approved Programme and Budget for 1996-1997 (28 C/5), specific actions are included to address the issue of information and communication technologies. The approach combines reflection and action and seeks to respond to two major concerns, namely, to reflect on the impact of the new technologies and to foster their appropriate use in the Organisation's sphere of action. More specifically, UNESCO's Major Programme IV "Communication, Information and Informatics" reflects the increasing convergence of communication, information and informatics by extending the principle of "free flow" to all forms of information that contribute to the progress of societies and by adopting an integrated approach to capacity-building for development through these three areas. The role of UNESCO's General Information Programme (PGI) and its Intergovernmental Council focuses on the challenge of the information technology revolution, taking into account, for example, new possibilities in the application of information technologies in libraries and archives ("virtual" libraries and archives). The Intergovernmental Informatics Programme (IIP), on the other hand, focuses on the application of information technology particularly in supporting the new generation of information systems and services in its programme and activities. Specific activities and projects are carried out also in other Major Programmes, as well as in the transdisciplinary projects. These include, in particular, the use of technologies for extending access to lifelong education for all (Major Programme I), fostering wider access to information or facilitating exchanges and transfer of knowledge and experience (Major Programme II).

Closely linked to these activities are those relating to the adaptation of copyright to the new technological environment, the protection of new categories of works and the encouragement of electronic cultural industries in developing countries with a view to protecting cultural diversity (Major Programme III). UNESCO, which traditionally has a specific and important world role with regard to copyright, recently organized an international symposium on "Copyright and Communication in the Information Society" (Madrid, March 1996). Undoubtedly, copyright rules have a tendency to lag behind progress in the field of technology as NITs could allow very easy copyright breaking of items stored in digital form down the "information superhighway". While there is a need to draw the attention of policy-makers and educators to the copyright of authors whose materials are used for education and training purposes, attention should also be drawn to the need for easy access to both national and foreign educational networks.

The expanding role of NITs in education systems suggests a more intensive cooperation with the producers of both hardware and software, including international companies, especially publishers and computer and media companies. It is important that educators' and trainers' voices can be heard by these companies, but there needs to be an international channel through which these voices can be routed. UNESCO might be considered to be the right "honest broker" to establish this dialogue.

Among the questions related to international co-operation and UNESCO's role in it are:

(a)*UNESCO's Catalyst Role.* What role should UNESCO play, in collaboration with other agencies of the UN system, intergovernmental and nongovernmental organisations, professional associations, private industry and others, to facilitate the sharing of available resources and expertise to strengthen the use of new technologies in education and training, especially in developing countries? In what way can international agencies and programmes support national initiatives and what are the most promising sorts of collaborations that may help support the formulation of better policy-making related to NITs? What specific recommendations should be made to UNESCO and its Member States to ensure that maximum benefit be derived from the use of the new information technologies in education and training? What priorities should be established for UNESCO's strategies in this field? What mechanisms of co-operation should be followed at the international and regional level? What specific global projects could be proposed for UNESCO to foster?

(b)*Information and Copyright Issues.* What are the most effective strategies for increasing the exchange of information and data on the use of informatics in education? How can intellectual property be safeguarded and yet be made widely available? With the complexity of "cyberspace", to what extent is it possible to check up on practice? To what extent and in what ways can education be effective in regulating and /or educating the practice of its staff and students with regard to the intellectual property of others?

(c)*UNESCO's Role as Go-between.* What patterns of co-operation can be suggested for education and industry? Should UNESCO convene meetings between industry and education? What outcomes could be envisaged? What specific co-operation could be imagined with the potential partners: large software development houses, system integrators and hardware manufacturers? What recommendations should be made to ensure continuing dialogue? How should UNESCO best make these (and any other) discussions accessible to everyone who might be interested?

SUMMARY

Advances in information and communication technologies have in recent years resulted in challenging innovations, including a convergence with other technologies, which are providing a very powerful sets of tools to allow individuals and institutions access to other communities, to information, to learning, to scarce resources of expertise and to sharing of ideas and knowledge. The new information technologies have had global impact in shaping the "information society". They have transformed business, industry, government, science, medicine and other sectors of global society. Indeed, they provide exciting new opportunities as well as challenges to the educational systems of the world.

However, inequity in access to information and communication technologies among countries remains a serious problem. Because of their cost and because of the built-in dominance of the culture of the nations mainly developing NITs (not least because of the dominance of the English language in the new media), there is a growing gap between the ability of developing and developed countries to have access to the technologies. Such a gap exists also within several developed countries, with a potential consequence of generating a new type of class society based on an unequal distribution of information.

The very fact that the technology is changing so fast is a disincentive to decision makers. Technology gets out-of-date so quickly that it never seems the right time to make a policy to purchase, and this can become an excuse for inaction. There is also, to many, the disincentive of the dominance of foreign culture, language and values. The technology is not itself essential but its interaction with learning and its role within the context of the overall educational system. This calls for respective educational policies and plans for the introduction and use of communication technologies in education.

Among the most central aspects present in educational policies, often inextricably interlinked, are: Learners, Teachers, Technologies, Policies, Economic, Social and Cultural Issues, and International Co-operation. UNESCO is pleased to invite the distinguished participants of the Second International Congress on Education and Informatics to explore these and other related themes, in view of recommendations to UNESCO and its Member States, and proposals for regional and international co-operation in the field of education and informatics. As tomorrow's progress is based on today's action, the 21st Century has virtually begun.

INVITATION

OF THE DIRECTOR-GENERAL OF UNESCO

Sir/Madam,

I have the honour to inform you that, in accordance with resolution 1.18 adopted by the General Conference at its twenty-seventh session (October-November 1993), UNESCO, in cooperation with the Government of the Russian Federation, is organizing the ***Second International Congress on Education and Informatics (EI'96):*** *Educational Policies and New Technologies, which will be held in Moscow from 1 to 5 July 1996.*

The first Congress, which took place in 1989 at UNESCO Headquarters in Paris, stressed the need to 'benefit from collective experience and the sharing of scarce resources in the field of new information technologies (NITs) in education' and, to this effect, recommended that international co-operation in this field be strengthened.

Today, co-operation is needed more than ever before. In recent years, remarkable development has taken place in information and communication technologies, whereby each succeeding generation of hardware and software has rapidly given rise to significant innovations and opportunities for convergence with other technologies. Unforeseen media combinations of global dimensions have emerged to shape the "information society" and to challenge those living in it. In the midst of the phenomenon of "information superhighways", education itself is challenged to critically re-examine its position in view of the fact that technologies tend to develop faster than education's capacity to make use of them.

The Congress, which offers an international forum to discuss the future of education and informatics, will analyse national, regional and international trends and experiences in the introduction and use of NITs in educational systems; review the latest developments in NITs and examine their application in education; discuss international, regional and national policies for the use of NITs in education; and make recommendations for international co-operation.

The Congress, which will pursue the above objectives through six central themes: Policies; Technologies; Teachers; Learners; Economic, Social and Cultural issues; and Transverse Themes, calls for broad international co-operation in order to reflect the variety of needs and aspirations of Member States in this increasingly challenging field.

I should be pleased if your Government would suggest names of individuals or institutions to whom invitations could be sent and to contribute to the preparation of the Congress as detailed in the Annex.

In conformity with the regulations for international congresses, the participants and observers are expected to cover their travel and accommodation expenses.

Accept, Sir/Madam, the assurances of my highest consideration.

FEDERICO MAYOR

DIRECTOR-GENERAL

DECLARATION

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We, the participants of the Second International Congress *"Education and Informatics: Educational Policies and New Technologies"* convened by UNESCO, in collaboration with the Russian Federation, in Moscow from 1 to 5 July 1996,

Referring

to the Recommendations of the first International Congress *"Education and Informatics"* of 1989,

Aware

of the rapid development thereafter in information and communication technologies (ICTs) and in their education application in particular,

Recognizing

the great potential that ICTs possess at the service of education, science, culture, peace and international understanding,

Concerned

by the possible manifestations of misuse of ICTs for disinformation and propaganda, the potential threat to culture and languages, and the overburden of information,

Cognizant

of the increasing responsibility of the Member States, intergovernmental and nongovernmental organizations and others concerned with the development of national, regional and international information infrastructures to enable all peoples of the world to benefit from ICTs,

Addressing

the needs of developing countries in order to bridge the gap between them and developed countries,

Considering

that ICTs are emerging primarily from the industrialized world carrying messages of its content and form, accelerating the further homogenization and loss of culture and language among many peoples of the world,

Recognizing

the mutual benefit of closer co-operation between education and industry, including hardware and software producers and companies delivering telecommunications systems,

Therefore,

declare our commitment to the effective use of ICTs to improve educational practice, to strengthen communication among nations and individuals, to help promote peace and international understanding and to foster international co-operation in a field of such essential importance to the future of humankind.

We, the participants of the Congress, in the above spirit and with reference to the recommendations here below, appeal to:

governments, educational authorities, business and industry, to strengthen their joint efforts in this field seeking new patterns of co-operation to ensure the availability of adequate ICTs at all levels of education for the ultimate benefit of learners within the framework of lifelong learning for all;

UNESCO and other agencies of the United Nations System, including the United Nations Development Programme, the International Labour Organisation, the World Bank, regional development banks and others concerned, to extend their support to the introduction and application of ICTs in education, notably to the benefit of developing countries.

RECOMMENDATIONS

OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

THEME 1:

LEARNERS

UNESCO should make available, via the Internet and other suitable distribution channels, existing high quality case studies and research on the use of Information and Communication Technologies (ICTs) in teaching and learning for all populations (primary, secondary, higher education, adult education, vocational education and special education) and, where it exists, provide evidence of most favoured and most productive examples. The needs of the hearing impaired should be especially considered.

Where there are critical research gaps, UNESCO should encourage (or even commission), research from Member States to produce evidence, with examples drawn from a cultural sample as wide as possible. Pilot projects should be set up in order to test new teaching/learning philosophies using ICTs in education. The studies should not only investigate the delivery of the old curricula through ICTs but also new curricula which the availability of ICTs has enabled.

UNESCO should investigate new evaluation and assessment paradigms to better reflect the cognitive learning processes and skills resulting from the effective application of ICTs. Researchers should be encouraged to compare learning achieved by traditional pedagogy, by an ICT-enriched pedagogy and by an ICT-based pedagogy.

Museums, broadcasting and media institutions, archive collections should be encouraged to make their collections widely accessible to the community (especially to teachers and learners) through the use of the Internet.

Specific skills are required by the learner and teacher to effectively use Distance Education. UNESCO should encourage international co-operation in creating and disseminating programmes that assist in the proficient use of Distance Education.

THEME 2:

TEACHERS

National and international agencies should support the dissemination, by appropriate means, of successful strategies and best practices of teachers' and trainers' use of ICTs. Teachers and their professional associations should be encouraged to involve themselves in the process of change to revalidate their roles and to master ICTs. The development of ICTs must not be left to the commercial and industrial world alone but be developed in co-operation with it.

Research data should be collected (and frequently updated) on the changes in the role of the teacher from an instructor to a guide and mentor. UNESCO should encourage the inclusion into on-line data bases of research data collected in developing countries. UNESCO should make links to these data bases from its sites in the World Wide Web.

UNESCO should collaborate with other agencies to set up models of in-service training and professional development for teachers and trainers which make effective use of the approaches, facilities and opportunities provided by the use of technology, including telecommunications. In particular, UNESCO should encourage the organization of workshops and seminars in developing countries, such as the ones using the UNESCO/International Federation for Information Processing (IFIP) document on *"Informatics for Secondary Education"*.

UNESCO should explore the possibility of linking regional telematic centres world-wide to cover topics such as the use of multi-media, training of trainers, management techniques, instructional design, pedagogical innovation, etc. and should endeavour to incorporate into such an initiative priority pilot projects, e.g. telematic development centres in Africa.

THEME 3:

TECHNOLOGIES

Policy-makers in Member States at all levels should set up working parties to consider priorities in the provision of technology for education and training, appropriate to the resources and infrastructure within Member States. Member States should consider lodging copies of reports on the strategies they are adopting or considering with UNESCO for it to make these available to help worldwide debate.

UNESCO should look into the possibility of setting up a forum on the Internet in which practitioners report on their use and on their opinions as to the value of emerging technologies in the educative process.

UNESCO is urged to consider co-operating with concerned nongovernmental organizations and professional associations such as IFIP in order to stimulate research on the improvement of computer interfaces for learning, particularly in teacher training and primary and secondary education.

The International Standards Organization, or such an appropriate body, should be invited to review, simplify and update the terminology in the area of new technology, in association with educational experts.

Governments of Member States are encouraged to urge their telephone and communication companies to consider the establishment of appropriate links to educational institutions, either free of charge or at discount rates.

Member States and UNESCO should consider supporting and facilitating the sharing of interactive television technology practices and output between countries.

THEME 4:

SOCIAL, ECONOMIC AND CULTURAL ISSUES

UNESCO should encourage Member States to share their ICT funding strategies and to consider publishing a selection of these where there are elements in the plans that could be of use to other States.

UNESCO should encourage the research community in Member States to address issues such as the value of ICTs in the pursuit of peace and international understanding, in reinforcing or protecting native cultures and in providing educational opportunity worldwide. UNESCO should use its offices as a clearing house for the publicity and dissemination of these research ideas.

It is recommended that Member States develop regional co-operation to encourage the pooling of experiences in the use of ICTs, acquired in comparable environments, in order to avoid the repetition of mistakes and the wastage of time and scarce financial resources. Telecommunications could assist this co-operation.

UNESCO, in co-operation with the World Health Organization, should consider re-assessing the effects of ICTs on the health and behaviour of children and students and disseminate the results and any recommendations to teachers, programme designers, students and the community at large.

THEME 5:

EDUCATIONAL POLICIES

It is strongly recommended that national governments plan and start evaluation programmes on the implementation of ICTs in their educational systems if they are not already doing so. UNESCO should act as a collector and disseminator of this information.

Case studies should be collected on successful techniques for implementing institutional change using ICTs and on their impact, both positive and negative, on changing existing curricula. UNESCO should disseminate these case studies. A comprehensive and systematic study of the causes and consequences of changes on society and learning systems (brought about by the introduction of ICTs in education and training) is needed. Special emphasis should be put on the interdependency of change factors in this area and their impact on strategic planning and policy.

UNESCO should encourage Member States to upgrade their ICT specialists by further education in their own or other countries, by the use of international consultants and/or by distance learning. UNESCO should facilitate this where possible.

UNESCO and Member States are asked to encourage national and international funding institutions to pay due attention to the potential of information and communication technologies as tools to improve educational access and opportunities, particularly for unreached communities and children with special needs.

Member States, who have not already done so, should be encouraged to formulate a national strategic plan for the introduction of information technology into their educational systems. This plan should take account of social, cultural and economic conditions.

It is recommended that UNESCO considers commissioning IFIP, established by UNESCO, to prepare a report on *"Information and Communication Technologies in Education"*. Although the report should cover the widest spectrum of policies, it should also specifically address the needs of developing countries.

Member States are asked to consider looking into ways in which business and industry can work co-operatively with education in order to enhance the teaching/learning environment. UNESCO might consider it appropriate to offer its services as an honest broker to facilitate this process.

In line with the recommendation in the report

"Learning: The Treasure Within" 1996, UNESCO is encouraged, with an eye to the future, to set up an observatory to look into new information technologies, their evolution and their foreseeable impact not only on education systems but also on modern societies.

UNESCO is encouraged to continue its work in copyright concerning the new technologies, working towards international standards of law and practice. Member States are urged to bring forcefully to the attention of their educational communities the illegality of malpractice and piracy.

THEME 6:

INTERNATIONAL CO-OPERATION

UNESCO should examine the possibility of convening a follow-up meeting soon after the Congress, inviting the collaboration of representatives of other agencies of the UN system, relevant intergovernmental and nongovernmental organizations, professional associations, private industry and any other appropriate individuals or bodies, to decide on the priority to be given to each recommendation made by the Congress and to identify responsibility for its implementation. UNESCO is urged to give some priority in its ITC programme to countries in transition and to developing countries, such as those in Central and Eastern Europe, the Palestine Authority and South Africa.

UNESCO should consider one or two major worldwide projects involving ICTs to directly meet the needs of Member States, e.g. *"A Global Network for Tele-training for Teachers"* and *"A UNESCO Institute on Educational Policy and NITs"* (see Annex), to be implemented in collaboration with appropriate partners.

A priority need expressed frequently during the Congress has been for the collection and dissemination of data on best practice. This could usefully include a bank of exemplary test items, case studies, curricular materials and accounts of implementation techniques. UNESCO is asked to consider establishing such a collection, accessed by way of the Internet.

Being aware of the urgent need to support schools in developing countries, the Congress urges Member States to initiate programmes which twin their schools with those in severe need in order to assist them in the acquisition and use of ICTs and to promote cultural exchanges and mutual understanding.

PROPOSALS FOR POSSIBLE UNESCO PROJECTS

UNESCO GLOBAL PROJECT:

"A GLOBAL NETWORK FOR TELE-TRAINING FOR TEACHERS

The proposal indicates plans for a Global Teachers Network Service Organization (GTNSO) which would provide a platform for the design, development and distribution of courses relating to technology in education for teachers throughout the world. The courses, as well as other communication and information services, would be made available via the Internet.

With rapid advances in technology, it is difficult for the existing systems of teachers training and in-service to stay up-to-date in terms of the implications of innovations in teaching and practice. Awareness and experience with the use of new technologies in teaching and learning are not yet found in all teacher education systems.

These new communication and information technologies provide opportunities for a worldwide community of experts to be brought together with teachers through a global project that facilitates the provision of quality courses and resources for teachers through a common service organization. This proposal defining such an organization is based on UNESCO's unique international network of scientific experts and national contacts such as Ministries of Education. A special benefit of such a service organization is that it can not only service existing institutes of teacher education and in-service but also the teacher's emerging needs for lifelong training.

A special feature of this proposal, in addition to the unique human, professional network on which the Network Service Organization can be built, is the provision of "authoring templates" for course materials. Course providers in countries throughout the world can provide course content, in their language of choice, and the content can be fitted into various templates for hyper linked, multimedia distributed access. Currently these templates make use of World Wide Web technologies.

Another strength of the proposal is the collection and availability of examples of models of good practice, involving new technologies and new didactics in the classroom. These models will come from a wide range of cultural settings, and will be eventually expressed in a range of languages as well as media, so that teachers can see, hear, or read about classroom applications of new technologies and student work developed from those applications.

The proposal is connected with a number of projects already attempting to use network technologies to bring networked services to teachers. At the same time the Project should benefit from the results of all R&D projects on national and transnational levels in which UNESCO is directly or indirectly involved (for example, the Russian DESCOP - Distance Education in New Information Medium, and others).

These are the arguments for presenting this proposal to the UNESCO Congress participants and to the Director-General of UNESCO. We hope that the Member States will support the proposal and include the Project into the final document.

2. A UNESCO INSTITUTE ON EDUCATION POLICY AND NEW INFORMATION TECHNOLOGIES

Proceeding from the recommendations worked out by international forums held under the UN auspices as regards the implementation by all Member States concerned of coordinated actions with the purpose of defining the community's policy and types of activity for the sake of humankind's steady development,

Basing on the fact that education policy should embrace postulates included in the recommendations of the International Commission on Education for the Twenty-first Century: learning to know; learning to do; learning to live together, learning to live with others; learning to be,

Recognizing that education technologies must create an environment allowing colleges and other academic, scientific and vocational training establishments to perform a critical role in the sphere of developing and accomplishing the strategy and policy of development,

Bearing in mind the necessity of applying new information technologies to education purposes for deriving advantages from a collective know-how, as well as a joint utilization of limited resources,

Participants of the Congress deem it essential to endorse the initiative to establish in Moscow a UNESCO Institute on educational policy and new information technologies with the object of working out a model of global lifelong education for all and everybody,

Recognizing that its activity will foster the elaboration, professional estimation, selection and worldwide dissemination of prospective education and information technologies, as well as updated means of communication.

FINAL REPORT
OF UNESCO
"EDUCATION AND INFORMATICS "

FOREWORD

The purpose of the present Report is to give a comprehensive and accurate presentation of the work and outcome of the meeting. Its contents are mainly fact-oriented.

The lines below are meant to bring into the limelight the people and institutions or organizations whose unflagging support, dedication and energy have paved the way for its successful preparation and organization.

It is due to the active and generous support received from the Russian Government, both in financial and technical terms, and the assistance offered by several sponsors, that the Congress was able to reach its objectives.

I would like take this opportunity to thank all members of the International Programme Committee for their high intellectual contribution to the preparation of the Congress programme. Their continuous commitment and enthusiasm were essential to its success.

Equally important was the intellectual and financial contribution made by the Children in an Information Age Programme, headed by Academician Blagovest Sendov, Dr. Ivan Stanchev (Bulgaria); Directorate-General XIII of the European Commission; The University of Twente, The Netherlands (Professors Jef Moonen and Betty Collis); the International Federation for Information Processing (Dr. Peter Bollerslev); the International Conference on Technology and Education (Mrs. Sylvia Charp, Mr. John Foster); and the University of Texas at Austin, USA (Professors Michael Thomas and Paul Resta).

Tribute also should be paid to the almost 100 Russian leading specialists whose intellectual contribution and organizational efforts to the preparation of the Congress have won wide recognition. In this respect I would like to thank particularly Professor Vladimir Kinelev, Minister of Education of the Russian Federation, who chaired the Russian Organizing Committee and presided over the Congress, and his close collaborators from the Russian Organizing Committee: Professor Valeri Meskov, Acad. Yuri Ershov, Dr. Irina Smirnova, Professor Eduard Manushin, Mr. Konstantin Peev, to mention only a few.

Thanks are also due to Professor Viktor Sadovnichy, Rector of Lomonosov Moscow State University, to the academic staff and students of the University for the hospitality and excellent conditions offered to participants.

Last but not least a word of sincere gratitude to my colleagues for their advice, assistance and encouragement, particularly to Heimo Mäntynen, Marco A. R. Dias, Peter Herold and Mariana Pătru.

EVGUENI KHVILON
CONGRESS COORDINATOR

INTRODUCTION

ORGANIZATION, OBJECTIVES AND OUTCOME OF THE CONGRESS

In accordance with Resolution 1.18 of the twenty-seventh session of the General Conference (October-November 1993), UNESCO, in co-operation with the Russian Federation, organized the Second International Congress (Cat. IV) on ***Education and Informatics (EI'96) - Educational Policies and New Technologies*** in Moscow, from 1 to 5 July 1996. The Congress was hosted by Lomonosov Moscow State University.

The first Congress, held in Paris in 1989, had stressed the need *to benefit from collective experience and the sharing of scarce resources in the field of new information and communication technologies (ICTs) in education* and, to this effect, recommended that international co-operation be strengthened. The recent years have witnessed remarkable developments in information and communication technologies, whereby hardware and software generations have rapidly succeeded each other and, in a most innovative manner, converged with other technologies. Unforeseen media combinations have emerged to further shape the *information society* and to challenge those living in it. In the midst of the information superhighways, education is challenged to reexamine its position critically, especially since technologies seem to develop faster than education has the capacity to use them.

The Second Congress, which offered an international forum for the discussion of problems of immediate concern for all countries in the world, was intended to pursue the following objectives: (i) to *analyze* national, regional and international trends and experiences in the introduction and use of new information and communication technologies in educational systems; (ii) to *review* the latest developments in the field of new information and communication technologies and *examine* their application in education; (iii) to *discuss* international, regional and national policies for the use of these technologies in education; (iv) to *make recommendations* for international co-operation.

At the end of its work, the Congress adopted a *Declaration* and *Recommendations* addressed to Member States and to the Director-General of UNESCO, as well as proposals for international co-operation and specific major projects in the field, notably to the benefit of developing countries.

As common for international congresses of Category IV, UNESCO invited Member States, international governmental and nongovernmental organizations, other UN specialized agencies, professional associations as well as private companies active in the field of introduction and application of new information and communication technologies in education to designate participants and observers in their personal capacity. Participants and observers included ministers, members of parliament, decision-makers, teachers, researchers, students, software and hardware developers, representing seventy-one countries and nine international governmental and nongovernmental organizations. Given the big interest called by this important event, a considerable number of Russian participants and observers attended the Congress.

BACKGROUND DATA AND PREPARATION OF THE CONGRESS

In order to ensure a good preparation of the Congress, UNESCO set up an International Programme Committee (IPC), which included academicians, presidents of universities, researchers and experts, representing all regions of the world. Academician Yuri L. Ershov (Russian Federation) and Professor Jef Moonen (The Netherlands) acted as IPC Co-Chairpersons. For the coordination of all preparatory activities and co-operation with UNESCO, the Government of the Russian Federation established a Russian Organizing Committee, consisting of ministers and rectors of leading Russian higher education institutions.

In order to identify the priorities and needs of Member States concerning the introduction and implementation of information and communication technologies in education, ten regional and sub-regional expert meetings/seminars were organized from 1994 to 1996 in preparation of the Congress. Four regional expert meetings were held in 1996 in: Austin (USA) for North and Latin American, as well as Caribbean countries; St. Petersburg and Vladivostok (Russian Federation) for Europe Region and Asia and Pacific countries, respectively; and Dakar (Senegal) for African countries. Six sub-regional meetings took place in Harare (Zimbabwe, 1993); Yalta (Ukraine, 1994); Enschede (The Netherlands, 1994); Sofia (Bulgaria, 1994); Moscow and Novosibirsk (Russian Federation, 1991, 1996).

Based on the proposals and recommendations put forward at the regional expert meetings, the International Programme Committee and UNESCO Secretariat elaborated and distributed a main working document and other reference documents which outlined the programme, the six major themes and the sub-themes to be examined at the Congress in the light of the objectives set.

PROGRAMME AND THEMES

In keeping with the established programme, the Congress conducted its work in plenary and commission sessions. Each Congress day began with a plenary session in which a keynote speaker made the main presentation on a major theme, followed by presentations and discussions in three commissions. Commission I focused its debates on *trends and experiences in the introduction and use of ICTs in educational systems*; Commission II, on the *latest developments in ICTs in education*; Commission III, on *co-operation for the use of ICTs in education*.

Six major themes were selected to address the needs of all those involved in the educational process at various levels. The first one dealt with *Learners* (learning tools, new roles for learners, new options for learning inside and outside educational institutions); the second was devoted to *Teachers* (current practices with new technologies, pre- and in-service teacher training new roles for teachers); the third theme focused on *Technologies* (computer science, computer-enhanced instruction and "traditional educational technologies, multimedia and telematics); the fourth theme dealt with *Social, Economic and Cultural Issues* (the role of ICTs in helping to ensure equal opportunities for the development of skills and knowledge; how the new learning and teaching methods, using the advantages of the already existing networks, can contribute to the overcoming of the social, economic and cultural barriers with reasonable and cost-effective solutions, negative and positive changes in the society under the pressure of the technology development); the fifth theme covered *Educational Policies* (developing national plans, strategies for change at institutional level, strategies for a future-proofed curriculum); and the sixth theme centred on *International Co-operation* (the needs for international co-operation in the human resource development area, the increasing role of UNESCO in promoting international co-operation in the field of open and distance education among interested partners).

The debates of the plenary sessions, which amounted to twenty hours in all, were daily broadcast via the Internet.

In addition to the plenary and commission sessions, twelve workshops were organized on the last two days of the Congress. More detailed information about the workshops is provided in para. 61 of the report.

In conjunction with the Congress an international trade fair (EDIT'96) was organized, in which 80 organizations, both Russian and foreign, participated (higher education institutions, research institutes developing educational software, etc.), as well as 15 leading computer companies, IBM, Apple, Novell, Oracle, Informix, to name only the most important. On display were the latest achievements in educational media and technology, telecommunications and information resources of global computer networks, general and special purpose computer equipment, broken down into ten categories: electronic educational media; telecommunications; distance education; general and vocational education; multimedia in education; information resources of higher education; expert and intellectual systems; simulation and computer-design systems; support of scientific and technological enterprise in higher education; and future technologies in higher education. The total trade fair space amounted to 1,000 square meters.

EXECUTIVE SUMMARY

OPENING CEREMONY

The opening ceremony was held on 1 July 1996 in the Grand Hall of Lomonosov Moscow State University. Mr. Vladimir G. Kinelev, Deputy Chairman of the Government of the Russian Federation and Chairman of the State Committee for Higher Education, welcomed participants and read out a message addressed to them on behalf of President Boris Eltsin.

Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, addressed the audience welcoming participants on behalf of Mr. Federico Mayor, Director-General of UNESCO.

Mr. Kurt Bauknecht, President of the International Federation for Information Processing (IFIP), an organization affiliated to UNESCO, then took the floor.

The next speaker was Mr. Armando Rocha Trindade, President of the International Council for Distance Education (ICDE), also affiliated to UNESCO.

At the end of the opening ceremony Mr. Viktor A. Sadovnichy, Rector of Lomonosov Moscow State University, addressed the audience welcoming them and expressing confidence in the success of this high-level international forum.

OPENING PLENARY SESSION

According to item 2 of the provisional agenda, the Congress elected Mr. Vladimir G. Kinelev, Chairman of the State Committee for Higher Education of the Russian Federation, as President of the Congress by acclamation. After the adoption of the Rules of Procedure, the President of the Congress requested participants to approve the constitution of a Bureau.

A group was elected by acclamation to draft the Declaration and Recommendations of the Congress.

The President introduced the provisional agenda (ED-96/ICEI/1) which was adopted.

The opening plenary session began with the presentation of three keynote papers, the purpose of which was to explore the current trends and pedagogical issues in the application of new information and communication technologies throughout the world, to analyze their strong impact on social, economic and cultural development in general, and to examine policy and strategy issues related to the expansion of the access of millions of young people and adults to education through communication technologies, including open and distance education.

The first presentation, entitled "Education and Civilization", was made by Mr. Vladimir G. Kinelev, Chairman of the State Committee for Higher Education (Russian Federation), who emphasized the great responsibility incumbent on today's policy-makers, educators, scholars to foresee the development trends of ICTs and come up with appropriate solutions to overcome negative social, economic and cultural effects. He made a brief overview of the rapid changes which science and technology have made particularly over the past two centuries, stressing that education has become an issue of concern to a wide range of stakeholders: teachers, scholars, scientists, and decision-makers. He also pointed out that the new information and communication technologies have opened new opportunities for teachers and students alike, the creation of global networks facilitating the access to, and the dissemination of, knowledge and skills. He further stressed that today's educational system should be capable not only of equipping students with knowledge, but also with skills and habits which enable them to study independently throughout their lives. He concluded by saying that education for the 21st century should be education for all, providing equal opportunities for individual development.

In his speech on "New Perspectives for Learning in the Information Age", Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, referred to the profound revolution which education is undergoing today, as profound as the invention of printing, and to the ways in which ICTs are transforming the perspectives of teaching and learning in all societies. He stressed that these technologies offer students the possibility of exploring domains of knowledge for themselves, of becoming genuinely active participants rather than passive recipients of knowledge dispensed by the teacher. The role of the teacher is also radically changing under the impact of ICTs, from that of a solitary information provider to that of a manager of class learning. He drew particular attention to the concern of UNESCO to ensure that the information revolution does not serve to widen the gap between the haves and the have-nots, between those who are and those who are not connected to the information superhighway, in other words between developed and developing countries. In this context he mentioned UNESCO's Major Programme IV ("Communication, Information and Informatics") of the Approved Programme and Budget for 1996-1997, which is focused on capacity-building in the developing countries in the field of communication, information and informatics, its International Programme for the Development of Communication, General Information Programme and Intergovernmental Informatics Programme. He pointed out that education is for UNESCO the single most effective means to curb population growth, eradicate poverty, reduce child mortality and foster democracy, peace and sustainable development. At the end of his speech, he mentioned the recommendation made to UNESCO by the International Commission on Education for the Twenty-first Century in its report, namely to create an 'observatory' to explore and ponder the likely impact of ICTs on human freedom and development and on educational and learning process in particular.

The opening plenary session ended with the speech given by Dr. Norio Matsumae, President of Tokai University (Japan), on "New Direction in Education". The paper focused mainly on the need to reevaluate educational values for the 21st century and the impact that changing technology or society have on education. The speaker's arguments focused on six principles: (i) the need to redefine human values starting from a reflection on the traditional concepts for the purpose of finding out the new direction in which education develops; (ii) the need to create a basic idea on the target of education with due consideration of Japan's postwar education; (iii) the complementarity of state and private educational institutions and their contribution to developing a sense of fair competition, as illustrated by the Japanese educational system; (iv) this fair competition has a positive impact on society from the perspective of the introduction of advanced information technologies: (v) the danger that advanced technologies pose to the preservation of traditional culture and values and the important role played by education in preventing undesired effects; (vi) the beneficial use of advanced information and communication technologies in higher education in the next century, including satellite-based distance education, and the role and responsibilities of universities in this new age.

THEME 1: LEARNERS

The first theme was introduced by two keynote speakers, Mr. Blagovest Sendov, President of Parliament (Bulgaria) and Mr. Tahar Hafaied, Director, Institut National de Bureautique et de Micro-Informatique (Tunisia).

In his keynote speech, entitled *In a Global Knowledge Space: Towards Global Wisdom*, Mr. Sendov drew attention to the challenges, both political and technological, that the world is confronted with on the threshold of the 21st century. The information society built upon global information networks offers new challenges to policy-makers, researchers, teachers and learners. He pointed out that the fact that the Congress was held in the European Year of Lifelong Learning was not accidental, on the contrary it reflects the concern of UNESCO and of the European Commission to ensure the conditions for the worldwide dissemination of a technology-driven educational reform. Such a reform would give learners all over the world unlimited access to information and locally available educational services, expertise and resources. However, in the speaker's opinion, ICTs should not be used to the detriment of cultural values, traditions, national identity. In this respect UNESCO is called upon to promote programmes aimed at preserving the cultural diversity in the world. One of the most important changes is the enormous information overload due to the low cost of multimedia information production and distribution and the diversity of distribution channels. This information overload could trigger off an information overskill problem, as the filtering of the great volume of information is very difficult to make and only a small amount of it can be transformed into usable knowledge. It is precisely in the selection of information that the role of teachers is most important. The speaker concluded that UNESCO, other UN specialized agencies, IGOs and NGOs, national governments should coordinate their efforts and launch programmes aimed at smoothing the transition to a communication and information technology-based education.

Mr. Hafaied developed in his speech, *Training in the Context of New Information and Communication Technologies*, some ideas touched on by the first speaker. He drew attention to the fact that the globalisation phenomenon in the application of new information and communication technologies brought about competitive strategies and instituted a new total quality management system in all sectors of activity. The new technologies have become decisive instruments in the development strategy of any country and the information infrastructure has a great impact on the management of most socio-economic activities. The training system (pre-, in-service or continuing) should better equip learners with the knowledge and skills necessary to help them cope with a rapidly changing environment. The speaker argued in favour of a transdisciplinary and dynamic educational system based on a systemic, interactive approach which takes into account the expected objectives. The traditional role of teachers is radically changed. They should be capable of rationally using the new information and communication technologies and of mastering the methodological concepts to allow them to simulate and navigate through the information flow, selecting and restructuring information according to well-defined educational objectives. The speaker stressed the importance of pre- and in-service teacher training courses, which should integrate cognitive, psychological, pedagogical and communication modules. The strategy to be adopted in order to bridge the gap between the traditional and the new, technology-based approach consists in the progressive integration of new information and communication technologies so as to eliminate the phenomenon of rejection due to high costs and human resources involved. Thus the new pedagogical solutions advanced by teachers and teacher trainers would in their turn lead to an evaluation feedback from the peers and ultimately to increased co-operation and participation in the training process.

The discussions in Commission I focused on the peculiarities related to the stages of introducing new information and communication technologies at different levels of education, in the fist place in secondary and higher education. In a first stage special attention should be paid to the acquisition of computer literacy skills, to the teaching of informatics in schools and higher education institutions. Thus the use of the new technologies gradually expands to various knowledge areas. The second stage is linked to the emergence of personal computers in secondary education, which are used not only in the teaching of informatics or foreign languages but also in the teaching of physics, mathematics chemistry and biology. However, several participants noted that only a few elite schools could use ICTs in the first stage. Concrete experiences in the teaching of informatics were provided from secondary schools in Switzerland and Russia. The third stage refers to the use of ICTs in higher education. Universities worldwide have developed programmes aimed at introducing ICTs in order to increase the efficiency of the teaching-learning process, to create more opportunities for distance learning, to give students more time for individual study. The special tasks of universities is to advance knowledge through research in the field, to experiment the application of ICTs in education and to caution against excesses. A general remark was that more attention should be paid to the human aspect when introducing new ICTs in distance education. More studies in psychology should be conducted to promote individualization, division of learners by learner types and the adaptation of learning materials. In spite of the rapid development of new information and communication technologies, the access to them remains restricted, many countries still lacking the necessary equipment.

Participants in Commission II devoted particular attention to the fundamental reorganization of society brought about by the introduction of personal computers and technologies linked to the Internet. These technologies, unlike books and TV, enable global communication between end-users without the need of intermediaries. The opinion was expressed that the changes in educational systems and in the role of the teacher lag behind those in the field of new technologies. However, the information disseminated by means of the new technologies becomes widely accessible and provides new educational opportunities through parallel educational channels. Concern was expressed with respect to the lack of sufficient rules of behaviour permitting to evaluate the correctness of the information disseminated via the Internet and to control possible misuse, particularly concerning international transfers where different legal systems apply. There is also the problem of increased error risk due to the concentration on limited sensory channels of communication. Laws cannot be expected to ensure the necessary behavioural changes which will require an increasing reliance on co-operation rather than competition in human relations. The suggestion was made that academic communities could provide a useful model for testing and emulation in this context, given that their working methods and approaches are already more co-operative and less competitive than in other sectors of society. Two case studies of programmes to introduce informatics in national school systems were presented at length (Israel and Russia). Other discussions centred on encouraging students to produce, and not only use, computer programmes and on providing sufficient training and back-up for teachers.

The discussions in Commission III focused on the Canadian experience in the creation and operation of the Tele-University in Québec and on the achievements in the globalisation of teaching and learning. An interesting presentation was made about a project involving the transfer of educational film to digital format for use on the Internet. The importance of distance education for a wide category of users was stressed, in particular for handicapped as well as gifted children and for the professional retraining of teachers themselves. Concern was voiced over the lack of worthwhile information on the Internet. Attention was drawn to the problems teachers in Central and Eastern countries face (e.g. Hungary) in developing curricula after a forty-year period of overcentralized national educational policy which tended to minimize the input of teachers. Other issues of interest referred to evaluation of successful educational programmes and to comparison criteria of new and old educational methods. According to one opinion, success is a function of three variables (the "3P" model): expected payoff, level of problems that have to be overcome and intrinsic pleasure in being involved with a computer-related innovation. One of the advantages of new information and communication technologies lies in the cross cultural transference of technological innovations in education. The problem of copyright and royalty payment to authors of educational materials 'broadcast' on the new communication technologies should be solved as a prerequisite to their successful application. Two recommendations were made to UNESCO: the first, to set up a working group which should examine the pedagogical aspects related to the use of new information and communication technologies, the present and future data exchanges between countries; the second, to collect and disseminate 'best practice' case studies on projects using new information and communication technologies.

THEME 2: TEACHERS

The second theme was introduced in the plenary session by Mr. Qian Kunming, Deputy Director, Distance Education Centre of Central Radio and TV University (People's Republic of China) and Mr. Alexei L. Semenov, President of Moscow Institute for Teacher Development, Vice-Chairman of Moscow Department of Education (Russian Federation).

Mr. Kunming's paper, *New Information Technology and Teachers*, gave an overview, based on statistical data, of teacher training programmes at the national level which make use of ICTs, a phenomenon which has gained momentum over the last years. Faced with the challenges of the 'information society' and of the 'information highway', the traditional teacher-centred educational model had to be changed and new policies be developed. He illustrated his arguments by taking his university, Radio and TV University of China, as a concrete example. The success of the teacher training programme based on ICTs, introduced by the University (1.5 million college graduates in 8 years only), prompted the Chinese government to extend the use of the new technologies in the training of primary and secondary school teachers. A national network of satellite TV education was established, which broadcasts two sets of educational programmes through a Chinese communication satellite. Special emphasis was laid on the courses produced by China TV Teachers College, covering a wide range of subjects (156 in total), 12,000 hours of visual teaching programmes, which are very popular among teachers. The growing role of distance education has turned the latter into an independent educational model. The wide use of the new information and communication technologies has radically changed the traditional teacher-student relationship. Notwithstanding the rapid development of ICTs, the latter can never replace the direct interpersonal exchange in the educational process. The speaker concluded by stressing the key role of the human factor (i.e. the teacher), the only one capable of inculcating moral values in students.

Mr. Semenov placed his presentation, *Informatics in Russian Secondary Education*, in the general framework of the in-depth educational reform going in Russia at all levels and covering all aspects, teacher training included. His conclusions are based on first-hand experience in the introduction and application of new information and communication technologies in secondary schools all over the country. The experiment conducted in secondary schools once again underlined the key role that teachers play in the reform of the educational process and that particular attention should be therefore paid to their pre- and in-service training. The assimilation by teachers of the necessary skills in mastering the new technologies was conceived as a modular, multi-stage process, designed to overcome possible psychological barriers. This process was backed by the development of federal and regional guidelines regarding the application of information technologies followed by all secondary schools. According to the curriculum, information technologies were included in the general domain of technology studies, involving the development of software environments (e.g. general applications, construction kits, combination of logo and hyper-encyclopedias on CD-ROMs). The success of the programme was ensured to a great extent by the good co-operation relations established between teachers-specialists in new technologies and non-specialists in the teaching of various subjects. Given the vast amount of information disseminated, teachers and students came to regard the Internet as a form of alternative and informal education, a source for student investigation and data collection projects, teleconferences in the framework of the regular curriculum. The speaker concluded that the Russian teachers involved in the project were ready to share their experience with colleagues from other countries and develop co-operation in the field.

The discussions in Commission I began with an evaluation of the results of what is referred to as the "first wave" in the application of computers in education. Proposals were then made for the "second wave" of computer network applications. Access to infrastructure and economies of scale at national or regional level was stressed. In order to minimize the problem of teachers facing difficulties in the access and use of computers, developers/project initiators should work through with teachers all problems related to the use of computers in the classroom. It was emphasized that there are no grounds for concern over the fact that the increased use of ICTs might lead to lack of communication with the students or for a need to protect the latter from harmful information. Governments and educational institutions should not carry out large-scale teacher-training programmes. It is better to concentrate efforts on small projects which are both cost-effective and relevant to immediate concerns. Mention was made of the lack of a large commercial market of computer software and commercial networks for educational purposes. The setting up of cost-free networks for teachers and students is a must in the face of the new challenges. Computer networks permit teachers to have wider access to information and resources and to choose relevant software for their teaching programme. Several speakers pointed out that the development of educational software should not be left to the commercial and industrial world alone. Teachers and their professional associations should be encouraged to become pioneers, innovators and initiators of the wide application of new technologies in education. An interesting presentation was made of a project on how information superhighways can be used for the purpose of introducing pedagogical innovations. Attention was drawn to the fact that the use of ICTs should focus on the pedagogical, and not technological, aspect. The teachers' role as coordinators and 'navigators' was emphasized. They should stimulate reproductive, problem-based and quality learning by using ICTs as one of the tools among others. Integrated curricula, active students and passive teachers, critical thinking and individualization are the key approaches which should be applied in computer-based teacher training programmes.

Commission II launched its debates by questioning whether the new information and communication technologies do actually benefit education. A case study conducted in Bulgaria suggested that they could, on condition that they help introduce a discovery approach to learning and that teachers are well prepared and enjoy their new roles. It was demonstrated that the application of computers can actually empower students, minimizing their traditional role of passive recipients, an autocratic teaching style being no longer possible. Another case study referred to the use of the Internet in the schools of Montana (USA), a state which, in certain respects, can be compared to some developing countries because of its isolation and relatively poor economy. The Network Montana project was developed on a cost-effective basis by planning for the whole state, enlisting the co-operation of industrial partners and making use of the communication channels developed for larger Internet users. A concrete example was the earth sciences curriculum delivered via the Internet, which makes extensive use of real data and image analysis software available on the Internet. It was noted that such experiments cannot be conducted in developing countries, on the one hand, because of the lack of corresponding infrastructure, and the considerable financial expenditure involved, on the other hand. The proposal was made that UNESCO should help these countries in evaluating these technologies and advising on their use.

Among the issues discussed in Commission III was the importance of 'strategic planning' for educational technology projects using new information and communication technologies, which has the following main stages: staff development, curriculum development, equipment development, courseware development and laboratory/practicum development. It was argued that the move to multimedia, like the move to effectively adopt any new teaching and learning methodology, can only be successful and viable if it is undertaken as part of a coherent long-term plan designed to provide solutions in a system-wide manner. One of the projects presented involved several US schools in a model of computer use, called Computer Supported Collaborative Learning. Aimed at changing the role of the teacher and the student and based on pedagogical goals of constructivism and 'intentional learning', the project has created a knowledge building community, using telecommunications, within and without the school, plus group support system software to achieve these goals.

THEME 3: TECHNOLOGIES

The third theme was introduced in the plenary session by Professor Jean-Pierre Arnaud, Conservatoire National des Arts et Métiers (France) and Mr. Rockley L. Miller, President of Future Systems Incorporated (USA).

Professor Arnaud's keynote speech, *Quelles technologies pour l'éducation? Les Nouvelles Tech-*

nologies Educatives à l'heure du déploiement (Which Technologies for Education? New Educational Technologies at the time of Deployment), brought to the fore several questions linked to the application of new technologies in education: (i) the purpose for which a student should acquire more in-depth knowledge about informatics and computers (what solution can be found to the "computers as object of study versus learning tool" dilemma); (ii) the growth of tertiary-professions favours the emergence of an information industry and calls for a change from the so-called processing informatics to communication informatics: in the light of these developments, what is the impact of information superhighways on educational systems and methods? (iii) as social and economic transformations accompany these technological changes, more and more time is devoted to the search for information, which is one of the principal components of knowledge acquisition and training: do the information and communication systems operating in educational institutions keep the pace with this evolution? can training remain a local or a national concern at the time of global networks? The answers lie in the new approach to learning, which should be regarded as a lifelong education process, giving everybody the opportunity to continuously update their knowledge and know-how throughout the active life, to enable them to cope with the everyday changes in the social and economic sphere. That is why the application of informatics in lifelong education has been developing at a more rapid pace than in pre-service and higher education. The speaker argues that the emergence at the end of the 1980s of the global networks and the definition of communication architectures have offered their users new models for the organization of their information systems, informatics changing its vocation from an information-centred to a knowledge-management system. The entire argumentation is based on a clear fact, namely that technologies are only a means to reform the teaching/learning process and not a substitute, and that software developers should systematically include in their projects an educational component accessible to all actors involved (teachers, institutions, enterprises).

Mr. Miller, the second plenary keynote speaker, whose paper was titled *A Matter of Mathematics: The Impact of Moore's Law on the Future of Education, Training, and Global Communications*, began by explaining why Moore's Law has proved incredibly reliable over the past two decades of computer evolution and has had a profound impact on the computing industry and all those parts of society that have benefited from harnessing that growth in computer power. Gordon Moore, founder of Intel Corporation, had predicted that the transistor density - and thus the raw processing power - of silicon-based microprocessor would double every 18 months. The speaker argued that the same law, which is expected to remain reliable for the next twenty years, is now having a major impact on the field of telecommunications, an impact especially demonstrated in the exponential growth in the vast international network of computers known as the Internet. With respect to the impact of technology advancement on public policy and social development, the presentation raised several hot issues of debate at the national and international levels: (i) the perceived widening gap between the 'haves' and 'have-nots', between developed and developing countries; given a proper measure, how can the same technologies be used to narrow it? (ii) the impact of technology advancement on the free flow of information across national borders, can the global marketplace of ideas be controlled by any governmental force, including the United Nations? (iii) can this flow be harnessed to serve every community of people? (iv) what policies and perspectives are necessary to harness Moore's law on behalf of the public good and to allow any country to ride the upward spiral of exponential advancement? The speaker provided statistics in support of his arguments on the fast development of the CD-ROM and multimedia markets over the last years, explaining why more and more educators, trainers and public policy bodies have become aware of the immense potential of computers and the wealth of information disseminated through such means, including the Internet.

The debates in Commission I began with a CD-ROM presentation on interface to interactivity, a necessary condition to an effective learning environment which can be reached through the use of ICTs. An important feature of educational interactive multimedia is that they bring a personal touch or human enthusiasm into the learning materials. Software design should be based on pedagogical needs, i.e. equally content- and learner-oriented. It is important to see how various technologies complement each other to produce the most relevant interactive learning materials (classical as well as ICTs). This presentation was followed by an analysis of the latest developments in ICTs and their application in education. High expectations were put on large computer information systems to solve social and economic problems. As a result, deficiency in applying ICT analysis in many areas called for a more in-depth analysis of the use of such technologies. Some pertinent conclusions emerged from this analysis: (i) an activity should only be "computerized if the structures are well understood and have reached a certain degree of formalization"; (ii) structures should be precisely mapped into computer algorithms before they are honed for higher performance; (iii) when introducing technology, one should build upon existing structures; however deficient they might be, and advance in small steps to new patterns and practices; (iv) the social interaction component should be more and more present in technology. Another presentation referred to distance learning, where more emphasis should be placed on the teaching of mathematical models. With respect to distance education, UNESCO was invited to support training in this area as it requires special training.

The debates in Commission II centred on the complementary nature of science and technology. The regret was voiced that computer science is taught mainly as technology (*learning to use*) instead of paying more attention to its fundamental laws as in other sciences. It was noted that generic informatics tools exist for particular disciplines and that higher-level tools should be able to incorporate the laws of programming educational interfaces in any discipline. A recommendation made referred to the introduction of mathematical modelling in school curricula at an early stage. Thus computing could help illustrate the concept and practice of modelling. It was argued that computer science "laws" are of a practical rather than abstract nature and that they could be readily learned by students. The opinion was expressed that laws and concepts should be introduced in primary and secondary school curricula instead of programming techniques, since the latter could be learned at the professional level when needed. Another aspect stressed was the importance of taking the clients' needs into consideration in developing educational software and of incorporating true interactivity for the user. Software should be designed within a strategic approach in which the context of usage is clearly defined, including the role of the computer among other learning tools used. A number of practical guidelines were developed within this concept, allowing the incorporation of all the required information in the software and taking into account the motivation of the users. Another interesting project, developed by CITCOM, a subsidiary of France Telecom, referred to the setting up of distance education networks based on videoconference techniques in 15 countries and pinpointed universities as the largest users of such systems. However, the project stressed that these new systems should not be seen as replacing the traditional educational techniques, but rather as useful tools in certain contexts. Another experiment revealed the possibilities of resorting to unused TV channels for educational teletext, but with little interactivity or use of a feedback channel in the educational process. A conclusion of the debates was that technologies exist independent of the educational context. The need of reinforcing defined educational methodologies using ICTs was stressed. Attention was also drawn to the importance of studying the psychological aspects of computer use in education and to the role of computers in meeting the special needs of gifted students.

Commission III focused its discussions on the experience of several countries and organizations in the application of ICTs in education. The examples referred to the organization of local schools and regional school networks in Finland; projects carried out by the UNESCO International Research and Training Centre at Glushkov Institute for Cybernetics in Kiev (Ukraine) on Internet literacy, creation of teleteaching networks, promotion of information and communication technology-based didactic laboratories for lifelong teacher training; the development of educational computer networks by the Informatics Centre of Lomonosov Moscow State University; and the structure of the Local Area Network at Minsk State University (Belarus). UNESCO was invited to make known the work and results of the Moscow Congress at the International Conference on Education, to be convened in October 1996 in Geneva, and to support, in co-operation with other partners, initiatives aimed at launching an international database of successful, right-scaled projects which give clear guidelines on teaching and learning methods. UNESCO was invited to promote, in co-operation with other partners, much closer international partnerships at the school level with regard to their experience in the use of ICT-based educational materials.

THEME 4: SOCIAL, ECONOMIC AND CULTURAL ISSUES

The fourth theme was introduced in the plenary session by Dr. P. A. Motsoaledi, Minister of Education of the Northern Province (South Africa) and Dr. Heinz-Werner Poelchau, Ministerial Counsellor (Germany).

Dr. Motsoaledi focused in his keynote speech, titled *The Penetration of New Information Technologies into Developing Countries: Cultural Hegemony or Mutual Exchange*, on the social, economic and cultural implications for his Province, one of the most deprived regions of the country during the apartheid years, with respect to the introduction and use of ICTs. While fully aware of the need to accelerate this process, comparing it to a "revolution within a revolution", he argued, based on concrete facts, that it raises a number of questions which need to be looked at from the perspective of ICTs being imported from the West to a developing country. The inadequate provision of math and science education at primary and secondary school level, the under-qualification of matriculating students entering teacher training colleges, thus preparing to perpetuate the poor standards they themselves worked under, called for the urgent initiation of a range of projects using ICTs. The aim was to provide the reconstruction of education with an adequate infrastructure. The speaker argued that the introduction and application of ICTs in education should be seen as a mutually beneficial exchange between the developed and developing countries and not as a form of cultural hegemony. Since all technologies and inventions bear the imprint of the cultural setting of the countries of origin, developing countries should strive towards becoming technology self-sufficient and not technology dependent in the long run. They are continuously in danger of being consumers of foreign culture. That is why the speaker stressed that the preservation and the nurturing of cultural values should not be alienated from the production process and the invention of new technologies. This is where the positive role of international exchanges comes in, the conclusion being that: developing countries should be encouraged to enter into international co-operation projects in the field of ICTs which promote development, cultural diversity and democracy.

The second speaker, Dr. Poelchau, although representing a developed country, placed the issues under discussion in a wider context. In his speech, *New Information Technologies as a Challenge for General Education and Vocational Training: Chances for International Co-operation from the point of view of the Federal Republic of Germany*, he referred to the rapid developments in the field of new technologies and to the multifacetted challenges the latter pose for society, in an attempt to answer whether ICTs can provide solutions to ever growing and diversifying social needs. In an increasingly interconnected world, he stressed the central role that ICTs can play in disseminating information and knowledge, in promoting economic development, in safeguarding cultural identity and ensuring individual wellbeing. Like the preceding speaker, he warned that a misuse of ICTs might further widen the existing gap between developed and developing countries, between the so-called *information-rich* and *information-poor*, and argued, therefore, in favour of expanding international co-operation in the field. This phenomenon calls for appropriate educational policies and concerted action at national, regional and world levels. Such policies would help to overcome social disparities, ensure wide access and equal opportunities. The speaker outlined the actions in the economic and social spheres taken by Germany over the past decade in order to ensure the transition from an industrial to an information society, leading to a 50 per cent increase in the number of jobs in the information processing sector. This has been made possible following the adoption of new educational policies in the mid-80s aimed at encouraging the use of ICTs in general education and vocational training and attracting the participation of private companies in the development of educational software and training programmes. By way of conclusion, the speaker suggested that international forums be set up for exchanges of experiences in the use of ICTs, inviting UNESCO to launch such an initiative.

The debates in Commission I continued some of the issues raised in the two keynote speeches. An interesting presentation was made concerning the application of scientific films in education using a compact interactive video disk, a project developed by the Austrian Federal Institute for Scientific Film. The opinion was expressed that the multimedia encyclopedias allow learners to study independently but they cannot replace the traditional teacher-student interface. The new curricula using ICTs should not be based only on the latest products, they should incorporate the resources existing in archives. Educational institutions and companies producing educational software should co-operate more closely. In this respect a proposal was made that UNESCO should coordinate at international level an appropriate mechanism which should facilitate the acquisition of educational software, regulate its legal use and ensure a market specially targeted at schools. Another presentation referred to the introduction and use of ICTs in the teaching of the humanities, stress being placed on the need for universities to find adequate solutions to the computerization of these disciplines. A major concern would be to make better known the specific nature of the humanities, a prerequisite for a successful definition of the role and place of new technologies in education in a longer perspective. The new information environment fully meets the most urgent requirements concerning the teaching and learning of the humanities. The expanding informatization of the educational process in these disciplines calls for the elaboration of new strategies so as to ensure students wider access to the knowledge and information imparted by teachers. Information self-sufficiency and information freedom are two major objectives to be pursued in university-level education. The importance of preserving and nurturing human values in the teaching of natural and exact sciences, as well as of engineering-technical subjects was stressed.

In Commission II discussions focused on issues related to the methodology and market for interactive media used in distance education from the viewpoint of a commercial publisher. A clear-cut distinction was made between products for collective versus individual use and those used in real time versus local or asynchronous mode. It was shown that multi-target applications on today's market may be overtaken by finely targeted products for very specific educational use. A clear commercial strategy is needed before a company can invest in multimedia production. The new technologies may become important factors of industry growth but on condition that they are accepted by the market. Real progress could be achieved by countries if they agreed to develop multilingual applications and consequently share resources, each specializing in a particular area. An issue high on the agenda, particularly of Eastern and Central European countries is the development of educational networking. Such networks are considered as the only possibility to overcome the information and organization marginalization of their educational and research institutions, the difficulties to publish and disseminate ideas and results, as well as to ensure the integration of these countries into the world community. The results of an interesting project, developed by the Conservatoire National des Arts et Métiers (France), in the field of distance education courses for adults were presented, which uses the on-line versus local approach and individual versus collective self-learning. However, a hybrid of on-line and local delivery was seen to be generally most appropriate. Self-learning is typically supplemented by real time telecommunication links to remote video presentations and student discussion meetings. An analysis was made of the impact of the development of informatics and of new information technologies on the socio-economic and technical-scientific development of society. Two recommendations were made to UNESCO: to draw the attention of the world community to copyright problems in respect of educational programmes and to organize workshops for African countries in particular, aimed at ensuring a wider use of educational software.

The debates in Commission III touched on such issues as the development of distance education in certain Latin American and Caribbean countries, as well as the current status of international co-operation in this domain, with particular reference to UNA-CRESALC projects. Stress was laid both on the organizational and technological progress achieved in this field and on the main problems facing distance education in the region, the latter including high dropout rates (about 90%); lack of policy continuity; low interaction between students and teachers; obsolescence of materials; and scarcity of staff development programmes. In order to deal successfully with the above problems, international co-operation, both inside and outside the region, is particularly important. The analysis of the development of distance education in Latin American and Caribbean countries ended with several recommendations addressed to developing countries and countries in transition. A project, entitled *International Visual Communications*, run by InterNews, a nongovernmental organization, which was designed to meet the educational needs of the hearing-impaired (200 million members), pointed to the particular opportunities that ICTs (especially, visual communication) create in this field and the need that the traditional educational policies with respect to the education of the hearing-impaired be changed. This process would not only respond to the requirements of this community but would also enrich the common educational and cultural heritage. A case from Zaire drew attention to the fact that the developing countries should not be left out of the "information revolution". Emphasis was placed on the need for the development of appropriate educational policies with regard to the purchase and use of computers for educational purposes, as well as for the protection of intellectual property rights. An appeal was made to UNESCO to assist in this respect.

THEME 5: EDUCATIONAL POLICIES

The fifth theme was introduced in the plenary session by Professor José A. Valente, Universidade Estadual de Campinas (Brazil) and Professor Tjeerd Plomp, University of Twente (The Netherlands).

In his keynote speech, *The Role of Computers in Education: Achievement and Comprehension*, Professor Valente started from the assumption that in most cases educational processes are restricted to asking students to do various activities, which they can, or cannot, do successfully. However, the fact that they may be able to accomplish these activities does not mean that these students necessarily comprehend what they have done. To substantiate his arguments, the speaker referred to the distinction, made by Piaget, between achievement with success (*savoir faire*) and the comprehension of what is achieved, according to which the passage from the level of achievement to the level of comprehension is being done thanks to the grasp of consciousness. This passage requires the transformation of action schemes into notions and operations. With the computer, the student can do lots of activities and achieve them successfully. However, depending on the type of software used, and the teacher's involvement in the computer activity, the student may, or may not, understand what he/she has accomplished. This is the case when the student uses a tutorial or many multimedia software. The speaker stressed the need for a new approach, one that encourages students to engage in a programming activity that demands different actions which can create the conditions for comprehending what he/she is doing. This process of programming can be seen as a cycle consisting of description-execution-reflection-debugging-description. In this cycle, "debugging" constitutes a unique opportunity for the student to construct his/her knowledge and understand what he/she is doing. Programming, the speaker argued in conclusion, is an opportunity to engage in the passage from achievement to comprehension, as it involves certain actions which are essential for the development of important skills that are not often present in the educational process today, nor in many types of educational software.

The second keynote speech, *New Approaches Needed to Teaching, Learning and the Use of Information and Communication Technologies in Education*, introduced by Professor Plomp, centred on the new challenges facing society, in general and all the actors involved in the education process, in particular, as a result of the impact of the use of ICTs in education. One major challenge the educational system faces today is to prepare individuals to cope successfully with the change from an industrial to an information society. Other challenges refer to the capability of educational systems (i) to find solutions to the social, cultural and economic problems of the society; (ii) to ensure individualized and flexible training, suited to specific needs, as the growing individualization in and diversification of society call for new approaches to education; (iii) to provide opportunities for lifelong learning and new demands for learning, since the guarantee for open and equal access to education for everybody is, under the current circumstances, becoming almost unaffordable. Immediate objectives, to be pursued by educational systems, such as managing large amounts of information, developing learning strategies to facilitate effective learning and assuring that all citizens are skillful in assessing, selecting and dealing with information are considered of critical importance. The speaker argued in favour of a new balance between a teacher-oriented and a student-oriented process, with much more emphasis to be given to the latter. He pointed that ICTs provide a means to instrument such revolutionary changes called for by the transition to an information society. The solution proposed was that today's schools and teacher training institutes should design programmes providing bridges from "old" to "new" definitions of education. Their main focus should be to generate and support "emergent practices", with ICTs as a medium, in order to prepare both students and teachers for their new roles in an information society.

Commission I focused its debates on current policies regarding the use of ICTs in several countries. For example, in France, the Ministry of Education has launched a number of initiatives aimed at modernizing educational management in schools; introducing relevant ICTs in technical and vocational training; ensuring the use of ICTs as a teaching aid in various subjects; expanding the use of ICTs in secondary schools by connecting them to Internet; and, last but not least, providing access for students to computers. Inter-school networking and twinning with secondary schools in other countries have also been developed. Leading schools which have put into practice ICT-based systems and programmes should be encouraged to make their resources available to other schools. Stress was laid on the importance of pre- and in-service teacher training programmes as teachers should play a pioneering role as far as the application of ICTs in education is concerned. Another case presented a programme developed by the Norwegian Ministry of Education, Research and Church Affairs for the 1996-1999 period designed to promote the use of ICTs at all educational levels. The programme pointed to the need of upgrading teacher skills in the use of information technologies and to the increasing role of distance education in teacher training. The experience acquired over a 25-year period showed that the main obstacles to the widespread use of ICTs in education had been the lack of computers, of a curriculum adjusted to their use and of adequate teacher education. While technology is no longer a problem and efforts have been made by most countries aimed at upgrading curricula, difficulties still persist in teacher education, a serious problem being the lack of funding for teacher training courses. In this context, distance education is seen as playing an important role. It was noted, however, that even the most sophisticated technology can never substitute the human factor, the face-to-face contact between a teacher and a student. Other issues discussed touched on the importance of elaborating a more clear classification and terminology in the field of ICTs and the need to promote a wide range of research on the effective use of ICTs.

Commission II began its debates with the presentation of a project carried out by IBM-CLIE (Centro Latinoamericano de Investigación en Educación), a research centre in Mexico, on the development of educational tools and approaches meant to prepare students to better cope with the new challenges they will face in a society rapidly transformed by information technology. Skills in knowledge navigation, new learning culture and role transformation are acquired through education based on the *Genesis* concept which stresses the development of imagination, initiative, observation and flexibility. This concept has been introduced in the curricula of about 1,500 schools in several Latin American countries, through the use of specialized microcomputer-based software modules developed by IBE-CLIE. An extension of the programme, called *Quorum*, employs networking in the region to provide a "knowledge production space" enabling children to co-operate in building conceptual knowledge maps. A case from Slovakia stressed a major problem facing Central and Eastern European countries, namely the so called double "brain drain" phenomenon, as it involves, on the one hand, students choosing to study in neighbouring countries and, on the other, graduates emigrating abroad. In order to minimize the effects of this phenomenon, the Slovak Technical University has developed policies intended to upgrade the information infrastructure, to encourage the study of all subjects in English as the latter is the dominant language of technology, to promote the international recognition of its diplomas, as well as to expand co-operation with Western countries. Three areas for further discussion were identified: (i) the Internet as a potential promoter or destroyer of cultural and linguistic diversity; (ii) the meaning of the "knowledge-based society" and the role of schools in bringing it about; and (iii) problems of access to information networks, particularly for rural areas. The SchoolNet project, sponsored by the ten provincial education ministries and the federal government of Canada, aims to link all 16,500 schools in the country to the Internet by 1997.Besides its pedagogical objectives, as it is designed to help teachers acquire the necessary skills to use technology in the classroom, SchoolNet hopes to strengthen communications and sharing among teachers who are scattered across the country. International co-operation, and particularly UNESCO's support, was considered to be very important in the preservation and dissemination of cultures and languages in an information society. A proposal was made that an international coding scheme for the content of databases and telematics applications be adopted.

The discussions in Commission III particularly wide-ranging in coverage of issues and in expressing a broad diversity of opinions. One opinion voiced the concern that ICTs should not dictate educational policy. Without denying the positive role of the new technologies, attention was drawn to the negative aspects of an endless thirst for information, a kind of "infomania". The problems faced by developing and least developed countries were particularly stressed: lack of political will and financial resources necessary for the development of ICTs; shortage of teachers; too small and widespread projects not backed by sound research and evaluation; not enough distance education curricula; lack of infrastructure, such as electricity and telecommunications; limited access to ICTs (technologies are accessible only in towns whereas the majority of the population live in rural areas); software inappropriate to cultural environment; software piracy. It was noted that instead of narrowing the gap between developed and developing countries in the field of ICTs, as recommended at the first UNESCO Congress, an opposite trend has been taking place. It was therefore proposed that associations of participating institutions be created at regional level, in which some members would act as "centres of excellence". Another issue centred on the need for research into students' concepts and attitudes to technology so as to train technologically aware and innovative youth capable of coping with the challenges of the twenty-first century. Several recommendations were made to UNESCO: (i) to assist African countries to formulate intellectual property legislation with a view to protecting the rights of African programmers; (ii) to set up a network of special teacher training centres in Africa; (iii) to help establish a database of ICT projects as an aid to policy advisors; (iv) to monitor the creation of an international network of women specialists in ICTs and to pay increased attention in its future action to gender-related information technology issues.

THEME 6: INTERNATIONAL CO-OPERATION

The sixth theme was introduced in the plenary session by Mr. Henrikas Yushkiavitshus, Assistant Director-General for Communication, Information and Informatics of UNESCO, Professor Armando Rocha Trindade, President, International Council for Distance Education (Portugal) and Mr. Wim Jansen, Task Force Educational Software and Multimedia (European Commission).

In his keynote speech, Mr. Yushkiavitshus gave a comprehensive outline of UNESCO's programme activities in the field of new information and communication technologies in the broader context of the emerging information society, of which both informatics and education are major building blocks. The speaker stressed that although the economic and commercial interests are the main driving force behind the building of the information superhighways, the development of education, culture and science as distinct and integral parts of human civilization cannot be left totally to the control of market forces. As an intergovernmental organization, UNESCO is concerned with ensuring access to the new technologies to its Member States, particularly to developing countries in order to reduce the gap between the "haves" and "have-nots". With the advent of the information age, learning is increasingly becoming a *lifelong* requirement giving individuals the possibility to be better equipped with the ever more diverse knowledge and skills characterizing an information society. In the field of education, information technologies can complement traditional educational methods and enable educational systems to adapt to different learning and training needs of societies. New tools such as interactive TV, computer simulation, telematics and teleconferencing provide an unparalleled opportunity to "reach the unreached" and to make lifelong education for all feasible, especially for learners for whom access is limited by time and space, age, or socio-cultural environment. As no country or even group of countries can hope to solve problems related to education and the information society single-handed, international co-operation is seen as a necessity and UNESCO is called to play the catalyst role in this process, in keeping with the ideals enshrined in its Constitution. Several actions undertaken by UNESCO aimed at expanding international dialogue in this area were mentioned such as a series of pilot projects, developed in co-operation with the International Telecommunication Union, on the educational application of interactive television in various developing countries (India, Mexico, Morocco); INFORMAFRICA, a programme launched in 1990 designed to help African countries to introduce informatics in their educational systems; or the Regional Informatics Network for Africa project, carried out by the Intergovernmental Informatics Programme of UNESCO. UNESCO's efforts in the promotion and defence of copyright and intellectual property rights were also stressed.

The second speaker, Professor Trindade placed emphasis in his speech, *International Co-operation in Open and Distance Learning*, on the increasing role of distance and open education in an information society. While admitting that certain skills and a number of subject matters cannot be taught to isolated users studying at home, even if linked to the teaching system by the most sophisticated telecommunications network, he argued that educational institutions should adopt a "mixed-mode" model of operation. This solution would ensure the necessary flexibility in the teaching and learning of various disciplines as it allows a balanced combination of face-to-face interaction and distance learning approaches. The speaker further added that although a mixed-mode model of operation is not formally adopted, institutional co-operation between distance teaching systems and conventional ones, belonging to the same linguistic and cultural area, always bear fruit. International co-operation in scientific and methodological research, exchanges of academic staff members are both profitable and motivating for all parties involved. The distance learning approach has been used successfully in vocational training, either in the initial stage or as continuing, lifelong training. Unfortunately, in spite of the diversity of organizations and institutions offering open and distance learning services and products, there is not yet a structured market in the field. This makes certain services and products very expensive for the current individual end-user when they are provided by private operators. The speaker mentioned another deterrent factor, namely the fact that continuing education has not been yet recognized as an individual and social right , which prevents the underprivileged categories of users from access to its benefits on a permanent basis. He concluded, however, on an optimistic note, reiterating the idea expressed by the previous speaker, that international co-operation is of paramount importance to pool experiences, to reduce costs, to create synergies and economies of scale. Intergovernmental and nongovernmental organizations such as UNESCO and the International Council for Distance Education should join their efforts and pursue common strategies in order to improve, democratize and reinforce education and training opportunities all over the world.

Mr. Jansen made a presentation of the European Commission's Task Force Multimedia Educational Software and of its main goals. The latter can be summed up as follows: (i) to identify the most appropriate R&D activities; and (ii) to promote the use of multimedia in education and training at all levels on-line and off-line. These goals have been set in order to better respond to the increase and diversification of the education and training needs that are developing as a result of the emerging information society, to upgrade and strengthen European industry by improving provision of high quality training material, and to enable companies, in particular small- and medium-size ones, to open future markets. The Task Force is seen to make a major contribution to increasing European employment, economic and social cohesion, by respecting cultural diversity, and bringing sustainable services to the citizen. In a world of growing competition, notably from the USA, European countries should strive to create major opportunities and benefits for a quickly expanding home market, which in turn requests further research to develop the next generation of products and services, and to train a better skilled workforce at lower cost. All these actions are aimed at preparing the individual to better cope with the new challenges of the information society. Various programmes such as Socrates and Leonardo da Vinci have been developed to stimulate research efforts through co-operation.

The debates in Commission I covered a presentation of the aims and objectives of the International Federation for Information Processing (IFIP), its relations with UNESCO and the International Council of Scientific Unions (ICSU). The presentation was followed by a briefing on the history of computer processing and the objectives of using computers in teaching and on the activities of IFIP's Technical Committee on Education (TC 3). The importance of using computers in curricula, stimulating computer-based learning and of producing information on teaching strategies was stressed. In this connection, mention was made of an IFIP publication on the pedagogical and psychological impact of information technologies, as well as of a modular curriculum for secondary school using ICTs. Another presentation concerned the impact of new technologies in the schools of Europe and the G7 nations, particularly in Canada, France and the UK, which introduced information technologies in national curricula. Statistics show that there are a lot of disparities among countries with regard to the number of microcomputers, percentage of primary and secondary schools with one or more computers and student/computer ratio. The importance of adequate teacher training programmes using ICTs was stressed, to enable teachers to make effective use of information technologies and thus to improve the quality of the educational process. A suggestion was made that an inter-governmental programme for the legal support of distance education be established to ensure state licence, as well as accreditation at national and international levels. Such a programme should also deal with legal protection against discrimination.

The debates in Commission II referred particularly to the need for policy- and decision-makers to redefine the mission of the school in a fast changing society under the impact ICTs. They are confronted with problems of adapting their educational systems and, consequently, curricula and teaching methods, so as to better respond to the emerging needs of an information society and facilitate insertion into the socio-economic sphere. Experience shows that ICTs play a decisive role in increasing the efficiency of the teaching/learning process and the adaptation capacity of educational strategies to the real demands of society. However, in a world of highly diverse educational systems, a prerequisite for the success of these changes is that they should take into account national specificities. Emphasis was placed on the need to promote education throughout life as knowledge and information acquired in school become rapidly obsolete. It was shown that teachers will play new roles as a result of the application of ICTs as present-day societies witness a shift from a mass educational to a partially individualized, "custom-tailored", process. A proposal, titled *A Global Network for Teacher Tele-Training*, continued some of the issues earlier discussed. It indicates plans for setting up a Global Teachers' Network Service Organization (GTNSO), which would provide a platform for the design, development and distribution of courses relating to technology in education for teachers throughout the world. The courses, as well as other communication and information services, would be made available via the Internet. With the rapid advances in technology, it is difficult for the existing pre- and in-service teacher training systems to keep pace with the innovations in teaching methods and practice. Participants suggested that the proposal be included in the recommendations of the Congress.

Commission III centred its debates on the results of some projects aimed at expanding international co-operation in the use of ICTs in education. One such project, developed in the Russian Federation, referred to the creation of a telecommunication infrastructure for science and education. The presentation was accompanied by an on-line demonstration between two Russian cities, Moscow and Novosibirsk. Attention was drawn to the importance of extending economic support for the introduction and application of ICTs in education, research and development, especially in countries undergoing transition. Telematics creates new possibilities for reinforcing co-operation between countries members of the Commonwealth of Independent States. In this context a proposal was made for the establishment in Moscow of a UNESCO Institute on Educational Policy and New Information Technologies, which would foster international co-operation in the use of ICTs in the region. Another presentation, expressing the viewpoint of the Economic Development Institute of the World Bank, stressed the fact that it is not only information technology that is changing. Many countries are undergoing both economic and political transitions, which bring with them enormous demands for knowledge, not just from students, but also from the public at large. Much of this demand is for knowledge that is built on the experience of other countries. The major problem for international organizations, such as UNESCO and the World Bank, is how to increase the chances for knowledge to flow, not from the rich to the poor, but among nations and individuals as information equals. The continuing global effort to reduce poverty through sustainable and equitable development should be at the centre of concerns for equitable access to technologies and the knowledge they carry. Governments play a key role in ensuring equity and in providing those public goods, such as education, that enable individuals to share in the benefits of growth. The importance of international partnership programmes was emphasized with a view to avoiding duplication of effort and costly mistakes. Several initiatives at the world level were mentioned, such as the Economic Commission for Africa's programme for telecommunications development, USAID's Leland Initiative to build Internet access in Africa, the World Bank's INFODEV programme in which both the Bank and the private sector are co-operating to improve telecommunications policies and applications, or the pilot project launched by the Economic Development Institute of the World Bank to establish international Internet networks in the former Soviet Union.

WORKSHOPS

In addition to the plenary and commission sessions, twelve workshops were organized on 4 and 5 July 1996 on the following topics: *Information Superhighways and Education*; *The Psychological-Pedagogical Impact and the Medical Consequences of the Application of Modern Information and Communication Technologies*; *The Software Environment - A Perspective for Effective Involvement*; *Transfer of Knowledge and Skills through Information and Communication Technologies*; *National Policies - Transfer of Technologies*; *Individual Distance Training*; *Analysis of UNESCO/IFIP Documents published in 1994-1995 (Part I: Informatics for Secondary Education -A Curriculum for Schools; Part II: A Modular Curriculum in Computer Science)*; *Logics, Informatics and Education*; *Information Technologies and Humanities Education*; *Development of Pre-University Education via Modern Information Technologies and Methods*; *Medicine: New Approaches to Knowledge Acquisition and Improvement*; and *Forming Integrated World Data Bases and Knowledge about Planets of the Solar System and Their Use in Research and Education.* The workshops were chaired by leading experts, academics and researchers, such as David Walker (United Kingdom); Peter Waker (South Africa); Alain Meyer (France); Tom van Weert (The Netherlands); Harald Schütz (Germany); K. K. Kolin; Yury N. Afanasiev and Alexei L. Semenov (Russian Federation).

A number of recommendations made by participants in the workshops were included in the Declaration and Recommendations of the Congress. The issues discussed are covered in depth in the Congress proceedings to be published.

CLOSING SESSION

Academician Yury L. Ershov and Professor Jef Moonen, Co-Chairpersons of the International Programme Committee of the Congress, took the floor to present a summary of their personal views on the discussions having taken place during the Congress, stressing the increasing role ICTs play in all educational systems today and the need for national governments to develop adequate educational policies and programmes on their implementation. The views of both speakers converged in stressing that the success of the policies aimed at expanding access to, and the use of, ICTs in education depends to a great extent on an improved coordination of the efforts made by various international organizations, UNESCO playing a unique role in strengthening international co-operation in this field.

Mr. Ivan Stanchev, Workshop Programme Coordinator, reported on the results of the twelve workshops. The topics of the workshops were related to the six major themes of the Congress. He stressed the wide coverage of the issues discussed, the diversity of opinions expressed and the large number of proposals which would be included in the recommendations of the Congress. More than 200 participants presented papers and took part in the debates. The main conclusions resulting from the discussions were the following: (i) ICTs lead to new forms of learning, such as open and distance education, individualized training, which complement the traditional system; (ii) teachers and trainers should be trained properly to use the new technologies through well-developed and flexible pre- and in-service teacher training programmes; (iii) there should be a closer co-operation between educators as ICT users and technology developers, with a view to broadening the access to network connection between teachers, schools and higher education institutions and providing a full multimedia platform; (iv) ICTs are recognized as a powerful tool for changing the educational systems of developing countries and countries in transition; (v) ICTs are also changing the cultural perception of the learning process and are leading to more individual-oriented education and training; (vi) governmental support is needed for the communication networks to be used by educational institutions, especially in developing countries and countries in transition; (vii) the need to establish a real functioning system for international co-operation between teachers and for UNESCO to play an important role by encouraging supporting the internationalization of information and curricula exchange in the area of teaching the basics of ICTs.

Then followed the oral reports on the work of the three commissions. Ms Katerina Martcheva, President of Commission I, gave an overview of the discussions which had taken place in the Commission. She emphasized the high interest of participants - decision-makers, academics, researchers, in the topics discussed, as demonstrated by the big number of recommendations made. The issues discussed included an analysis of the latest developments in the field of ICTs and the best approaches to the latter's introduction in curricula, of the trends and experiences in the application of ICTs in educational systems, as well as the results obtained at national, regional and international levels. The proposals put forth by participants, while emphasizing the important role of ICTs, voiced concern for the preservation of the social, cultural and linguistic diversity.

Mr. Gerald McConaghy, Rapporteur of Commission II, took the floor. He stressed the large representation from many countries and the variety of views expressed. He summarized the main issues discussed at length, such as the importance of promoting and enriching culture and language through the use of new technologies and the Internet; the provision of equal opportunities in access to computers and the Internet; the important role of teacher training, particularly as it relates to the use of technology as part of the teaching experience and methodology; the need for the sharing of information, of various models that have been used, of programmes; and, last but not least, the need for closer co-operation between education and industry through the development of partnership schemes. He underlined the common interest all participants shared in trying to promote ICTs as an important tool to help young people learn.

Mr. Alexei M. Dovgyallo, Vice-President of Commission III, made a summary of the results of his commission. He stressed that distance education was given particular attention in the discussions and many recommendations were made in this respect, especially from the perspective of the needs of developing countries and countries in transition. A proposal made by the Russian participants and supported by the rest of participants to be included in the Recommendations of the Congress referred to the creation in Moscow of a UNESCO Institute for information technologies in education, which should focus its attention, among others, on scientific expertise of short-term forecasts in the field of new information technologies in education.

Mr. John Foster, Rapporteur-General of the Congress, then summarized the results of the Congress, the general conclusions, recommendations and suggestions for action drawn up by participants during the Congress.

The President of the Congress requested participants to adopt the Declaration and the Recommendations, mentioning that the final text will include all the recommendations made during commissions and workshops.

Mr. Colin N. Power, Assistant Director-General for Education of UNESCO, addressed the audience recapitulating on the work of the Congress and assured participants that their recommendations would be taken into account insofar as possible in the Organization's future programme, especially those concerning the strengthening of national, regional and international co-operation.

Mr. Viktor A. Sadovnichy, Rector of Lomonosov Moscow State University, took the floor on behalf of the host institution. He stressed the role of international co-operation and exchanges in promoting the use of, and research on, ICTs in education.

Mr. Vladimir G. Kinelev, President of the Congress, thanked participants for their contribution to the success of the debates and declared the Congress closed.

REPORT

UNESCO'S MAIN ACTIVITIES IN THE FIELD OF EDUCATION AND INFORMATICS AFTER THE FIRST INTERNATIONAL CONGRESS ON EDUCATION AND INFORMATICS

INTRODUCTION

The purpose of this document is to provide an overview of UNESCO's activities carried out after the First International Congress on Education and Informatics held in Paris in 1989. In line with its recommendations, the Organization's activities have focused on the promotion of international cooperation in the application of new information technologies in education and training with the aim to alleviate educational disparities within and between the countries, improve the management system of education and to broader access to various types and forms of education and training within the context of a future complex learning society.

This concern was reflected in UNESCO's Third Medium-Term Plan (28 C/4) for 1990-1995, which stressed the need for cooperation -with inter-governmental and non-governmental organizations to promote the use of the new information and communication technologies in education. Based on the Third Medium-Term Plan, the subsequent Approved Programme and Budget for 1990-1991, 1992-1993 and 1994-1995 foresaw national and regional activities which were carried out within the framework of the Organization's Regular Programme, Participation Programme and extra-budgetary operational projects. The Regular Programme activities consist of the organization of seminars, research, publications, promotion of networks and pilot projects. Assistance is also provided to Member States in the planning, implementation and consolidation of national and regional projects through extra-budgetary operational projects. Within the Participation Programme, contributions are also made to national activities in informatics and education through consultancy services, purchase of equipment, fellowships and study grants.

While these three programmes constitute the main modalities for the promotion of information technologies in education, it is important to single out the Intergovernmental Informatics Programme(IIP) which UNESCO's General Conference created in 1985. In order to meet the challenge posed by the widening gap between the developing and developed countries, the IIP has centred its development objectives around the valorization of human resources for informatics and through informatics, the main areas of activities being the training of specialists, teachers and informatics users, the promotion of informatics networks, the development of software, research and development and the development of policies and strategies in informatics. From 1988 to 1995, more than 180 projects were carried out within the framework of IIP.

The present report focuses on the main activities in the broad field of education and informatics initiated by UNESCO in close cooperation with related NGO's, IGO's, Aid agencies and professional associations. The activities are presented under the following five categories:

(i) The introduction of information technologies in schools, universities and in instittjites of non-formal education Information technologies as a subject matter, as a main or support learning tool

(ii) Information technologies and the role of teachers

Awareness raising, training of teachers in the use of information technologies at school, development of educational software

(iii) Development of informatics in education

Development of educational software, training of experts and users, promotion of networks and cooperation schemes, policies and research, socio-cultural considerations

(iv) Information technologies as a tool for educational management. Use of informatics for educational statistics, management and administration in the educational system

(v) Information technologies for the development of distance and open learning the use of information technologies as instructional methods or means of communication for student support.

(I) THE INTRODUCTION OF INFORMATION TECHNOLOGIES IN SCHOOLS, UNIVERSITIES AND INSTITUTES OF NON-FORMAL EDUCATION

DEVELOPMENT PROJECTS

A project on the introduction of informatics into a national education system in Syria was carried out with the aim of developing a computer education programme in secondary education. Four Informatics Teacher Training Centres were established and 120 teachers were trained to be responsible for teaching computer science as a subject in secondary school. As many as 5,500 students in 14 pilot schools were involved in the training process.

In Bulgaria, a national Research centre for Educational Informatics was established within the framework of a project on the introduction of informatics in education of children in Bulgaria. The centre serves as a focal point for all national activities related to the application of advanced information technology to children's education and promotes research, exchanges and training in methods and techniques for introducing informatics into the education of children. The project outputs were awareness of the introduction of computers and related tools into the process of education and education of teachers; development of research, adaptation of training systems; implementation of new methods and new tools - hardware, software, videoware etc.; establishment of a system of scientific and technical publications and information bulletins; exchange of experience in the above fields.

The project «Development of computer education programme in Egypt» was designed to introduce and teach informatics as a subject of instruction in secondary school, and to prepare the groundwork for the use of computers as educational tools in teaching other subjects as well as in school administration. More than 3,000 teachers and 20 teacher trainers were trained and an Educational Software Development Unit has been set up.

The REDALC Project (Support to Telematic Academic Networks for Research and leaching in Higher Education, Science and Technology in Latin America and the Caribbean) is executed by the UNESCO Office in Caracas,(CRESALC) in cooperation with the Latin Union, the Foundation for Networks and Development (FUNREDES) and the support of the Commission of the European Union. The main products of this project are:

- Inventory of information and communication systems for higher education and scientific and technological development in Latin America and the Caribbean.
- Methodology for the evaluation of academic information and communication systems.
- Methodology for the development of academic networks in higher education, science and technology in developing countries.
- Methodology for the creation and development of virtual communities and interest groups in the academic world for research, teaching and cooperative work. The Project *"Quality and Technology in Higher Education in Latin America and the Caribbean "*, as a follow-up of the REDALC Project and Network for the improvement of quality in higher education, was carried out by CRESALC between 1986 and 1989. The main products of the Quality and Technology project are two books published by CRESALC and four regional and sub-regional training workshops. (See Sections Publications and Training activities).

UNITWIN/ UNESCO Chair Programme

An innovative approach to the transfer of knowledge. Following the decision of the 26th Session of the General Conference of UNESCO, the UNITWIN/UNESCO Chair Programme was established with the aim to assist in the institutional development of higher education in the world and to promote rapid transfer of knowledge by developing university networking and linking arrangements among institutions. The programme lays special emphasis on co-operation among higher education institutions in the developing world and encourage networking at sub-regional, regional and interregional level. Focusing on graduate studies and research, the programme promotes visiting professorships and covers a wide range of fields: sustainable development, environmental and population issues, science and technology, social and human sciences' peace, democracy, human rights, the educational sciences, culture, communication. In Latin America, there is a UNITWIN Network of UNESCO Chairs on new technologies of information and communication in distance education for which the University National Abierta in Venezuela is the focal point in collaboration with UNESCO Office in Caracas .

3 UNESCO Chairs are established:

- UNESCO Chair in Information Technology, Universidad de la Habana, co-ordinated by the University of Murcia (Spain) and the Universidad Nacional Autonoma of Mexico
- UNESCO Chair in Computer sciences. University of Mauritius
- UNESCO Chair in Informatics for the Humanities, Institute of Mathematics and Informatics, Vilnius. The present Chair organized in 1994/1995 2 basic courses for postgraduate students:

- Informatics for the Humanities (1st level course) computerized data processing, data bases, academic and research computer networks.

- Informatics for the Humanities (2nd level course) image analysis, multimedia systems. Special courses for developers of telelearning materials in the field of informatics for the humanities are under preparation. To support the teaching and research activities, the Chair had 3 visiting professors, as well as a number of study tours and fellowships.

Within the framework of the UNESCO Associated School Project (ASP), a new ASP international telecommunication pilot project was designed and conducted on 16 November 1995. Entitled *"This is Our Time"* the project involved some 30 schools in 20 countries worldwide and focused on enabling ASP students to share their ideas about the 50th Anniversary of the United Nations and UNESCO and to learn about each other. The pilot project was conceptualized and designed by an ASP school in the Netherlands and funded from extra-budgetary resources.

Under the project *"Promotion of Science and Mathematics Education through Large-Scale Secondary Teacher Training Using Information and Communication Technologies in Uruguay"*, action was initiated and co-ordinated with OREALC, Santiago, in 1994-1995. The project activities started in 1995 and will be continued through 1997. It is planned to use and replicate in the region the experience gained and results achieved in Uruguay.

In addition, numerous national projects and activities have been supported through UNESCO's Participation Programme including the introduction/reinforcement of informatics in technical institutes and universities (Guinea, Sierra Leone, Georgia, Botswana, Republic of Czech , Pakistan, Sao Tome-et-Principe), the use of informatics and information network for educational management (Seychelles, Fiji , Mongolia, Syria, Regional Africa, Gambia), teacher training (West Samoa, The United Arab Emirates, Saudi Arabia), informatics in secondary education (Tonga, The United Arab Emirates, Bulgaria, Burundi, Romania), regional meeting on information technologies and education (Japan), training seminar in educational technology/informatics (Jordan, Oman, Romania, Togo), computerization of the world register of university studies in Jewish civilization (Israel), training on the use of UNESCO CDS/ISIS Software (Canada), development of computer assisted learning (Turkey), specialists training (Ukraine).

RESEARCH AND POLICIES

Within the framework of the international programme «Children in the information age» a workshop *Informatics at school today and tomorrow* was organized by the Ministry of Education and Science of Bulgaria, the Bulgarian Mathematical Society and UNESCO in Sofia, Bulgaria in November 1994.

Under the project USEIT (Use in Systems of Education of Information Technologies) and in close cooperation with the International Association for the Evaluation of Educational Achievement (IEA), a survey on the situation and tendencies of the countries with regard the introduction of informatics in schools was conducted with the participation of 200 schools in 12 countries

The draft version of an inventory of *"Examples of Secondary School Curricula and Teacher Training Materials"* was prepared in 1995. The teacher training materials include - among others - programmes relating to the use of information and communication technologies for large-scale teacher training.

A sub-regional seminar on the introduction of informatics in secondary education was organized by the UNESCO Regional Office in Dakar (BREDA) in Ouagadougou, July 1989, with the participation of 30 experts from the sub-region in charge of projects in informatics education. The seminar focused on the elaboration of national policies for the introduction of informatics in education and the definition of a strategy for a progressive and selective introduction of .informatics as a teaching tool.

A case study on the experience in Ivory Cost of the introduction of informatics in technical and vocational training was carried out by BREDA. The study provided some information on the potential and means for the introduction of informatics in technical and vocational training.

A sub-regional consultation on the use of micro-informatics in science and technology education was organized by BREDA at the Institute de Recherches Mathematiques of the University of Abidjan (Ivory cost) in September 1989 with participation from Burkina Faso, Cameroon, Mali, Senegal and Ivory Cost.

The consultation examined five sub-themes: Programme and methodologies for computer-assisted learning; Programme and methodologies for a computer-assisted learning in the area of applied mathematics; the software available or to be produced; sub-regional and regional cooperation in the use of micro-informatics in science and technology education. The meeting recommended that micro-informatics for science and technology be introduced at senior secondary school level. Appropriate software to be produced locally by specialists in the sub-region based on existing programmes and manuals were also discussed as a modality for sub-regional cooperation.

A sub-regional seminar on the introduction of informatics in technical and vocational training was organized by BREDA in Dakar in July 1993.

The seminar discussed issues such as the introduction of informatics as both subject and a learning tool in technical and vocational training and the maintenance of equipment. Particular interest was the training of teachers in informatics as a subject, and the training of other teachers in the use of computer in the area of specialization. A programme for the training of trainers ;is well as a specific programme for the training in maintenance was suggested.

TRAINING ACTIVITIES

Regional training workshop for national coordinators of information systems for higher education, science and technology in Latin America and the Caribbean, within the framework of the REDALC Project (Brazil, 1991).

Regional training workshop for users of telematic networks in higher education and science and technology institutions in Latin America and the Caribbean, within the framework of the REDALC Project (Dominican Republic, 1992).

Sub-regional training workshop for the Andean sub-region in the use of new information and communication technologies in higher education and scientific research activities, within the framework of the REDALC Project (Ecuador, 1993).

Regional Training workshop on Mediatics and Telematics in the Academic World, in cooperation with the University of Quebec at Montreal, Canada, as part of the project *"Qualify and Technology in Higher Education in Latin America and the Caribbean "* (Venezuela, 1993).

Regional Workshop on Computer as a Teaching Aid in Higher Education (Alexandria, 13-14 October 1990).

PUBLICATIONS

«*Informatics in Secondary Education*» (English) published in the framework of UNESCO/IFIP cooperation scheme.

«*Calidad, Tecnología y Globalization en la Educación Superior" (Quality, Technology and Globalization in Higher Education"*, as part of the project *"Quality and Technology in Higher Education in Latin America and the Caribbean "* (Published by CRESALC in 1992).

«*Una nueva manera de comunicar el conocimiento"* (A new way to communicate knowledge), as part of the project *"Quality and Technology in Higher Education in Latin America and the Caribbean"* (Published by CRESALC in 1993).

"Present and Prospects of Telematic Academic Networks in Latin America and the Caribbean ", as part of the REDALC Project (To be published by CRESALC in 1996).

As a follow-up action to the International Congress on Education and Informatics held in Paris in April 1989, a publication entitled *The Influence of Computers and Informatics on Mathematics and the Teaching* as Document no. 44 in the Science and Technology Education Documents Series in 1992.

A Guide book for the teaching of informatics in secondary level technical and vocational training was published by BREDA in 1994. The book describes some methodologies for the elaboration of teaching programmes in secondary level technical and vocational training.

(II) INFORMATION TECHNOLOGIES AND THE ROLE OF TEACHERS

RESEARCH AND POLICIES

In February 1994, a workshop was organized in conjunction with the Commission of the European Communities, the University of Twente and UNESCO under the theme *Teacher education and information and communication technologies: Issues and Experiences for Countries in Transition* (Enschede, The Netherlands). UNESCO granted 25 fellowships for the participation of specialists from Central and Eastern Europe. The workshop examined the use of communication and information technologies (CIT) in teacher education in Europe, and identified cooperative links for further partnerships among Western, Eastern and Central European CIT specialists in teacher education. Following the workshop, the publication *Information technologies in teacher education* (English) was published.

A study entitled *"Teacher Education, Open Learning and the Use of Information Technologies. An International Perspective"* is being finalized under contract with the Center for Research in Teacher Education, School of Education, The Open University.

TRAINING

In Africa, two sub-regional seminars on teacher training in informatics in technical and vocational training were held: in Harare, Zimbabwe in May 1993, and in Dakar, Senegal in July 1993. The major objectives of these meetings were to orientate those responsible for introducing computers into education towards the locally developed and produced materials and methodology for the training of teachers in informatics in order to facilitate the teaching and learning processes in technical and vocational institutions. The seminars focused on teaching informatics as a subject matter, the pedagogical applications of computers for teaching various subjects, and caching in computer maintenance.

PUBLICATIONS

Within the series Teacher Education, a handbook for teachers *Informatics in General Education* was published in 1994 (series No. 3).

(III) DEVELOPMENT OF INFORMATICS IN EDUCATION

DEVELOPMENT PROJECTS

The Programme INFORMAFRICA - Informatics in the Service of the Development of education in Africa was created in 1990 with the aim of helping African countries to introduce advanced technologies for educational purposes. The activities consist of training in and through informatics of teaching staff: management and administrative personnel in education) training of maintenance personnel that could take up the responsibility of maintaining the hardware locally at a relatively low cost rather than importing expatriates at high costs, training in the production of educational software at low cost with the participation of teachers and computers/software specialists.

INFORMAFRICA has started by a regional seminar organized by UNESCO within its Priority Africa Programme and in cooperation with the Agency for Cultural and Technical Co-operation (ACCT) in December 1990 in Lome, Togo, with the participation of 37 African Member-States. The seminar discussed the policy and strategy of incorporation of informatics in education, programmes of action for research and development, the production of educational software, maintenance and the problem of national languages, and the modalities for inter-African and international cooperation.

Within the framework of INFORMAFRICA, UNESCO through its Regional Office in Nairobi, has been involved in the following activities:

Conferences/Seminars/Workshops

- An international conference and exhibition on «Computer-based automation in developing countries (AUTO-DC '95)» was held in May 1995 at Enugu, Nigeria with the participation of 198 experts from various fields such as educators, researchers, computer consultants, vendors, computer managers/directors, planners and users.
- A workshop on informatics education was held in August 1995 at Ogbomoso, Nigeria with the participation of teachers from the universities, secondary schools. Federal Colleges, Ministry of education and private sector. The outputs of the workshop include recommendations regarding pre-university education in informatics and curriculum proposals for the teaching and learning of informatics in Nigerian secondary schools.
- In March 1995, a regional Forum de L'informatique, de la Bureaucratique, des Résuaux et de l'Electronique (FIBRE 95) was organized by the Centre National de Développement de l'informatique (CENADI) in Cameroon, with 237 participants from the sub-region.
- A national workshop for the drafting of curriculum for the teaching and learning of informatics in secondary schools in Kenya was organized by the Kenyan National Commission for UNESCO, involving educators, curriculum developers and informatics experts.
- A National Conference «Computers and National Development» was organized by the Computer Association of Nigeria (COAN) in Ilorin, Nigeria in May 1994. The Conference brought together 200 participants comprising educators, researchers, computer consultants, vendors, computer managers/directors, planners and users from within and outside Nigeria.

Projects

Under the project «Introduction of Computer Literacy in Secondary School in Malawi», a survey of computer courses to be introduced in secondary schools was carried out and training modules were produced. Computer equipment was procured and training workshops for teachers were organized. Introduction of the computer courses in selected secondary schools is expected to start in April 1996.

Research

The Centre des Techniques Informatiques (CTI) Lome, Togo, undertook a research study on the introduction of informatics into the education curriculum at secondary school level in the sub-region, between December 1994 and March 1995. The output of the study covered the strategy and policy for informatics education in secondary schools.

Training

- A three month training course in Micro informatics maintenance was organized at Yaba College of Technology, Nigeria, from September to November 1995 with the participation of 26 Nigerian trainees from the public and private sector.
- A «training the trainers» course in informatics was organized at the University of Swaziland in September 1995 with the participation of teachers from the local teacher training colleges. The course content included an introduction to computers and to computer applications(dBase, Wordprocessor and Spreadsheet).
- An on-the-job training programme in computer utilization was developed for and implemented at the Directorate of Public Service Information Technology Management in Namibia between May 1994 and August 1995. Computer equipment was also procured for this purpose.
- Under the project *Establishment of Computer Training Programme for Tanzania Women Scientists,* 8 women researchers and technologists were trained in computer skills at various levels between June 1994 and November 1995.

In order to widen the use of informatics in many areas including education and training, the development of national, regional and international networks in informatics is an important activity. Through IIP, UNESCO contributes to the launching and development of regional informatics networks which aim at linking institutions at regional level and serving as a bridge between national and international networks.

The Regional Informatics Network in Africa (RINAF) was established, with the objective of bringing together African scientists and academicians and facilitate exchange of scientific and technological information, thus fostering cooperation between them through:

- providing opportunities for countries in the region to share scarce resources (hardware, software, information, data etc.);

- serving as a gateway for Africa to link up with other similar networks in the region; minimizing duplication of time, money and materials in developing similar facilities;

- providing a unique opportunity for African students and academicians to interact via network brain-tapping and exchange of views on diverse topics;

- providing means for African informaticians to explore the resources of high performance computers and large databases that reside outside Africa.

A survey of the African institutions earmarked for participation in RINAF as communication and service nodes was made, as well as the specification and installation of additional hardware and software needed by the regional nodes, and training for regional nodes officials and on-the-spot training for operators responsible for the networks in the regional nodes were organized.

Experiments were carried out involving the exchange of messages and data between regional nodes and with international networks such as Internet and Rio, via links between Algiers and Pisa and between Dakar and Montpellier.

A workshop on the networks and the educational applications of informatics for the RINAF nodes in Southern Africa was organized in Zimbabwe in June 1994 .

In Arab States, the RINAS network aims at linking the countries of the Maghreb (Algeria, Morocco, Mauritania, Libya, Tunisia) and five Middle Eastern countries (Egypt, Jordan, Lebanon, Syria, Yemen) with the other Arab countries grouped in GulfNet. The actions taken within the context of the RINAS include:

- writing the technical specifications and supplying the additional hardware and software needed by the institutions chosen for RINAS to enable them to establish links with each other.

- making an inventory of the services offered by each institution, including messaging and data base, with a view to making them accessible through the network. A messaging system enables the institutions to communicate with each other and to communicate with other institutions through international networks.

In Europe, The RINEE has been the subject of a feasibility study involving network specialists from Eastern Europe. RINEE is in an experimental phase in six Eastern European countries (Bulgaria, Czech Republic, Estonia, Russia, Slovak Republic, Ukraine). The feasibility study has, made it possible to define:

- a general architecture for the links between the institutions in each country chosen as communication nodes.

- The technical means needed to establish the links and the additional hardware and software required. The additional equipment has been supplied and has made it possible to set up a messaging system and to gain access to Western European networks.

The BALTBONE network is a network that links the research and higher education networks of the three Baltic countries. Equipment has been supplied to Estonia, Lithuania and Latvia so as to link together three institutions, one in each country, themselves connected to the national research and education networks. The same equipment provides links with the international networks via the countries of Northern Europe.

In Asia, network-related activity is intense and corresponds to a highly diverse situation on the various economic, technical and human levels. An effort has been made to harmonize and coordinate initiatives under both RINSCA (South and Central Asia) and RINSEAP (South-East Asia and the Pacific).

A co-ordination meeting for RINSCA and RINSEAP was organized in New Delhi in November 1991. A regional seminar on the management of informatics networks was held in Melbourne in April

1993, jointly with the third RINSEAP planning meeting. The meeting examined the results of a study of the feasibility of an informatics network within RINSEAP carried out by New Zealand with IIP financing.

Within the framework of IIP, the following activities provided support to regional information networks:

- Computerization of student management at the National University of Engineering; testing of the Nicaraguan academic research network and organization of the international informatics congress, Nicaragua, 1992.
- Strengthening of the Sabaragamuwa affiliated University College's Regional Computer Centre, Sri Lanka.
- Establishment of a postgraduate training course in informatics applied to the water sciences, at the Ecole Inter-Etats d'Ingénieurs de l'Equipement Rural, Burkina Faso, 1989.
- Strengthening post-university training in software engineering, Sudan ,1994.
- Support to the education and research network, Baltic countries, 1992.
- The use of networks in distance education, Lithuania, 1992,
- Regional information network on educational software, Argentina, 1992.
- The development and production of educational software in Spanish-speaking countries of South America, 1989.
- Teacher training in informatics with a view to developing informatics application for education, Bolivia, 1992.
- New training syllabus in educational informatics, Cuba, 1992.
- Evaluation of educational software developed in Korea, 1992.
- Strengthening of a management system at Nouakchott University Services, Mauritania, 1992.
- Computer training for Government Offices staff in Equatorial Guinea, 1994.
- Organization of the Ibero-American Congress on educational informatics, Venezuela, 3992.
- Organization of the Congress on computers, education and society, Dominican Republic, 1992.
- Introduction of the use of micro-informatics in science and technology teaching in secondary schools, Nigeria, 1989.
- Computer-based education. El Salvador, 1991.
- Software production for science and technology teaching. Ivory Coast, 1989.
- Introduction of computer literacy in secondary schools, Malawi, 1994.
- Development of multimedia applications for handicapped children, Argentina, Paraguay 1994.

The Learning Without Frontiers Programme (LWF) Following the recommendations of the *Ad hoc forum of reflection on UNESCO's role in the last decade of the twentieth century,* convened by the UNESCO Executive Board in October 1993 (142EX/37), the Learning Without Frontiers Programme was launched with the aim of promoting learning increasingly free from restrictions as to when, where, at what age and in what circumstances it is to take place. Member States are encouraged and assisted in finding ways to «reach the unreached» and to diversify their education services to meet the learner's specific needs throughout their active life using diverse delivery systems -both formal and non-formal- including open and distance learning modalities.

Recognizing the potential of modern advances in technology to lower barriers surrounding traditional, institution-based education, specific attention is given to the integration of emerging technologies with existing ones while developing approaches that benefit the unreached and underserved.

A number of activities have been initiated within the framework of LWF programme, such as the coordination of the Joint Distance Education Initiative of the Nine High Population countries, launched by the nine high population countries as an attempt to exchange experiences in the use of distance and open learning in the provision of education for all.

Feasibility studies are carried out in India and Morocco for a Joint UNESCO/ITU pilot project for teacher education which makes use of television, telecommunication and computers. The project focuses on developing a learning model for in-service teacher training using the emerging capacities of interactive television. It is anticipated to lead to the definition of a flexible, durable system spanning a range of needs found in developing countries where the educational problems are most acute. "The system will incorporate the necessary flexibility to accommodate the range of delivery and telecommunications channels likely to be available to it, including terrestrial broadcasting, satellite and the public switched telephone networks(PSTN).

In collaboration with the International Centre for Distance Learning (ICDL), a data base on the use of electronic media in open and distance education is being developed and an analytical study prepared.

RESEARCH AND POLICIES

Following the recommendation of the first International Congress «Education and Informatics» a seminar «A European Platform to develop a mechanism for cooperation in the field of information technologies in education» was held in Moscow in June 1991 with the purpose of reviewing the present situation concerning the use of information and communication technologies in education and to elaborate on a possible platform for a more intensive cooperation. The meeting which brought together 70 participants from 19 European countries representing various fields such as education, technology, communication, information, and industry, focused on the central role of the teacher at all levels of education and training, and as a consequence, the crucial importance of the training of teachers in order to enable them to master the use of computers. It was emphasized that in order to create an effective interaction between hardware, software and educational personnel, the use of information technologies should be included in early phase of designing educational policies and planning curricula and teacher training programmes.

The importance of fast and easy access of educators to educational data bases was emphasized. In this respect, a special attention should be given to efforts to establish computer networks at sub-regional and regional level, as well as international networks such as BARN or INTERNET.

The development of educational software was given considerable attention whereby the close co-operation between educationists and software developers was viewed as a prerequisite of relevant software. At the same time, the protection and preservation of languages and cultural identity should be taken into consideration in the context of international standardization of information technology.

Modalities of European cooperation such as exchange of documentation, software, researchers, trainers as well as human, scientific, technical and financial means were discussed. In order to encourage sub-regional and regional cooperation, it was suggested to provide more opportunities for specialists in Eastern Europe to participate in international seminars, congresses and summer schools. Organizations such as UNESCO should support cooperation projects with Eastern European countries concerning hardware, software, and training.

The seminar had a positive impact as regards future perspectives concerning the role of information and communication technologies in education and the development of a cooperative framework.

Within the framework of the project Information Technology in Education of Children (ITEC), a multinational investigation was made on the impact of classroom computer use on children's high level cognitive functioning. The study which involved 25 countries, focused particularly on the reflection to the psychological and social consequences for the children from the application of the information technologies in education and the systemic investigation of the influence of different types and modes of information technology application in education on children's specific cognitive and social skills. The results of the study were presented at the Fourth International Conference «Children in the Information Age: The Impact of Technology in Education on Children» , Albena, Bulgaria, May 1991.

An international UNESCO symposium on *Copyright and Communication in the Information Society (global infrastructure, protection of rights, economic and cultural impact)* was held in Madrid, March 1996. Among other themes, the symposium focused on the author's rights in cyberspace, questioning whether additional law is needed to secure authors' rights in cyberspace, and suggesting that, while the need for more legal protection in cyberspace at national and international levels is being raised strongly, the issue of law reinforcement should be approached carefully through observing how cyberspace and markets for digital copies of copyrighted works develop and broadening discussions among governments, authors, users and publishers, in order to find out the right form of regulation suitable for everybody. The symposium discussed as well the potentials and challenges of the information highways in the widening of access to education.

- An expert meeting was held in Yalta, Ukraine, in September 1994 in conjunction with the East-West Conference on computer technologies in education,

- Regional Consultative Meeting of Experts on the Utilization of Micro Computers in the Teaching of Science and Technology (Cairo, 28 May-1 June 1989). This meeting was organized by UNEDBAS in cooperation with the Egyptian National Commission for UNESCO. Twenty five participants attended the meeting from the United Arab Emirates, Jordan and Egypt, representing educational institutions, information and computer centers, universities and other scientific institutions concerned with the use of computers in mathematics and technology. During the meeting, the participants formulated a number of recommendations related to the exchange of experience and expertise among the Arab States, the establishment of computer associations and the provision of support to those already established.

- Study on the *"Objectives of Computer Education in Science and Technology»* presented at the "Regional Consultative Meeting of Experts on the Use of Computers in the Teaching of Science and Technology" held in Cairo, 28 May - 1 June 1989 (Arabic, 15 pages).

- A Regional Seminar on Information and Computer Networks in the Arab Region (Damascus, 9-14 September 1989) was organized and conducted by the UNESCO Regional Office in Cairo (ROSTAS) and supported by UNEDBAS .

- A Regional Expert Meeting on Science and Technology Popularization and Networking (follow-up to UNESCO Project 2000+ on Science and Technology for All (Damascus, 16-19 May 1994) was attended by 11 participants, among them 6 women, from 11 Arab Member States, namely Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Qatar, Syria, Tunisia. Recommendations related to popularized scientific concepts in the programme and curriculum of formal and non-formal basic education were adopted. Attention was also devoted to the diversification of educational aids and technologies and exchange of information knowledge and experience in the context of regional and international co-operation.

PUBLICATIONS

«A Modular Curriculum in Computer Science» was published in the framework of UNESCO/ IFIP cooperation scheme.

«Les Nouvelles Technologies: Outils d'enseignement » by Henri Dieuzeide;

«Education and Informatics Worldwide: State-of-the-Art and Beyond» makes a attempt to look beyond the more immediate future in terms of a closer interaction between education and informatics at international and regional levels.

PARTICIPATION IN SEMINARS AND CONFERENCES

EDUCOM Conference in Atlanta, USA. This Conference gathered together about 4.500 researchers and educators from all regions of the world interested in the use of information and communication technologies at all levels of education (November 1994).

Iberoamerican Conference of the Iberoamerican Network for Education and Informatics (RIBIE) (Santo Domingo, Dominican Republic, June 1993).

Annual International Networking Conference of the INTERNET Society (San Francisco, USA, August, 1993).

III Regional Forum on Telematic Academic Networks in Latin America and the Caribbean

(Caracas, Venezuela, November 1993).

Annual International Networking Conference of the INTERNET Society (Prague, Czech Republic, June 1994).

IV Regional Forum on Telematic Academic Networks in Latin America and the Caribbean (Buenos Aires, Argentina, November 1994).

International Conference on Tele-Teaching (Trondheim, Norway, August 1994).

Annual International Networking Conference of the INTERNET Society (Honolulu, USA, June 1995).

V Regional Forum on Telematic Academic Networks in Latin America and the Caribbean (Lima, Peru, April, 1994).

Annual International Networking Conference of the INTERNET Society (Montreal, Canada, June 1996).

(IV) INFORMATION TECHNOLOGIES AS A TOOL FOR EDUCATIONAL MANAGEMENT

DEVELOPMENT PROJECTS

Within the framework of the Major Project of Education in Latin America and the Caribbean, UNESCO has developed computer analysis models to counter the deficiencies inherent in the poor quality and reliability of statistical data in order to promote research and information *for* decision making in education.

UNESCO is sponsoring an «item bank» and conducting academic performance measurements in 12 countries. Eventually, this data will be processed and related to all information available on schools which are part of the respective samples. Progress has also been made in terms of functional illiteracy characterization, with seven countries having been measured, so far.

The creation and systematic use of basic indicators on education is another area where considerable progress has been observed. The limited use of available information may be attributed to the scarcity of analytical models, computer time and software programmes, and specialized human resources. The Regional Information System in Latin America and the Caribbean (SIRJ) has been responsible for developing models that measure access to primary education , entry age, permanence in the system, progress in the higher grade basic education, and grades ultimately passed. SIRJ has also developed analytical models designed to integrate the finding of multiple research on the causes of low quality education , high repetition and temporary drop out rates.

Through its Regional Office for Asia & the Pacific (PROAP), UNESCO provides support to the development of Educational Management Information Systems (EMISes), which consist of the establishment of reliable information systems for the processing and production of education information such as education indicators in Asia and the Pacific countries. EMISes are broadly used by planners and administrators to assess the performance of the school system and the level of attainment and investment policies, and they are key tools to monitor the progress of education and to ensure the sustainability of funding and renewed interest in the education and training.

HEMIS (Higher Education Management Information System) is a component of the broader field of higher education management which covers, *inter alia,* institutional and staff development. HEMIS refers to the use of computerized management of universities and similar institutions: academic records, enrolment and timetabling are a few examples of its many applications UNESCO has undertaken activities in this area to promote research and training. The International Institute for Educational Planning (IIEP) as well as the UNESCO Regional Office in Bangkok (PROAP) organized training seminars within the framework of HEMIS. A study on the needs of African universities in this area was completed in 1995 within the framework of the joint UNESCO/ACUCHEMS Higher Education Management Programme.

TRAINING

- As a part of Ghana Government's action plan to increase management capacity in higher education, a training on the skills of computer-assisted time tabling and academic programming was organized for University Officers at Legon University , University of Science and Technology and University of Ghana.

- Regional Seminar on Strengthening Information and Data Base on Girls and Women Education with emphasis on rural areas (Cairo 2 - 7 November 1995).

This meeting was jointly organized with ISESCO and in cooperation with the Institute of National Planning in Cairo. 18 participants, among them 6 women, from Jordan, United Arab Emirates, Oman, Sudan, Syria, Iraq, Palestine, Qatar, Morocco, Mauritania, Yemen, Lebanon and Egypt attended the meeting. The output of the meeting was the production and distribution of one manual on the improvement of data collection methods with respect to education of females in basic education in early 1996.

PUBLICATIONS

«Micro-informatique, gestion et planification de l'education en Afrique» was published by BREDA with the aims of reinforcing capacities of educational planners, administrators and managers in the application of informatics in the management of education system in Africa.

(V) INFORMATION TECHNOLOGIES FOR THE DEVELOPMENT OF DISTANCE AND OPEN LEARNING

DEVELOPMENT PROJECTS

Interactive Distance Education through Tele-Seminars: A combination of satellite T.V, written materials and discussions through INTERNET. In Latin America, UNESCO has initiated a pilot project on tele-seminars through the use of the Spanish satellite HISPASAT with the purpose of creating a powerful interactive learning tool among universities in the region. Under the coordination of UNESCO Regional Office in Santiago (OREALC) and in cooperation with the Iberoamerican Association of Educational Television (ATEI), a first tele-seminar on environment education was organized in the first semester of 1995. The material composed of video programmes and written material presenting a variety of experiences in the field of environment education was co-produced by 7 institutions from Chili, Colombia, Honduras, Mexico and Spain. The programmes transmitted via HISPASAT during 7 weeks was complemented by the use of E-Mail in order for all participants to interact with each other. This activity targeted to postgraduate students in education, teachers and professionals interested in the topic opened innovative discussions in environment education in 18 Universities in 10 countries of Iberoamerica.

A second Tele-Seminar on the topic « Quality in Education » was carried out in November/December 1995 and March/April 1996 with presentations of 10 institutions from 9 countries and the participation of 38 institutions from 11 countries.

Creation and support to the Network for Innovations in Distance Higher Education (RIESAD), within the framework of UNITWIN Programme and the Programme "Learning without Frontiers . The network is coordinated by the National Open University of Venezuela with the cooperation of the main distance education universities and higher education institutions from Brazil, Bolivia, Costa Rica, Ecuador, Mexico and Peru. This project and network has produced several training workshops, multimedia courses and telematic courses through the INTERNET (See Section Training activities). CRESALC will publish a book on *"Present and Prospects of Distance Higher Education in Latin America and the Caribbean"* which gathers the first results of the project and the main trends problems and innovations of distance education in the region (See Section Publications).

UNESCO Series of Learning Materials in Engineering Sciences. Taking advantage of recent advances in information technologies which make affordable the production of multimedia learning materials, UNESCO has developed a series of distance learning materials in engineering sciences which provide new generations of engineers entering the world of industry and practising engineers already working in it with opportunities of studying at their own pace a subject which requires constantly an updating of knowledge. The first series of learning materials for undergraduate level engineering course were conceived for Africa within the framework of the project «African Network of Scientific and Technological Institutions» linking 50 scientific and engineering departments located in 32 sub-Saharan African countries. In 1991, a bulletin *UNESCO Series of Learning Materials in Engineering Sciences for Africa* was published.

A *Multimedia Postgraduate Learning Materials in Environmental Engineering* was developed comprising six modules on environmental engineering. The learning packages which are at the same time suitable for delivery and use in the formal classroom environment, consist of a combination of the following:
- structured written texts;
- video and audio cassettes;
- Interactive Computer Assisted Learning Programmes.

The structured text is presented to the end-users in the form of computer diskettes for viewing on a computer monitor or capable of being reproduced in loose or bound sheets at the user's end. This form of presentation has the advantage of mass production and therefore results in a relatively cheap unit cost to the end-user as compared with the high cost of standard text books.

The package is designed to be user-friendly and has a self-assessment software which enables students to assess their own understanding on a regular basis at their own pace.

The International Institute for Educational Planning (IIEP) has started in cooperation with the Russian State Committee for Higher Education (SCHE), a distance learning course on institutional management in higher education using Internet. The course which uses IIEP training materials is attended by senior administrative staff from 10 selected universities in the Russian Federation.

RESEARCH AND POLICIES

An Open Classroom Conference was organized by the European Distance Education Network (EDEN) and The International Council for Distance Education (ICDE) with the support of UNESCO in Oslo, Norway, in September 1995. The Conference's discussions, which focused on various topics concerning distance education and the use of technologies in education, were transmitted through satellite to schools and universities in Europe interested in the use of information technologies.

TRAINING ACTIVITIES

Regional Workshop on New Information and Communication Technologies in Distance Education, as part of the RIESAD Project and Network (Venezuela, 1994).

Tele-conferencing Workshop on Distance Education, as part of the RIESAD Project and Network (Several countries simultaneously through satellite communication and follow-up by electronic mail through INTERNET, 1995).

PUBLICATIONS

- Book on *"Present and Prospects of Distance Higher Education in Latin America and the Caribbean "*, as part of the RIESAD Project and Network (To be published by CRESALC in 1996).
- World Wide Web information server on the INTERNET with information, documents and publications about distance higher education in Latin America, as part of the RIESAD Project and Network (In preparation, to be opened to the public in 1996).

ANNEX I

DOCUMENTS AND PUBLICATIONS

African universities - review of information systems by D. Mason. A Report funded by UNESCO. UNESCO/CHEMS (Commonwealth Higher Education management Services), 1995, 54 pp.

Calidad tecnologia y globalizacion en la educacion superior Latinoamericana. Caracas, UNESCO/CRESALC, 1992, 525 pp. ISBN 980-6226-66-6

Computers in education: the shape of things to come. Bulletin of the IBE, No. 250, January-March 1989. Paris, UNESCO-IBE, 1989, 96 pp. (Bilingual: E,F)

Contemporary information and communication technologies and education by A. Hancock. International Commission on Education for the Twenty-First Century, First session, Paris, 2-4 March 1993. Paris, UNESCO, 1993, 10 pp. EDC/1/3 (E,F)

Directory of the international network for information in science and technology education (INISTE). Paris, UNESCO, 1992, 157 pp. ED-92/WS/8 (Bilingual: E,F)

Education and informatics worldwide. The state of the art and beyond by Jacques Hebenstreit et al. London, Jessica Kingsiey; Paris, UNESCO, 1992,253 pp. ISBN 1-85302-089-3 & ISBN 92-3-102798-0

Education and informatics: strengthening international co-operation. International congress, Paris, 12-21 April 1989. Final report. Paris, UNESCO, 1989, 1 16 pp. ED/89/CONF/402/COL.4 (E,i-)

Education and informatics: strengthening international co-operation. International congress, Paris, 12-21 April 1989. Proceedings, Vol. I and 2. Paris, UNESCO, 1989, 757 pp. (Bilingual: E,F)

Education in informatics for women by women: International workshop edited by Ingrid Ellebrecht et al. Hamburg, Germany, 30 November - 3 December 1992. Hamburg, UNESCO-UIE, 1993, 125 pp. (UIE reports, 12) ISSN 1014-9880. (Bilingual: E/G) (Available only from UIE)

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ANNEX II

LIST OF ABBREVIATIONS

- ACCT Agence de Cooperation Culturelle et Technique
- ACU Association of Commonwealth Universities
- ASP UNESCO Associated Schools Project
- ATEI Iberoamerican Association of Educational Television
- BALTBONE Baltic countries education and research network
- BREDA UNESCO Regional Office for Education in Africa
- CDS/ISIS Computerized Documentation System/Integrated Set of Information System
- CEPES UNESCO European Centre for Higher Education
- CHEMS Commonwealth Higher Education management Services
- CIT Communication and information technologies
- CPSC Colombo Plan Staff College for Technician education
- CRESALC UNESCO Regional Centre for Higher Education in Latin America and the Caribbean
- EIMIS Educational Management Information System
- FUNREDES The Foundation for Networks and Development
- HEMIS Higher Education Management Information System
- HISPASAT Spanish satellite
- IBE International Bureau of Education
- ICDE International Council for Distance Education
- ICDL International Centre for Distance Learning
- IEA International Association for the Evaluation of educational Achievement
- ITIP International Federation for Information Processing
- IGO Intergovernmental Organization
- IIEP The International Institute for Educational Planning(UNESCO)
- IIP Intergovernmental Informatics Programme
- ILO International Labour Organisation
- INFORMAFRJCA Informatics in the Service of the Development of education in Africa
- INISTE International Network for Information in Science and Technology Education
- ISESCO Islamic Educational, Scientific and Cultural Organization
- ITEC Information Technology in Education of Children
- ITU International Telecommunication Union
- LWF Learning Without Frontiers
- NGO Non-governmental Organization
- OREALC UNESCO Regional Office for Education in Latin America and the Caribbean
- PROAP UNESCO Principal Regional Office for Asia and the Pacific
- PSTN Public switched telephone networks
- REDALC Project Support to Telematic Academic Networks for Research and Teaching in Higher Education, Science and Technology in Latin America and the Caribbean
- RIBIE Iberoamerican Network for Informatics and Education
- RIESAD Network for Innovations in Distance Higher Education
- RINAF Regional Informatics Network in Africa
- RINAS Regional Informatics Network in the Arab States
- RINEE Regional Informatics Network in Eastern Europe
- RINSCA Regional Informatics Network in South and Central Asia
- RINSEAP Regional Informatics Network for South-East Asia and the Pacific
- ROSTA UNESCO Regional Office for Science and Technology in Africa
- ROSTAS UNESCO Regional Office for Science and Technology in the Arab States
- SCHE Russian State Committee for Higher Education
- SIRI Regional Information System in Latin America and the Caribbean
- VIE UNESCO Institute for Education
- UNEDBAS UNESCO Regional Office for Education in the Arab States
- UNESCO United Nations Educational, Scientific and Cultural Organization
- UNEVOC UNESCO International Project on Technical and Vocational education
- UNITWIN University Twinning
- USEIT Use in Systems of Education of Information Technologies

ANALYTICAL SURVEY

ON THE ISSUE OF "EDUCATION AND INFORMATICS"

(NOTIONS, CONDITION, PROSPECTS)

PREFACE

This analytical survey on the issue of "Education and informatics" was prepared by a group of Russian specialists representing the International System Research Center for Higher Education and Science, Institute of Problems of Informatics of the Russian Academy of Sciences and the Russian Academy of State Service affiliated with the President of the Russian Federation at the request of UNESCO Education Department in the framework of preparation for the Second International UNESCO Congress entitled "Education and Informatics" (Moscow, July 1-5, 1996).

At the first Congress that took place in 1989 in UNESCO headquarters in Paris it was emphasized that "application of new information technologies in education is vital for using the advantages of the collective expertise and joint utilization of limited resources" and for this purpose expanding the international cooperation was highly recommended.

The letter of UNESCO General Director F. Mayor dealing with the Congress, its objectives, programs and topics, participants as well as other aspects distributed by the UNESCO headquarters in January 1996, states that the international cooperation in that sphere is now becoming even more critical than ever. In recent years the sphere of information and communication technologies is tending toward significant progress and as a result, generations of computer equipment and software are rapidly substituting one another and these innovations integrate into other technologies. It has also resulted in emergence of previously unexplored combinations of information means that leads to forming an "information society". Creation of information super highways urges the education sphere to detailedly revise its situation which is extremely vital given the conditions of rapid development of technologies in comparison with the possibility of their application at all levels of education.

Even countries with the most advanced education system fail to effectively solve the range of problems the education endures entering the 21st century. The Congress would be a fine meeting point for nations of the whole world. It will contribute to the development of international contacts in the education sphere, precise formulation and coordination of national education systems. Basically, the major issue the Congress is dealing with is the national and international strategies in the education sphere, organizational and technological forms for implementing this policy. The modern strategy in 1 lie education sphere is formulated based upon new information technologies and the legal and legislative principles that form the foundation of concrete decisions and results. That is why the word "Education" was deliberately put in the first place in the title of this Congress.

In this regard, the Congress will be dealing with an analysis of national, regional and international trends as well as the expertise of introducing and applying the new information technologies in education systems. It will also include a review-of state-of-the-art works in the sphere of new information technologies and study of their application in the education sphere as well as discussion of international, regional and national policies in using new information technologies in education and formulation of recommendations with regard to international cooperation.

It is essential that organizers of the Congress assumed that education is the top priority that is why the UNESCO General Conference chose Russia as the host country for holding the Congress which has achievements in education recognized all over the world. In addition to the role of the host of this global meeting, Russia will also act as a country running in the forefront of the education sphere and applying new technologies for developing it. The country possesses centers for computerization of higher and secondary education supported by the state. This centers offer methodological works and test samples of program complexes in a number of program spheres. There are also a series of tools for mastering and perfecting professional skills in technically complex professional spheres. These centers hold conferences and seminars, release numerous publications on the issue on the agenda.

For example, materials of the International scientific methodological conference entitled "New Information Technologies in University Education" alone (regarding mostly Russia and just certain CIS member-states) published by the Russian State Higher Education Committee and the Scientific Research Institute for mathematical and information education fundamentals affiliated with the Novosibirsk State University (Novosibirsk, 1996) totaled 24.5 quires. More than 220 reports offer works of specialists in the following directions:

- problems of higher education informatization;
- computer technologies in teaching natural science disciplines',
- computer technologies in teaching humanitarian and social economic disciplines:
- teaching informatics:
- distance education in higher schools:
- teaching computer systems in schools:
- instrumental means for developing teaching computer programs:
- application of computer networks and telecommunication systems in education.

It is important to point out that reports delivered on all topics are extremely practically articulated.

The Russian National Report entitled "Policy in the Sphere of Education and New Information Technologies" that will be delivered at the UNESCO International Congress offers an inclusive review of numerous directions in development of education and application of new information technologies. This report actually reflects the official opinion of state institutions education administrative organizations regarding the issue in hand.

On the other hand, it seems interesting and useful to set forth independent expert opinions represented by famous Russian specialists in the sphere of education and informatics regarding problems that are to be discussed at the Congress. The analytical survey was given birth in this regard. Its authors, according to the topic sequence of the Congress, analyze the current situation in Russia as opposed to other countries with regard to directions that fully correspond to the subject of the forthcoming international forum and render their opinions on each direction according to their own experience and domestic works available.

The section dealing with Russia's policy in the sphere of education and informatics sets forth the major principles and strategic objectives of Russia's education policy, shows the necessity of the country's education system informatization as an indispensable condition and a critical stage for the informatization of the entire country. It also describes the major directions of works covering practically all sides of pedagogical and scientific activities that will undergo reforms as a result of applying the new information technologies as well as renders a review of conditions and trends in developing the course of informatics in secondary and higher schools all over the world. It is pointed out that studies of informatics in the form of an obligatory course in secondary and higher schools that commenced quite recently - in the last ten years - is currently being conducted on a permanent basis in all higher education facilities and colleges of not only the developed countries but in many developing ones as well. In this context, the trend toward dispersing the course in the education sphere is showing a persistent growing curve, the contents of the course is undergoing changes and gradually assumes new features. The reason for these changes lies in the fact that the process of society informatization is now taking a global scale embracing practically all countries of the world including Russia. That is why knowledge of informatics fundamentals, its possibilities and prospects for development becomes necessary for basically all members of the modern society.

The survey also deals with the still controversial issue of choosing the name for the course of informatics. One of the compared titles is "Computer Science" (this term is popular mostly in the US, Canada and several countries of Latin America) and the other is "Informatics". The authors deem the second name more appropriate since it reflects the information orientation of the subject sphere of this scientific and educational discipline to a greater extent.

The survey emphasizes the necessity, importance and timeliness of drawing the attention of UNESCO leaders as well as those of education authorities, scientists and pedagogues of various countries of the world and the mass media to the fact that today informatics is one of the most important and lucrative "points of growth" of the world science with a new complex of information sciences forming around it. In this respect, it is necessary to recast not only the contents of the informatics course and technical disciplines similar to it (such as computers and cybernetics) but also a number of humanitarian disciplines such as philosophy, economics, sociology and psychology. The works of Russian scientists present information and scientific knowledge as important strategic resources for further development of the civilization and the problem of activation and effective use of these resources is given the top priority as the most important one among other scientific technical and social economic problems the modern society faces.

The preparation and organization of teaching the special educational course entitled "Social Informatics" which is a new and prospective complex scientific and educational discipline, is undoubtedly deemed as an achievement. Russia's expertise in introducing such courses as "Theoretical informatics" and "Information Technologies in the System of State Service Bodies" appears to be unique.

The analysis shows that during the last ten years of active application of new information technologies in education, the pedagogical software did not drastically change teaching in secondary schools with the computer serving more like an instrument assisting teachers in conducting their classes traditionally. On the other hand, application of computers made it possible for higher schools to introduce an effective computer experiment in a number of courses.

The major obstacle for developing pedagogical software is not the lack of instrumental means but the lack of purely pedagogical materials for implementing it on computers. It is necessary to form creative groups composed of practicing teachers, teachers-methodologists, artists, screenplay writers, programmers and other specialists.

It is also pointed out that the new model of using in schools one or two modern multimedia computers instead of purchasing a set of educational computers is most expedient.

The possibility of using network technologies in education are determined (just as with respect to developing pedagogical software) not by the technical characteristics of telecommunication systems but by the contextual and methodological contents which does not always manage to keep up the pace of development of technical means. On the other hand. using E-mail, teleconferences, distant databases and other modern information means for education purposes opens broad horizons for developing education technologies.

Expansion in application of new information technologies in education is getting underway given the conditions when teachers, pedagogues and students are not quite prepared for the new roles. The new role of the teacher is confined to the fact that he gains additional options for supporting and building the identity of the student, for creative search and organization of joint work, preparing and choosing the bast variants of education programs. There is also a possibility to give up the teacher's routine activities intrinsic to the traditional education by providing him with intellectual forms of labor. The information technologies release the teacher from the necessity to set forth a considerable portion of educational materials and operations related to practicing skills and knowledge. Expanding the sphere of application and increasing the effectiveness of using information technologies in the field of knowledge and skill conveyance require international coordination and joint efforts of specialists from different countries in working on the development of information and technological education means.

It also renders a review of models for using information technologies in schools showing that the traditional class-lesson model of interaction between students and information technologies has become outdated. It should be replaced by collective project and individual models. The major distinction of these models lies in the fact that they enable the informatization of the education process, make it possible to accomplish goals with minor costs and are particularly well suited for modern schools.

The strategic role of information technologies as a factor of social and economic development of modern society, may undoubtedly be regarded today .is commonly recognized. It is determined by a number of major features of information technologies specified in the work, that stipulate the necessity to give them the top priority both in the sphere of national scientific and technical policy and that of education.

It also points out the possibilities informatics provides for creating new solutions for a number of vital problems of modern culture. The possibilities of multimedia technologies are in particular so immense that the Russian culture scientists ungroundlessly refer to creation of a new direction in the cultural sphere namely - screen culture. It is extremely important that this direction find the proper reflection in the sphere of humanitarian education.

The analytical survey on the issue in hand would have been incomplete if the authors had not described a number of "transparent" topics, among which the priority ь given to the problem of distance education. The survey analyzes its possibilities, expedient spheres of application, drawing the conclusion that the distance education may successfully integrate into the existing systems of internal and external, open education, education at home or without abandoning the major activities. However, now we have to refer to the distance education mostly in subjunctive mood or in the future tense. Creation and implementation of the Federal Program "Development of a uniform distance education system in Russia" should bring the distance education considerably closer to the implementation phase.

In concluding the survey, a general prospective structure the education course entitled "Fundamentals of Informatics" is offered for the system of secondary and higher education in Russia. The structure is based upon a problem module principle and hence is quite flexible. The contents of the course is viewed in the form of critical comparison with the foundation materials of a similar course rendered in the Russian national report entitled "Policy in the sphere of education and new information technologies". It may be asserted that the contents of the course set forth in the survey shall contribute to practical implementation of the role of education as a forerunner in the process of intellectualization of the Russian society.

1. POLICY

1.1. FORMULATION OF NATIONAL PLANS AND STRATEGIES

The international cooperation in developing new information technologies and their efficient application in education is one of the major issues for humanity. There is no doubt that informatics is one of the most important "points of growth" of the world community, with broad prospects.

It is self-evident that information and its superior form - knowledge is the ultimate factor that determines the development of society in its entirety.

Major principles of Russia's education policy and general education programs are designed to resolve issues related to shaping culture in general, fostering intellectual, moral, emotional and physical evolution of individuals, formulating scientific concept of the world, assimilation of individuals in society. Russia occupies a respectable position in the world education system especially with regard to furthering methodological teaching principles. It is widely acknowledged in the world that Russia represents one of the top three countries with regard to level of comprehension in such general education spheres as mathematics, physics and chemistry.

The strategic objectives of Russia's state policy in the educational sphere are:

- creation and implementation of conditions for ensuring constitutional rights of citizens to obtain education, expanding boundaries for character-building of individuals and spheres of their self-evolution;
- development of mentality in the Russian society based upon general human values, adapting awareness of masses to shaping respect for human rights, public concerns as well as those of territorial and national communities;
- shaping a system of education capable of adapting to conditions and norms human existence as well as new type of interaction between theory and practice;
- introduction of promotional education principles and methodology of active approach, converting education into the sphere of comprehending different types of mentalities and activities;
- integration of the Russian education system into the world general education system.

The organizational basis for Russia's state policy in the sphere of education is formed by the Federal program on development of education, ratified by the supreme legislative body of the Russian Federation. The program stipulates concrete mechanisms for achieving the projected strategic goals.

One of the most important mechanisms embracing all of the major directions of education system reform in Russia is its informatization which may be regarded as an essential condition and a critical stage of Russia's entire informatization. The transition of community from industrial stage to the information one is based upon new information technologies (NIT).

Informatization of education will allow over the long run to effectively apply the Following vital benefits of NIT:

- a possibility of building up an open system of education ensuring a particular curve of self-training for each individual;
- a drastic change in organization of comprehension process by virtue of reshaping it toward the system mentality;
- efficient organization of comprehension activities for trainees in the course of education process;
- organization of an education process that furthers an active approach toward that process throughout all stages (demands-motives-goals-conditions-means-acts-operations);
- individual approach in the education process and preservation of its integrity based upon projectable nature and versatility of automated educational programs;
- a possibility to organize and apply radically new comprehension means.

Informatization of education is one of the most important means of implementing a new state educational paradigm, within the framework of which the focus is replaced - from the pragmatic goals confined to a single specialty to acquisition of general knowledge; from the historic context of scientific knowledge development to a modern concept of structure and integrity of science contents.

1.2 FORMULATION OF THE STRATEGY FOR REMODELING THE EDUCATION SYSTEM (AT THE LEVEL OF EDUCATION INSTITUTIONS)

It is self-evident that information and its superior form - knowledge is the ultimate factor that determines the development of society in its entirety.

In order to effectively use the huge volumes of information and knowledge accumulated in the course of modern information revolution for resolving real issues, it is necessary to formulate a strategy for remodeling the education system including that at the level of education institutions.

It requires a special information policy with its major provisions conceptually absorbed and set forth applicably to the education system in Russia. A series of programs stipulating implementation of large-scale projects with regard to the following directions is devised and executed.

Informatization of the education and upbringing process:

- transition from the disciplinary model of education contents to a system one with the major objective - to teach understanding of the world, society, oneself and one's occupation;
- radical replacement of the scientific methodological, educational methodological and information basis of education;
- providing equal opportunities for individuals with regard to obtaining an education of personal and public importance, that is capable of assisting them in spiritual and intellectual self-evolution as well as in finding the best possible niche in the job market;
- reducing terms of education by means of resorting to methods of modern intensifying and increasing effectiveness of the education process;
- formation and introduction of scientific methodological and educational methodological materials in order to support training in new information technologies.

Creation of modern information environment for the education system:

- ensuring links and interaction between information technologies and education institutions in the course of multi-phase education process (information links between subjects and objects in all stages of continual education);
- formation of information systems serving for purposes of particular educational institutions;
- forming and putting into operation functional complexes based upon local computation networks for automation of administrative activities at various levels and in different directions;
- creation of distribution databases in different subject spheres and educational topics.

Information integration of Russia's education system into the world education system:

- formulation of a new strategy for the international scientific and educational cooperation;
- ensuring independence of educational facilities in determining the locality and functional contents of international information networks and increasing their international mobility;
- creation of a global information computer network accessible for various higher education institutions ensuring their integration into international networks containing scientific, technical and educational information;
- cooperation in developing international educational standards for education;
- organization of international cooperation in exchanging expertise of the NIT application in education.

The major working directions set forth above embrace practically all aspects of pedagogical and scientific activities that may undergo transformation resulting from application of new information technologies. The above-mentioned directions fully reflect contents of the problem and in their entirety form an adequate conceptual information field required for organizing their implementation.

1.3. INFORMATICS COURSE IN THE EDUCATION SYSTEM: CURRENT CONDITION AND PROSPECTS FOR DEVELOPMENT

1.3.1. Condition and development trends of informatics course in secondary and higher school

Studies of informatics as an obligatory course in secondary and higher schools have started comparatively not long ago - within the last ten years. Primarily, this course was introduced into the training program for students of universities and technical higher education institutions of the developed countries and then started spreading out rapidly in the school education system as well.

Today the informatics course is studied practically on permanent basis not only in all higher education facilities and colleges of the developed countries but also in a majority of the developing ones. The trend of expanding the course on within the sphere of education persists through. The reason for such an event is confined in the fact that there is a serious permanent social demand for informatics studies in the society. It is caused by a hectic progress in means of computerization and communication, penetration of information technologies in basically all spheres of social practice and a pending necessity to efficiently apply them for solving a number of vital social and economic problems [1,2].

As far as the substance of informatics course is concerned, today in secondary schools and humanitarian higher education facilities it is mostly oriented at acquiring computer literacy, i.e. basic knowledge and skills in the sphere of applying modern computers and telecommunication systems for processing and transferring information, solving elementary tasks using the most of mass information technologies.

Apart from this, universities and technical higher education facilities offer broader knowledge in the sphere of technical and information support of informatics means and software, computer and telecommunication systems as well as in the sphere of new information technologies (NIT). This chapter of informatics course usually includes information regarding various types of intellectual and expert systems, methods and means of information modeling, hypertext and multimedia systems, computer graphics and virtual reality.

Particular chapters of the informatics course dealing with new information technologies have been lately more and more often included in educational courses taught at humanitarian higher education facilities as well as in lyceums and colleges. It is entailed by the global character of social informatization that embraces practically all countries of the world including Russia. That is why knowledge of informatics basics, its possibilities and prospects for development is an inalienable condition for the entire modern society.

1.3.2. Modern concept of informatics as a science and educational topic

The ever-disputed issue of choosing a name for the modern informatics course shall undoubtedly be dwelt upon in the context of the discussed problems. Not only is the nature of this issue educational and methodological but also philosophic and scientific for it is closely linked to the modern concept of informatics substance as a science and hence that of the educational course corresponding to that science. Ancient philosophers used to say "to name correctly means to understand correctly" and this issue is in serious controversy today.

For example, today the term "computer science" is commonly known in the United States, Canada and several South American countries. This term is used as a name for both scientific and educational courses dealing with procedures related to processing, storage and transfer of information via computers and telecommunication systems. Thus, the "computer orientation" of topics taught in the framework of these scientific and educational courses is accentuated.

As far as Russia, the CIS member-states and the Western Europe are concerned, a term of French origin - "informatique" is more popular. It is a apparently a derivative of two other French terms - "informatione" (information) and "avtomatique" (automatic).

In our opinion, the term "informatics" is more appropriate for naming the scientific and educational courses at hand because it to the greatest degree reflects the information orientation of their substance. Ukrainian scientists share this opinion with us. A fine example of it would be to cite the name of two academies of sciences that have been recently established in the Ukraine. On of them is entitled "The international academy of computer sciences and systems" and focuses its major activities on the issues of creating and effectively using computers and systems based upon them, that society deems extremely important for implementing modern and prospective information technologies.

The other academy of sciences - the Ukrainian Academy of Informatics chose studies of information, information-related processes in the society and social consequences of its informatization as the major objectives of its research.

As it appears, these two closely linked areas are considerably different in their essence.

Taking these facts into consideration, we may positively assert today that "informatics" and "computer science" are not two different names for the same scientific and educational courses. They are two closely related courses with different contents. In this context, due in the fact that contents of informatics is rapidly expanding, this difference will become more and more noticeable.

It is also worth pointing out that not only does informatics as an independent science and educational course have its own clearly outlined area of problems, but also its own research method - information-oriented approach. Applying this method makes it possible already today to reveal, analyze and perceive many new characteristics and principles of information and processes related to it that are under way in the society and the world around us.

The information culture becomes today an inalienable part of the general culture of the society and this may be regarded as the effect of objective civilization development laws.

1.3.3. Prospects of informatics development in the near future

Informatics as a science is currently undergoing a stage of intensive development Having been created in the framework of a science dealing with administration processes - cybernetics, the contents of informatics is rapidly expanding and we can witness that it turns from a technical course covering methods and means of processing data via computers into a fundamental natural science handling information and processes related to it that are under way in the nature and society [3].

We can reasonably assert that informatics is one of the most important and prospective "points of growth" of the world science with a new set of information sciences forming around it [4]. That is why it is of paramount importance to timely focus attention of the UNESCO heads, education bodies, scientists and teachers from different countries of the world as well as the mass media on that phenomenon in order to adequately reflect it in programs, methodologies and curriculums of the higher and secondary education systems as well as in the system of advanced training of specialists with higher education and primarily pedagogues.

This implies that changes must be introduced not only to the contents of the course dealing with informatics and other technical courses related to it (computerization, cybernetics), but also a number of humanitarian courses such as philosophy, economics, sociology and psychology. It is extremely vital to include this provision in the Recommendations of the UNESCO Second International Congress on "Education and Informatics".

1.3.4. Contribution of Russia's scientists to the development of informatics as a science and educational subject

Russian scientists have been lately energetically conducting fundamental research in the sphere of information-oriented problems of the modern society development including philosophic problems related to analyzing the role of information and scientific knowledge in the further evolution of civilization and transition of the society to a new paradigm of safe and stable development. This research is based upon the noosphere concept of biosphere evolution created by works of such world famous Russian scientists as K.E. Tsiolkovsky, V.I. Vernadsky, A.L. Tchizhevsky, and N.V. Timofeev-Resovsky. Today this concept gained momentum in he works of such Russian philosophers as N.N. Moiseev, A.D. Ursul, A.I. Rakitov, Abdeev and others [3-6].

Information and scientific knowledge are viewed in the current works of Russian scientists as essential strategic resources required for the further development of the civilization and the problem of activation and efficient application of these resources is given the priority among other scientific technical and social economic problems of the society today [7,8].

Results of this research are energetically discussed by scientists and pedagogues in scientific press, during seminars and conferences and are already reflected in a number of pilot educational courses on informatics taught in Russian higher education institutions.

For example, the course entitled "Theoretical informatics" taught in a number of years in the Russian Academy of State Service and to students of the Moscow State Social University, includes topics dealing with information, knowledge, information processes and information technologies that are set forth by the pedagogues precisely from the philosophical perspective and that of the general system position.

With regard to analyzing the role of information processes in modern society as well as impact of the global imformatization process upon the development of society and humans, these problems are dealt with in a special educational course entitled "Social informatics" which since 1989 is studied by graduate and postgraduate students of a number of Russian humanitarian higher education institutions in Moscow, Saint Petersburg and Nizhny Novgorod [10].

It is necessary to mention that social informatics as a new and quite prospective complex scientific and educational course has lately become more popular in the Russian educational system. A number of problem-oriented departments of social informatics have already been created and are successfully functioning in the Moscow State University named after Lomonosov, the Moscow State Social University, the Nizhny Novgorod State University and in Youth Institute. In 1994 an association of these departments was established. Problems of social informatics are given a great deal of coverage in Candidate's and Doctor's thesis works and regularly discussed at scientific and scientific methodical seminars.

The Supreme Attestation Commission of Russia was filed a motion by the scientific community on introducing a new scientific specialty - "Social informatics", which would assist in activating training of scientific personnel for this vital and socially important scientific problem.

Russia's expertise in applying the informatics and information technology courses when providing training and advanced training of specialists for state service authorities shall be undoubtedly taken into account. In particular, such courses are taught at the Russian Academy of State Service affiliated by the President of the Russian Federation. Starting in 1994, this Academy operating in the framework of the continuous higher education system for state officials also trains specialists that after accomplishing their thesis obtain the qualification of "System analyst in information technologies" [11].

Employment of specialists with such qualification in federal and municipal authorities of Russia already draws a great deal of attention It will positively contribute to fostering more effectively the process of informatization of the Russian society supported by the fact that the Academy of State Service has a number of branches in different regions of Russia.

1.3.5. Russia's international cooperation in dealing with new problems of theoretical and social informatics

Starting in 1989, Russia's scientific, methodological and pedagogical expertise in studying the aforementioned new problems of theoretical and social informatics is quite regularly discussed during international conferences, congresses and forums with specialists both from the Western and the "near abroad" countries - republics of the former Soviet Union - participating in them. For example, at the International Congress on "Information processes and technologies" (Moscow 1993) three out of four major plenum reports were dedicated to these problems [12-14]. Moreover, international conferences on the social informatics issues have almost gained the status of being "annual" Another conference entitled "Social informatics - 96" will take place in Moscow in April, 1996.

Results of scientific research and pedagogical expertise of the Russian scientists in informatics are now studied by specialists from a number of universities in the US, Great Britain, Western Germany, France, Spain, Portugal and India. Particular problems such as for example, those related to developing methods for distance education and multimedia technologies, are internationally cooperated in on a long-term contractual basis with such countries as

Great Britain and Spain and in the sphere of theoretical and social informatics - with scientists from the Ukraine [15,16].

In order to foster a broader and more inclusive international cooperation, it is vital to obtain financial support from the UNESCO and governments of the countries that are members of this organization. This support is primarily critical for publication and distribution of scientific works and monographs covering the future problems of informatics as well as for conducting scientific and methodological conferences and seminars on the most essential problems.

Regarding the issue of generalization and distribution of the generated scientific and methodological expertise in studying such courses as "Theoretical informatics", "Social informatics" and "Information technologies in the system of state service authorities", in our opinion, Russia's experience in this field is unique and worth being studied in detail.

2. TECHNOLOGIES

2.1. COMPUTERIZED EDUCATION

2.1.1. Current condition

In the last ten years of applying NIT in education, pedagogical software has not radically changed the teaching methodology in secondary schools. Computer is at best an instrument assisting teachers in the traditional way of conducting classes. According to expert estimates, computerization in higher schools allowed to introduce an effective computer experiment in a number of courses.

By Fall 1995, 34 thousand out of 35 thousand complete secondary schools had computers or computer classes with the average number of computers per school totaling nine. Schools are mostly equipped with different types of computing machines, for example 22 types of computers were used in Tomsk region in 1993 and 17 types in Novosibirsk region. During the last years, the type of computers acquired for secondary education was mostly confined to IBM PC or Macintosh but their number (according to experts) can hardly reach 10-15% of the entire number of all computers installed.

Only 365 schools out of 30.5 thousand (1.2%) had computers (according to the official statistics of the Russian Federation Ministry of Education with incomplete information on Chechnya and Dagestan). It suggests that application of computers and NIT in education provided for junior students did not exceed the limits of experiment.

With regard to complete secondary schools, the following conclusions may be drawn. Software and methodological support of the educational process informatization may be divided into six categories of educational computer programs:

1. Knowledge control and testing.
2. Training programs for solving problems.
3. Informative reference systems with materials of studies, "talking" systems, combinations of the above-mentioned directions.
4. Professional programs as a topic of studies.
5. Modeling programs, powerful graphical training and reference systems, complex computergames, framing modeling environments, multimedia systems.

Testing programs are the most spread out ones in Russia because they are easy to create. Almost in every sphere several testing and controlling root programs have been created for different types of computers.

Program and methodological complexes (PMC) have become popular lately as well. One of the first organizations to develop them was KUDITs (Moscow) operating in the framework of an IBM pilot project. PMC represent an autonomous product that includes:

- methodological support;
- software;
- information support.

Methodological support is the key component of these complexes. PMC present an opportunity to use the assistance of a teacher or study independently.

Until now no training environments have been created that serve for purposes of the masses, despite that there are projects aimed toward that end implemented in Pereyaslavl-Zalessky (Robotlandia), in Moscow (INT - Logomiry) and in other locations. Very few modeling, simulation and multimedia systems exist. In many ways it is related to the structure of the computer base in secondary education and higher educational facilities. The computer base in secondary education has already been described above, however, most of computers in higher schools are based on microprocessor 286. These models can hardly be deemed as a testing site for the modern instrumental programs and are hard to develop modeling and other multimedia systems on.

Despite the fact that a series of instrumental programs (such systems as "Urok", "Computer Stratum" etc.) were distributed in Russia in quantities totaling several thousand units, it almost ceased the development of domestic instrumental programs and those prepared by single authors and now such world popular author systems as Authorware Professional etc. are not used broadly. On the other hand, dozens of almost identical training programs covering small parts of the curriculum appeared on the market. Training in foreign languages (English primarily) for which quite inclusive courses containing different classes of educational means, may be pointed out among them.

The ordinary textbooks are still the major "instrument" of students. Any text is easier to read in a usual book than on the computer screen Electronic textbooks, on the other hand, is more comprehensive and effective in cases when it:

- ensures feedback;
- helps quickly find the necessary information that may be difficult to pinpoint in an ordinary textbook;
- considerably saves time in the event of frequent references to hypertext explanations;
- along with a concise text shows, talks, models etc. (This is where the possibilities and advantages of multimedia technologies are self-evident).

2.1.2. Prospects

The intensive development of training programs is carried on by enthusiasts and in the framework of programs on informatization of education, electronic textbook for higher schools, electronic textbook for secondary schools etc. So is the development of courses embracing the entire educational process during many years (for example the course entitled Information culture).

A large-scale certification of pedagogical programs originating in the Institute of Education Informatization (for secondary schools) has started. It is expected to expand it in the near future. The development of first multimedia training systems many of which will be applied in teaching humanitarian courses, is still underway.

2.1.3. Recommendations

It is necessary to continue the certification of pedagogical programs and publication of detailed information regarding the certified programs.

It is also vital to pursue experimenting in creation of training environments as cue of the most promising directions.

The major hurdle for developing pedagogical programs is the lack of purely pedagogical materials for implementation on computers rather than the lack of instrumental means. It is necessary to organize creative groups combined of teachers-practicing, teachers-methodologists, artists, writers, programmers etc. as well as to continue organizing contests of designers and support programs for such groups.

The work of teachers must be assisted by the most user friendly computer (today this type of computer is represented by Macintosh). The objective is not the installation of computers in educational facilities, but their lucrative application for teaching purposes. It needs to be emphasized that teachers value not the processing speed of the processor or frequency of it etc., but the fact of computer being user friendly and the complex character of the offered solution. Teachers must not waist time choosing the computer configuration that suits his course the most.

2.2. MULTIMEDIA

2.2.1. Current condition

Due to the fact that in the previous years there was a lack of powerful computers for designing multimedia systems in Russia, such systems rarely fall under the consumer goods category. The major surge got underway in Russia in 1994-95. About 80 compact disks were created in Russian mostly containing cultural and historical data.

Multimedia technologies are linked with the process of creating and using multimedia products, i.e. electronic books, multimedia encyclopedias, computer films, databases etc. The primary characteristic of these products is a combination of textual, graphical, audio and video information and animation in the computer. The secondary one is the volume of information offered to users. The category of multimedia products may include the ones with the data volume totaling approximately several hundred megabytes. As opposed to ordinary programs, in this case information itself is a factor. It may be represented in several ways and most importantly, it is always structured - both the textual and the graphical ones. Thus, from the terminological perspective, it implies not only a multimedia environment but also a hypermedia one to draw a parallel with the hypertext technology.

Hypermedia products (despite that the term multimedia product is usually used) of this type may be used during classes, students may also process a large amount of materials represented in a form other than the textual one. All of it is possible in the interactive (dialogue) regime when not only do teachers (or students) passively watch and listen, but also participate in the process of selecting materials, making notes and preparing the proper summaries.

2.2.2. Prospects

The goal "Humanitarization of education via informatics" becomes quite achievable with the help of multimedia computers and such programs as computer encyclopedias, tourist guides, electronic books, reference software on literature, art, music. A good case in point here (as far as the Russian-language programs are concerned) would be the "Hermitage", "Russian Treasures", "Moscow Kremlin, directory", "Cathedrals of Moscow" etc. The process of informationalized education given the use of multimedia technologies depends above all on the human factor, that is to say on how the teachers will take the innovations suggested.

It takes simple instrumental (author) means for teachers to prepare something and use it during the class. Nothing better and easier than Macintosh hypercard has yet been invented. It was the hypercard that could bridge the gap between a computer and teachers in the United States. Certain difficulties might be encountered when using the hypercard in Russia, since there is a language used in it which is close to the original English, but Alas!, to English and not to Russian. This, in turn, calls for an adequate Russian-language equivalent of the author means.

The development of the first multimedia training systems is still underway, many of them will be applied in teaching humanitarian topics. Most of electronic textbooks and encyclopedias must be designed not by the teachers operating given local conditions but by qualified designers including specialists in humanitarian arts and natural sciences. Teachers may base their preparations to concrete classes on these materials.

2.2.3. Recommendations

It is time that we reject the complex of computers as the only model applicable in educational organizations which is even more dramatic since schools can rarely afford buying 10-15 latest computers at a time.

In this case, a new model of using one or several multimedia computers in schools might come in handy. One computer a school is an electronic board for teachers, telecommunication unit for connecting with the rest of the world, practice for groups of students, a desktop publishing device in schools, electronic library or art center in schools (center of culture and information). Naturally, it is impossible to use one computer for all of the above-mentioned purposes, but any educational facility may chose the one that is the most adequate for meeting their requirements whereas other model may be purchased in the form of acquiring additional computers. The most important aspect of it is that computers (a computer) installed is schools should immediately provide feedback and not be locked up in a classroom with no software installed. This scheme allows to use multimedia options of computers that meet the standards not lower than MPC-2.

The best computer for these purposes is Macintosh which according to 1994 estimates, is easy to handle for librarians and teachers specializing in particular topics. Macintosh is deemed as the world's best multimedia machine - it is reliable and simple. The extra price is compensated by the options it offers and low maintenance costs In the event that IBM PC compatible computers are chosen for this purpose, it is important that educational organizations are oriented at using multimedia computers that meet the standard not lower than MPC-2.

Libraries in schools must become multimedia centers contributing to informatization of schools and should serve as a source of information both in the printed and electronic forms for teachers and students. It is also possible to rename this facility into media library (mediateka), electronic gallery etc. The name is not as important as is the fact that libraries should become information centers that avail processing multimedia information, instill in students skills required for living and working in the modern information-oriented society. Such electronic libraries in schools should also offer modern multimedia encyclopedias, art galleries, tour guides describing sights of different countries and a set of additional materials on educational topics etc.

The major obstacle in the way of developing pedagogical programs is not the lack of instrumental means but 1) the lack of exclusively pedagogical materials to be implemented on computers; 2) the lack of specialists-"directors" - somewhat similar to movie directors, capable of combining the source pedagogical and education materials in one attractive multimedia product. It is important to organize creative task forces combined of teachers-practicing, teachers-rnethodologists, artists, writers, "directors", programmers etc. as well as to continue organizing contests of designers and support programs for such groups.

2.3. OPTIONS FOR APPLYING NETWORK TECHNOLOGIES IN EDUCATION

No matter how complex the essence of telecommunication means is, what ideas are used in that field, only the following options are available for users:

- retrieve (read) information;
- transfer (send) information;
- place information;
- search (scan) information - an option that only recently became available disc to the rapid growth of INTERNET.

That is why the options of using network technologies in education are in the first place determined by the contents and methodological essence of telecommunication systems rather than their technical characteristics [17].

2.3.1. Electronic mail

Application of telecommunication in education was initiated in our country in the end of the 1980-scientific in the form of E-mail [18]. Primarily it became clear that E-mail may not be used as a base for individual or collective correspondence between students. All attempts of that sort gradually entailed the fact that all contacts were ceased. However, in the early stages of contact, within a limited period of time, this correspondence may be used as a way for students to meet each other. The principal result obtained during the initial years of using E-mail in schools is confined in the fact that success may be achieved only through specially organized and coordinated educational activities of students based upon E-mail.

The result of secondary importance may be considered the understanding of the fact that the program employing E-mail can fit the limits of system of classes with great difficulties.

The third result is confined in the fact that E-mail is an economizing means of education process informatization since it requires only one inexpensive computer per school. In a number of cases, when schools did not have any computer available the authors had to organize and support the course of educational activities via E-mail. In terms of operation, [19] E-mail may be naturally used in schools according to a collective project model.

2.3.2. Teleconference

In the Western countries, where the development of telecommunication is somewhat ahead of our achievements, on-line conferences became one of the major means of distance education [20], Teleconferences assist in organizing collective work of students, implement methods of business games and brain attack. All of it becomes possible due to the implementation of a virtual class based upon teleconferences. This technology is almost unknown in our country - only a handful of publications [21-24] took place as well as several attempts of the department for education informatization problems of the IIP RAS to implement an educational course employing teleconferences. Nonetheless, this technology has a vast potential with regard to education and hence, is presented in the survey in the form of a separate section.

Participants of teleconferences may be divided into groups for working on particular topics and their access to certain topics may be limited. In general, there are broad horizons for organizing the educational process. At this point it would be appropriate to mention that off-line teleconferences. The problem is that it takes a certain period of time (hours and even days) to send a sentence and place it via off-line conferences and to read it at the teleconference and obtain it on your computer. Thus, applying to off-line teleconferences you will every time retrieve only a part of the information contained there at the moment when you receive the information on your computer. That is why your sentence may be outdated, repeated, inappropriate in the event that the discussion unfolded in a new direction and so forth. Another weak point of off-line teleconferences is the impossibility to select new materials for reading.

Working at on-line conferences, each participant may scan the contents of the conference and determine what he wants to familiarize himself with, after which he obtains only the required information on his computer. Participants of off-line conferences never know in advance what new materials became available and subsequently they have to order all of them. The more intensive work is the worse off-line conferences are. In case of a slowly evolving conference with a small number of participants application of this conference may be deemed justified to the extend of considering justified slowly evolving education.

2.3.3. Database

Means of telecommunication make information stored in distant from users databases accessible to them. A fine example of distant databases is the information stored in INTERNET servers. One of the most interesting functions implemented in INTERNET is the option of browsing or surfing the information. Users search for information in INTERNET either for particular reasons or just for looking around and finding out what is available. INTERNET contains enormous amounts of information so it may take a very extensive period of time just to switch from one sector into another scanning the available information. The emergence of such means of conducting the search of information as GOPHER and WWW had a bomb effect.

2.3.4. Potential and prospects

According to facts set forth above, we may draw the conclusion that the major methods of working with network technologies are confined to firstly project activities and secondly - distance education. Distance education is implemented in this case either in the form of self-studies using the education materials stored in distant servers or on-line teleconferences. On-line education is obviously different from the traditional one which is based upon personal contacts. Some of the most significant differences are:

- people from geographically distant places can be "present" in classes without physical transportation to one place;
- it helps save time and transportations (which basically means financial benefits, although it requires initial and current costs to participate in on-line education);
- participation in conferences is possible within a certain period of time - it may be accessible either within a definite period of time (for example one month) or within an unlimited period (for years);
- interaction (responses to messages etc.) is not simultaneous and immediate;
- participants may contribute to the conference at any moment when they feel it appropriate i.e. they do not have to wait for their turn and cannot interrupt others;
- contribution to the conference may be maid 24 hours a day, seven days a week;
- participants of the conference may contribute to it from any geographic location which means that the participants who due to their occupation travel a lot may communicate from basically anywhere;
- interaction between the participants takes place (not necessarily though) in a more regular, slow manner;
- all contributions to the conference are automatically recorded and may later be used as a database;
- participants may also use other sources of information of the system not determined by the program they are participating in;
- social aspects of participation, process and results of teleconference usually differ from those in case of personal communication;
- the possibility of collective work in groups is increased - teleconferences may sustain collective education via such means that may not be achieved in case of meetings in person.

INTERNET offers unique education options. Although there are no general methods of using INTERNET in the educational process, they are likely to emerge in the near future. It allows us to draw the conclusion that it is necessary to take into account the possibility that systems worked out for the education system which are currently designed and projected may be plugged in INTERNET in the future.

3. TEACHERS

3.1. INFORMATION TECHNOLOGIES IN EDUCATION AND NEW POSSIBILITIES IN TEACHING METHODOLOGY

The education technology in Russia implies a means of implementing contents of education stipulated by educational programs and representing a system of forms, methods and means of education that ensure the achievement of the set didactic objectives.

The peculiarities of the new information technologies in education are the following specific environments in which they are implemented and components related to it:

- technical (type of the applied equipment);
- program and technological (software catering for the implemented education technology);
- organizational and methodological (instructions for students and teachers, organization of the education process);
- subject matter of knowledge.

Automated computer-supported training courses serving for one or several education purposes gained popularity. These courses include programs, methodological and educational materials (photo slides, printed, audio and video materials etc.) required for different types of educational work.

Various works in the sphere of didactic programming considerably developed as well. In pedagogical literature this term is sometimes referred to regarding the issues of selecting and structuring educational material as well as optimal organization of the education process. One of the major objectives of didactic programming is a combination of a target system regulating optimal education administration actions under the implementation of which the condition of knowledge and skills reaches proximity with the required standard.

Currently, there is a growing trend of developing and applying author integrated environments supporting different information components such as texts, dialogues, schemes, pictures and including analytical and imitative models of the studied objects and phenomenon, databases and bases offering expert knowledge, support systems for implementing particular professional actions such as scientific, engineering and technical calculations, automated projecting etc.

Modern information technologies grant students access to nontraditional sources of information, increase the efficiency of self-reliant work, offer totally new opportunities for applying creativity, acquiring and mastering different professional skills, allow to implement principally new forms and methods of education using means of conceptual and mathematical modeling of phenomenon and processes.

Educational modeling creates illustrative effect for the studied object thus increasing the interest of students to this form of education and studies of processes in their dynamics results in a more thorough processing of educational materials.

Since modeling itself becomes an educational objective with regard to a number of subjects, instrumental software is being developed in Russia that assists teachers and students design and modify training models in the interactive mode thus eliminating the necessity of programming.

Information technologies in education make it possible for teachers to use both particular types of educational work and entire sets of them for achieving didactic goals i.e. to project a training environment. Teacher-oriented instrumental means allow the user to quickly renew the contents of automatic training and controlling programs keeping up with the emergence of row knowledge and technologies.

Teachers are offered additional options for supporting and directing the character-building process of the trainees, creative thinking and organizing their cooperation, designing and selecting the best variants of education programs. Teachers become the major suppliers of the education subject goals taking into account the varying character and significance of educational courses (humanitarian, economic, natural science etc.) in a concrete educational facility. There is also a possibility to reject the routine types of teachers' activities intrinsic to the traditional education, offering them an intellectual form of labor. Information technologies release the teacher from the necessity of setting forth a considerable part of educational materials to students and routine operations related to polishing skills and abilities.

Due to the access to telecommunication networks, not only do teachers considerably increase their information stock, but also get a unique opportunity to communicate with their colleagues basically all over the world. This creates perfect conditions for professional communication, conducting joint educational, methodological and scientific work, exchanging educational projects, software, data etc.

For this purpose banks of data and knowledge are created that accumulate normative, reference, instructive, photographic and other types of information. Means for analyzing business and other information related to activities of educational facilities are also being created.

In the framework of the specified directions at the level of educational institutions, interlinked computer systems are being created that ensure automation of functions related to educational process management which above all will allow to reduce the pending expenses for organization of education process administration in educational institutions. This project implies the development of electronic means of access to library and reference information, rating calculation of each student and educational facility.

3.2. CONVEYANCE OF SKILLS AND KNOWLEDGE VIA INFORMATION TECHNOLOGIES

Conveyance of skills and knowledge may theoretically be divided into two pans - intellectual (creative) and technological. The intellectual part includes collection of knowledge, their systematization (structuring), generalization (separation of major knowledge aspects within a subject sphere), conveyance of knowledge in the form of "lively" communication of teachers and students (lectures, seminars consulting). The technological part includes testing, training in order to determine eligibility for studies, examination of the amount of knowledge mastered as well as self-control of the depth and knowledge of the mastered information. The border between the specified parts is quite hypothetical and possesses flexibility.

In the course of accumulating knowledge and perfecting the methodology of teaching an evolution shift of the border takes place with expansion of the technological border and simultaneous expansion the subject sphere outer border by means of including into it new knowledge (skills) or depth of their understanding.

The creative origin in the sphere of conveying knowledge and skills is the human prerogative. information technologies in this sphere ensure the information support of the process in the form of profession-oriented databases, means of data telecommunication, means of their visualization for perception as well as in the form of auxiliary means of systematization and generalization of knowledge.

The technological part is implemented via device and program means and directed to ensuring testing and training in all forms.

The concrete combination of means and techniques of both parts of the knowledge and skill conveyance process in all of the numerous subject spheres determines the paradigm of the national education system.

A considerable role is played by the technological component in sustaining the self-study process -compilation of training programs, schedules of classes, transparent topics for training specialists in peculiar subject spheres. The last direction may include models of training systems, models for evaluating the efficiency of funds invested in the education system and other components of modern information technologies.

Russia possesses a world famous higher education and professional training of average qualification specialists system. There are centers for computerization of the higher and secondary education supported by the state. The specified Centers offer methodological projects and test samples of program complexes in particular program spheres (in separate subject (curses). There is also an extensive list of training software for practicing and perfecting professional skills in technically complex professional spheres.

Prospects for development of information technologies in the sphere of knowledge and skill conveyance

The modern condition of information technologies in the sphere of education support may be characterized by the fragmentary structure of components. There are components that solve particular private issues of specialist training. The major direction of expanding the sphere of information technologies application in the field of knowledge and skill conveyance may be regarded the creation of complex system for education informatization.

Such system may include:

1) Creation of profession-oriented databases containing scientific, professional and educational information on industrial basis,

2) Setting standards in the sphere of presenting and transferring information related to the education support process;

3) Creation of a concept, principles and functional structures that ensure actualization of information used in the educational sphere;

4) Design of technological means for overcoming language barriers when distributing information for education purposes;

5) Creation of an industry manufacturing applied program packages serving for the major elements of conveying knowledge and skills (creation of quite versatile program nutshells for introducing automated elements into the education process).

6) Creation of sets for information and technological support of education m the most spread out subject spheres.

Russia's contribution to the development of information and technological components of the education process

Russia possesses personnel, knowledge and generated expertise in training highly qualified specialists. This expertise may be used when creating:

1) Databases containing scientific, professional and educational information in profession-oriented spheres where positive results were achieved;

2) Uniform program components and program systems catering for particular functions of the education process.

3) Standards of presenting and distributing profession-oriented information.

4) Methodologies for applying means of automation and information technologies in the sphere of conveying knowledge and skills.

5) Computer training programs for perfecting professional skills in technically complex professional spheres.

Expanding the sphere of more effective application of information technologies in the field of conveying knowledge and skills requires international coordination and joint efforts of different countries directed toward creation of information and technical means of education.

3.3. PRACTICING INFORMATION TECHNOLOGIES IN SCHOOLS AND PREREQUISITES FOR RESHAPING

The massive introduction of computers in secondary schools in Russia that lasted for more than ten years did not live up to the expected informatization of the education process. Reasons for that are quite obvious now. The major method for organizing work places of students was regarded the computer lab. The major topic implying the use of computers has become the course of informatics and computer basics. Thus, it appeared that computers were used mostly for the purpose of studying them. Informatics teacher combined their ordinary responsibilities with the material ones for the computer lab. Computerization of the education process was restricted to the computer lab in the framework of a single course.

Starting in 1985 deliveries of computer sets for equipping laboratories were centralized. Each school of this type endured the necessity to hire a teacher of informatics. Since the large-scale training of teachers had lagged way behind, the most natural and probable way out was requalification of programming engineers into teachers of informatics. The major educational activities during informatics classes became studying one of the programming languages - Basic as a rule. This situation still persists in many schools despite thê emergence of a large number of programs designed for studying particular topics in the framework of other courses as well as such programs especially designed for versatile application of computers as instruments as text and graphics processors, desktop publishers, electronic tables and databases. Event the transition from the eight-bit mode computers to the sixteen-bit mode ones had a slight impact upon the commitment to Basic.

Thus a typical situation would be the one when the only person is an average school who was capable of using computers and knew their target purpose was the informatics teacher. Since all computers were concentrated in the lab they were used only during informatics classes. In this event, the class was divided into two groups because the number of computers was limited to 10-15 units. If a school acquired computer programs for studying other courses, these rare classes were held in the computer lab with the informatics teacher obligatorily participating in them since he was the only teacher capable of starting these programs and the one who assumed the material responsibility for computers.

Educational programs and curriculums were centralizedly approved and set as standards throughout the country. No initiative was allowed. Now we can witness more favorable conditions for practical implementation of new organization models for using computers in schools. These models include the following:

1) Independence of schools. Each school may decide as to what educational programs teachers will use. Some schools even jumped at the class-lesson system and declare a transition to new means of educational process organization.

2) Readiness of teachers. Presence of computers in schools could not pass unnoticed. More

and more teachers feel the necessity of applying information technologies in studies of their courses. Meeting these needs, a course of mastering and implementing a project method for teachers was developed in the Institute for Informatics Problems RAS.

3) Change of teachers' role. The process of gradually transferring knowledge from people's heads into magazines and books and then into computers which is underpay all over the world involved schools as well. Now teachers become more and more aware that they no longer represent a source of knowledge for students. Teachers' role of a source of information is substituted by the role confined to methodical organization of the process implying self-reliant acquisition of knowledge by students from various sources.

4) The economic situation. The economic situation played an important role in arising the necessity to overhaul the organizational form of using computers implemented in schools. The project collective model requires considerably lower costs for computerizing the education process. The same approach may be applied to the model of individual activities.

5) Civilized methods. Several years ago school were supplied computers according to directives of the party and the government. Now schools acquisition of computers is based upon sponsor investments. The further step toward civilization would be to apply for sponsorship not only for providing the given school with computers but also for implementing certain education projects that will bring in particular results. The transition to financing projects is getting closer. This is the way science is financed. The transition to the collective project method of organizing the use of information technologies may create advantages for schools in getting the proper financing.

4. STUDENTS

4.1. MODELS FOR APPLICATION OF INFORMATION TECHNOLOGIES IN SCHOOLS

It can hardly be expected that in the near future schools will be able to equip every working place of students with computers. It is also unlikely because neither the teachers nor designers of educational programs can offer students a constant substantial work on computers at least in certain courses except for informatics basics. It seems that the class-lesson model of using computers reached the limit of its possibilities. Hence, the task of informatization of the education process must be solved through other ways.

As one of these ways it is possible to propose to start implementing other organizational models for interaction of students with the information technologies. Let us view what options it presents. In order to do that we will have to list the mechanisms of educational interaction between students and computers and evaluate the possibility of their implementation in the framework of certain organizational models. We can map out the following models of using information technologies applicably to computers:

1) Model of studies. This model is designed for studying and mastering computer user interface and programs. An instrument or a working tool is being mastered. The model is characterized by the immediate communication with computers for a consequent implementation of actions and test for the correct reaction of software. This model plays an auxiliary role as a preparation stage providing a possibility of implementing other models for applying computers. In the overwhelming majority of cases this model is used in schools.

2) Model of existence. Programs featuring certain artificial environments via modeling (simulation) or creation of virtual reality have gained more and more significance lately. Multimedia means are used as well. Under these circumstances, the user of such a program - a student in this case - views this artificial environment as reality in which he exists within a certain period of time. The purpose of such programs may vary. Most frequently this model is used in computer games and training programs. Another fine example would be INTERNET. Some of its features make it possible to implement a collective model of existence in artificial environments. The model of existence has a paramount importance because it provides the greatest impact upon the user. This model is implemented in the conditions of direct communication of the user and the computer. The education application aspect may be represented by such "construction" games implementing macroeconomic and social models as SimCity, MotorCity, Civilization and others.

3) Model of managing one's own information. This model is implemented when as a result of work with a computer, the user accumulates certain materials that require particular attention in terms of storage, renewal organization etc. This self-reliant work requires personal memory resources. The simplest version of the model of information management is implemented when students create their own subcatalogues featuring results of their activities such as texts, charts, tables etc.

4) Model of managing technological process. This model features application of computers as an intellectual interface between the controlled process and the operator. As far as the education process is concerned, this model may be used in case of computerized control of physical and chemical tests. There are projects on managing such physical characteristics in the classroom as temperature, humidity, light etc. They may form part of the education process when dealing with such courses as physics, geography and nature studies.

5) Model of creativity. In the event that computer is mastered as an instrument, students may face a situation that requires a certain portion of creativity. Computers make it considerably easier to write essays, enables students to format the created texts providing them with polygraphic quality. Creation of computer pictures and programming may also be regarded as creativity. The process of creativity requires a special creative atmosphere which can hardly be achieved during the classes and especially in the situation when all students must do the same work.

6) Model of communication. Modern computer

networks feature the function of transferring messages among the users. These possibilities are so immense that they turned into an important element of human culture during the last years, which may not be implemented via other mechanisms of transferring messages across a distance (mail, telephone, telegraph, fax). Computer networks just like ordinary every day communication may feature educational projects containing along with the materials for educational purposes element- of motivation for students. These means also allow to execute distance education implementing the parable of a virtual classroom.

7) Model of browsing (surfing). Those students that are computer wizards usually familiarize themselves with a new computer not starting with solving the task in hand, but with finding the contents of the computer memory. They scan catalogues, starts the programs he is interested in and scans files that may be of interest for him. This scanning or browsing is a rudimentary example of the behavior that may fully be realized in INTERNET. An analogue of these activities may be represented by scanning books with a free access in the library. This model is implemented both for satisfying one's curiosity and as a method of browsing information. In this case it does not matter whether the person engaging in scanning knows what he looks for. Currently, no experience of practical application of browsing model has yet been generated. However, there is so great an interest shown toward such a possibility that we may soon expect publications of methodological materials on its application.

8) Model of retrieving information. This model may be outlined as an independent mechanism for computer interaction because in the event of a straightforward search of information other programs are employed than the ones used for implementation of the browsing model. This model may be executed in case of educational use of electronic encyclopedias and tour guides on CD-ROMs, for example, when preparing summaries or reports.

9) Model of intermediary interaction. Among many education projects there are ones that do not require direct communication between the computer and all participants of the project, although, the information retrieved from the computer considerably determines studies related activities [1]. A fine example illustrating that model may be the description of a project entitled "Holidays" that got underway in 1992-93 in the framework of an E-mail pilot project for schools in Great Britain and the CIS. Students of schools exchanged descriptions of national holidays and then picked one of the holidays celebrated in the other country for doing so in their school. After settling on a particular holiday, a detailed study of the chosen holiday took place in the school including the behavioral scenario, clothes and national cuisine. The closing event was the celebration of the chosen holiday with the further exchange of videocassettes containing a recording of it. The direct work on the computer was accomplished by a small group of students and in some schools this role was played by the teacher alone. However, the intermediary interaction of practically the entire school with their counterparts lead to a significant for the schools event. The project materials increased motivation during geography, literature, history world culture classes, because it inspired studies of both British cultural traditions and those of their own country.

All of the described models may appear useful when implementing educational activities of students employing computers. However, the modes of organizing students should conform to the applied models. Let us view organizational models of interaction between students and information technologies.

1) Class-lesson model This model is characterized by the fact that all of the working places are equipped with computers as well as that of teachers'. It is also assumed that all computers are plugged into a local network and supported by a server. The interaction with computers during the classes is organized so that all students engage in similar or same actions. The teacher's task is simplified. He presents problems, shows how to solve them and controls the process. It is fairly easy to control same tasks just like it is to comparatively evaluate the results. This organizational model provides the best implementation for the model of studies which is auxiliary with regard to the rest of them. The model of browsing would probably also fit the profile of such a computer class in the event that no concrete goals are set before the students and the process assumes the form of mastering the browsing procedure. All other models require individual actions of students thus not fitting the class-lesson system.

2) Collective project model. This model is based upon a project method well known in pedagogic. One of the major controversies of modern schools is that goals of pedagogues are different from those pursued by students. Low rating of pedagogues' goals among students does not increase their motivation and leads to a general decrease of interest taken in the studies and hence to a decrease in the level academic achievements. One of the effective methods increasing the motivation of students is creation of goals important for them and which can be achieved by obtaining particular knowledge. In this case achieving the pedagogical goals becomes a means of achieving the goals that were artificially presented to students. It appears probable enough that this famous pedagogical situation may find a second chance due to the emerging possibility of using computer based information technologies is schools. Perfecting the project method teacher concentrates on pedagogical issues and on planning changes in the educational process of character building. Employment of information technologies plays an auxiliary role in ensuring the planned changes. Since project activities implies different roles of participants, the use of computers becomes momentary and takes place to the extend of being necessary according to the distribution of roles among participants. If there are several, from six to eight project groups in the classroom one or two computers may be enough for supporting the entire work. In this case every group may use the computer differently than others. Naturally, teacher's task in such a class becomes more complex. However, because of the intensive motivation of students one may be assured that everyone is occupied with a task. Subsequently, it becomes harder to evaluate the academic achievements of every student. In order to avoid this complication, the evaluation procedures should be planned when working on the project. Apparently, depending on the contents

of projects any of the models employing information technologies may be implemented, with the possible exception being the model of studies. The collective project model may be employed when using a single computer in a school. Some of the projects may not require a computer in the classroom at all. In this case it is the education process that undergoes informatization but not *the* operation of studying the computer itself. Practical application of the collective project model requires that teachers possess new knowledge and follow the special procedure.

3) Model of individual activities. This model finds its best application when using a computer at home, however it may be replaced by an analogue represented as single computers located in a school library, for example. This organizational model allows to apply any of the models employing information technologies including the model of studies. In order to employ it, both time during the class and off the class may be used. In the event that students have a computer at home, the accent may be replaced on the homework.

The major conclusion that may be drawn from this material suggests that the class-lesson model of interaction between students and information technologies is depleted. It should be replaced by the collective project model and the individual model The main advantages of the offered models are represented in the fact that they allow to subject the education process to informatization, achieve this goal with lower costs and suit the modern school better.

5. SOCIAL, ECONOMIC AND CULTURAL ASPECTS

5.1. TECHNOLOGICAL INNOVATION IN THE SOCIAL SPACE AND INFORMATION TECHNOLOGIES

One of the major principles of the modern society development is the great degree of technological innovation in the social space [25]. The technological development level of the society determines today its capability to produce high quality competitive goods, makes the country economically powerful and socially stable, determines living standards of the overwhelming majority of our planet's population. This is exactly why a brand new type of the world market has been forming lately - a market of promising technologies where the information technologies play more and more considerable role. In other words, information technologies become such an important product of social activities as manufactured goods, products and services. A characteristic example of it would be Japan - the first country to give informatics and information technologies a priority status in their national policy of social and economic development.

The strategic role of information technologies as a factor of social and economic development in the modern society may be deemed generally acknowledged today with no room for doubts. It is determined by the following major peculiarities of information technologies that stipulate the necessity to give them the priority status both in national scientific and technical policy and the sphere of education [2].

1) Information technologies make it possible to activate and efficiently utilize national and the world information resources of the society that today represent such an important factor for the development of the civilization as mineral resources, raw materials, energy and human resources.

2) Information technologies allow to optimize (and in many cases - to automate) information processes that have occupied larger niches during the recent years in different social activities spheres It is a common knowledge that the development of the civilization assumes the direction toward informatization-oriented society in which objects and results of the work accomplished by the majority of population are not tangible values but mostly information and scientific knowledge. Already now in the developed countries a large part of working population (more than 60% in the United States) are closely linked in their activities with the processes of preparing, storing, processing and transferring different types of information and therefore, it has to develop and practically apply the proper information technologies. Thus, the rapid development of the information sphere in the society had a considerable impact upon the structure of population's occupation and requires the proper orientation of the education system. For example, the development of personal informatics means and the telecommunication system provide new options for providing jobs for handicapped at home, pensioners capable of working and women raising small children. And these are quite vital and important social problems for many countries in the world.

3) Information technologies are often important components of other types of technologies both industrial and social. In this case they implement the most vital "intellectual" functions of these technologies. Characteristic examples may be systems of automated projecting of manufactured products, flexible automated and robotized types of production, automated systems of technological process control, modeling complexes for conducting tests of complex technical systems etc.

4) Information technologies play an extremely important role today in providing information interaction between people as well as in the systems of preparing and distributing mass information. Today, in addition to the customary means of information communication (such as telephone, telegraph, radio and television) systems of electronic communications gain more popularity in different spheres of social activities. These systems may be represented by E-mail, facsimile communication of information and other types of telecommunications. These means are rapidly assimilating in the culture of our society since not only do the) create certain conveniences and save social time but also facilitate solution of many industrial, social and routine problems entailed by the globalization and integration process the world community is undergoing, expansion of national and international cultural and economic ties, migration of population and more dynamic transportation across the planet. The level of development and distribution of modern information technologies determines the extend to winch a country enters the world community space. This is one of the critical conditions for developing not only the economy but also for efficiently developing its science, culture and

education.

5) Information technologies are pivotal in the process of intellectualization of the society and development of educational and cultural systems. Practically in all of the developed countries and in many developing ones computers and television equipment, education programs on optical disks of CD-ROM types and multimedia technologies become customary attributes of not only higher education institutions but also ordinary schools that form the system of secondary and elementary education. The application of information technologies became also an efficient method for education systems, continual education as well as for qualification advancing systems and retraining of personnel. Thus, the issue of developing and distributing progressive information technologies in the society is most closely related to the problem of qualitative development of human resources and intellectualization of the society.

6) Another promising direction in the process of safe and stable development of the civilization is the development based upon knowledge. It implies that both global and regional knowledge should be rationally developed and actively knowledge that reflects the historical experience and peculiarities of development in particular countries and regions of the world [26].

In this regard it is appropriate to emphasize especially the key role if the information technologies in the processes of generating, distributing and effectively using new knowledge. Today, the traditional methods of supporting scientific research confined to basically computerization of mathematical calculations, employing methods of statistic modeling and in distributing scientific and technical information within telecommunication networks does not satisfy scientists anymore. These methods are replaced with the new ones based upon application of rapidly progressing options for means of informatics and promising information technologies.

It should be primarily noted that such methods as teleconferences, assigned scientific task forces as well as methods of complex information modeling of complicated natural processes and phenomenon that allow scientists conduct a sort of a "calculation experiment". In this event, the characteristics of the researched processes may be selected the ones that often may not be implemented given the conditions of natural modeling due to its great complexity, high cost or danger post to those conducting the experiment. This direction created and actively developed by academician A. Samarsky from RAS was widely acknowledged by both Russian and foreign scientists [27].

The second prospective direction is formed by methods of artificial intellect that assist in finding solutions to ill-formalized problems as well as problems with incomplete information and blurred initial data. In this case the logical sequence of the automatic search for the type of problems specified above reaches in its character that of metaprocedures used by the human brain [28].

The next promising direction is represented by methods of multi-dimension cognitive computer graphics that make it possible to present various mathematical formulas and principles in spacious form. With the help of them Russian scientists managed to observe several new principles even in such an abstract field as the theory of figures.

It is necessary to underline that fostering research in the field of theoretical informatics and philosophic perception with which the Russian scientists deem the role of information in the evolution process help form a new picture of the world around us, which appears considerably more informative than it was thought before [29].

5.2. INFORMATICS AND CULTURAL ISSUES

Development of means of informatics and information technologies make it possible to find new solutions to a number of pressing problems of modern culture. One of them is the problem of how to save cultural legacy of different peoples, represented by ancient books, manuscripts, pictures, photos, sound recordings, films, videos, etc. Another problem is how to provide a wide access to this data to all interested users, with no threat to their good condition in future. Both these problems can be effectively solved by creating electronic encyclopedia, reference books and data base of the works of culture, where their electronic copies are kept in high-fidelity computers and can be easily accessible to many distant net users. Necessary distribution, as well as local use of this data, for instance, for research work, studies, culture education activities, etc., are also possible.

Invention and application of digital copies of the works of culture, as well as recent development of integral multimedia technologies have become the main instruments of the fast-developing art trend - screen art. Dozens of thousands of CD-ROMs, which have already become an industry trend, popularize world's cultural masterpieces, which have been accessible only when in museum, palaces, picture galleries, art exhibitions or private collections.

Multimedia technologies let not only link the picturesque and detailed images of the works of architecture, sculpture and fine art item by item, but supplement them with diverse reference and scientific data, as well as music, movies, video, animation, etc., if needed. All this strongly influences the audience emotionally, develops its sense and interest in art and, simultaneously, lets it obtain the necessary knowledge in culture, art, human history.

Opportunities of this trend of informatics means and information technologies development are so promising that Russian culturologists have good reasons to say that a new cultural trend, i.e. screen culture [30], is being born. Most important is to ensure that this trend is fully applied in the area of humanitarian education.

It is worth mentioning that there is one more type of promising information technologies. Its appearance will provide absolutely new opportunities for the realization of human creative talents. This is the so-called creative technologies which are intended to exercise information support for human art processes with the help of computers, TV and other information equipment.

Application of these technologies is especially effective when the art process implies combinatorial tasks, searching for necessary combination of space, color and other elements of the work. This is rather typical for architects, designers, modelers, arrangers, animators, sound engineers and some other art professions.

Creative technologies are new. Therefore their opportunities are not widely known yet. Though they will have a good future. If digital TV and sound-recording studios already exist, the specialized computer centers for the data support of other types of creative activity are the matter of the near future of information.

That is why one of the tasks of the modern education system is to properly update both teachers and students on the main opportunities, problems and peculiarities of this fast-nearing future, which gives us no time to get ready for it.

5.3. INFORMATICS AND OF NATIONAL SECURITY ISSUES

Informatics and information technologies are the necessary and rather effective means of ensuring national security, many of which are of a mostly information character [31].

Paying no particular attention to the well-known problems of military security, which is impossible without strong computer base, we will consider three basic problems, which people meet at the door of XXI century and which pose a serious threat to their future existence.

The first among these problems is the problem of environment and its greatest part - human environment. Ensuring of chemical safety of a person under modern conditions of the himself-made artificial world is becoming one of the most pressing and urgent problems of national security. The ways to find a solution to this problem are closely connected to the use of modern information technologies.

As a result of the rapid growth of chemical industry and insufficient toxicological control over production of many artificial substances and materials, dangerous to health and sometimes life, our society is now living in an undeclared chemical warfare, having no idea about this fact.

Man is surrounded by toxic substances: paints, lacquers, plant and anti-insect strays, furniture varnishes of different kinds, building structures, etc. There are thousands of them already and they keep increasing in number [32].

The problem is even more dramatic due to the fact that different toxic substances influence human body in different ways, not only according to the type and the quantity of the substance, but to the individual peculiarities of the organism as well.

Thus, today diagnosis and treatment of acute chemical intoxication are not purely medical but mostly information tasks, which solution demands the use of such means as automatic toxicological data base, expert systems for doctors-toxicologists, telecommunication networks, etc.

Another serious problem of national security, demanding the use of the latest inventions in the area of informatics, - is the fight against crime, especially Mafia. The problem of co-interacting the crime in its traditional forms, as well as in form of new types of crime against individuals and society (environmental and computer crimes) can be effectively solved only on the basis of creation and wide application of latest means of informatics and information technologies in the activities of internal affairs bodies. Personal identification, ballistic tests on weapons, tests on document and money bills authenticity, operative connections and transmission of criminal data - these are just some of the problems, which security services and police institutions have to face nowadays. Besides, the problems increase in number every day.

One more new and, probably, not enough realized problem is the necessity to ensure information security of man and society. This is a complex problem, involving such components as ensuring sufficiency, accessibility and authenticity of the data, used in society, prevention against personal information control and other no less important and complex social problems. They all need careful study in terms of information approach, as well as development and introduction of appropriate information technologies in social practice.

5.4. PROSPECTS FOR THE DEVELOPMENT OF INFORMATICS AS A SCIENCE

One of the most important conclusions of modern science is the conclusion that information and scientific knowledge are the main factors, representing not only general potential of the society, but the prospective of its further growth. In this situation it is extremely important to introduce into education system new principles of information study which is to be considered as a fundamental natural science discipline, which will study features and laws of data motion and transformation within nature and society.

Today, on the threshold of information civilization, it is inadmissible to treat informatics as a purely technical science on methods of data computer processing. This approach does not already conform to the fast-growing subjective sphere of modern informatics and its part in the process of further social development.

The above examples of the use of information technologies in the different areas of social activities and the important part of society in solution of urgent social, economic and cultural problems witness the necessity of substantial reconstruction of traditional informatics study courses under the motto, set forth by academician A. Ershov: "From computer literacy to information culture of society", which is to become an inseparable part of its culture.

This would comply with the one of the main principles of Russian modern educational policy - to ensure the leading position of educational system as opposed to other means of social, economic and cultural development of our society [32]. Top priority, given to education, is a contribution to the future of Russia.

6. TRANSPARENT TOPICS

6.1. DISTANCE EDUCATION IN RUSSIA: OBJECTIVES AND PROSPECTS

In the last two years the term "distance (or distant) education" became quite trendy. It is mentioned at every conference dealing in the least with the issues of using information technologies in education. Each author with a fair amount of self-respect writing about the application of information technologies in education can hardly keep silent when it comes to this topic. The reason for this is quite obvious - for our huge country with the intrinsic to it pour infrastructure system and significant concentration of scientific and educational centers, the possibility of obtaining education without suspending the major activities is extremely critical. It is apparent that the existing system of extra-mural education due to a number of circumstances fails to meet the pending requirements.

The meaning of the term "distance education" is confined in the realization of the possibility to obtain education without suspending the major activities and without physical transportation to the location of the educational institution The fact that this term is broadly used reflects understanding that there is a growing necessity of emergence of such an opportunity rather than possession of techniques and methods for its implementation.

It would appropriate to say several words about the system of extra-mural education that formed in our country. It feels like the more extra-mural education resembles the standard one the better it is. The entire information interaction between teachers and students is carried out during an extensive session. Outside the limits of the session practically no programs exist. In this form, the extra-mural education will always lag behind the standard one which causes quite a negligent attitude toward it.

On the other hand, extra-mural education has a paramount importance for such a huge country like Russia and its perfecting based upon new technological options may appear quite promising. That is why, apparently there was an explosion of interest toward Distance Education. In this case everyone deems the distance education as he pleases. This includes television education, extramural programmed education, videoconference education and self-education using the means of information technologies. It is worth mentioning that the system of extra-mural education is much more rich in options than in our country which may be explained by the absence of the strict centralization which we all witnessed and participated in. That is why a certain confusion took place. If any specialist is lucky enough to familiarize himself with an existing system of extramural education that is considerably different from the one in our country, under the slogan Distance education, then with a certain degree of probability one could assume that he will take it for the distance education everyone is talking about. Especially if the system employs such technical means as computers, television or satellites. Let us try, though, to outline the most important aspect that entitled this term to exist. We propose that the distance education shall be considered the forms and methods of education that offer a possibility to exclude any direct personal contact of teachers and students regardless of the nature of the applied technical and other means. In this event, it is not the issue to obligatorily dispense with any possibility of personal contact. In each concrete cases only the methods that suit the education purposes the best should be applied. Thus, if as a result of education an issuance of a certain certificate or a diploma is implied of certain importance then undoubtedly the final stage which is graduation exams and thesis hearings shall be accomplished in personal contact. The education related to working with special equipment is also conducted at the location of this equipment. However, the preparation and theoretical stages may be implemented distantly.

Thus, the successful implementation of distance education requires the following:

- supply of the educational materials to students,
- presence of interaction with the teacher,
- ensuring collective distance work where needed.

In this context it is necessary to bear in mind that students are physically left to themselves. That is why the educational materials, tasks and the consequence of their studies and fulfilment shall be worked out more in detail than it is usually done in case of a standard education.

In essence, the real distance education takes place if there is a distant feedback. The regular mail plays the primary role in this case (historically). One can easily imagine a written exchange of information between teachers and students. Of course we are not trying to point out that each teacher has to respond to every student's letter. Terms for accomplishing particular tasks, form of material presentation, form of consulting organization (everyone knows his questions but each gets a complete set of answers) mechanisms of evaluating the submitted results shall be determined. In certain cases telephone and facsimile communications may be used. However, it should be admitted that the most prospective and convenient for distance communication is the telecommunication in the form of E-mail or teleconferences

In the events when organization of a collective work of students is required, teleconferences would be the only acceptable solution Videoconferences solve such problems as well however, currently they can hardly be widely used. Distance education based on computer (telecommunication) networks and videoconferences feature the parable of a virtual class, the possible variations of which depend on the age of students and level of education. All of them to a significant degree depend on the role assumed by the teacher or a group of teachers like in a normal class situation. I cases when the teacher educates and evaluates the contribution of students there may be different styles of interaction in the group with each member of it who possesses knowledge and skills sharing it with the others. Teacher in this context acts as an assistant.

Thus, the application of distance education methods allows to obtain (provide) a complete education at the location of residence or work without suspending major activities. Depending on the advanced character of the communication means and the proper scope of financial resources available, particular technical means may be preferred It is worth mentioning at this point that everything concerning the possibility of obtaining distance education specified above applies to teachers as well. He may also teach without suspending his major activities and do that from his home or office regardless of the location of the educational institution that provides the training. This fact is rarely paid attention although implementation of these options may be as important for teachers as it is for students.

Such options offered by the distance education as:

- collective (group) work;
- employment of distant educational materials;

operative (in the course of education process) exchange of information between all the links

are fully demonstrated when using telecommunication. That is why they may be considered the main and systematizing feature of distance education [33-39].

We can map out at least four ways of applying distance education methods:

- for complete substitution of personal contacts;
- as an addition to personal contacts,
- as information-oriented approach toward the education process,
- when using a fully integrated method.

Full substitution

Methods of distance education are used for replacing the traditional methods of education that require personal presence or ensuring these contacts via electronic means across a distance with regard to geographically isolated regions or offering them a constant (permanent) alternative for extra-mural courses. A good example may be represented by the application of teleconferences for implementing distance on-line courses in the New school of social research in Manhattan. The school offers complete courses based on that technology. The traditional college atmosphere is represented at these courses the following way: traditional classes are formed as separate teleconferences, there are conferences for an electronic campus cafe for students and teachers, recreation room for students, electronic library and board of announcements. This program serves for students from any state of the US, Tokyo, Singapore or Great Britain just like it does for those from the closest to this are of New York.

Addition

The technology of distance education is also applicable as an addition to the traditional education based on personal presence. Electronic seminars may introduce a useful and motivating aspect both in standard and extra-mural education. Materials covered during the lectures may be supplemented and commented on during the teleconference. Students may ask teachers questions, require additional information for ensuring success of the entire class. Personal contacts may be continued during the simultaneous teleconferences for carrying on discussions on the raised issues or topics that were not possible to discuss during the personal meeting.

Information-oriented approach

Distance education methods are used for ensuring an education based upon information resources. In thus event different types of delivering and using information may be used. An example of such approach is the course in the Open University on information technologies. In addition to the traditional materials used in education (texts, audiocassettes, television, lectures, additional materials, course programs etc.) students are also granted access to teleconferences for such activities as exchanging information of the course, renewal of information, consulting and collective self-reliant preparation. Thus, teleconferences are one of the several alternative ways of providing education within a course. In this context, the variety of available education means meets the various needs of students.

Completely integrated method

In case of the integrated approach each means of education offers the advantages that it may add to the education. Lab works are carried out according to the traditional way. The types of work that do not require personal presence are accomplished via distance education methods which become an important and organic part of the course but not some overtime addition.

As a rule, authors writing about distance education accentuate that it is vital for Russia. This really is vital factoring in the vast size of the country, inefficiency of transportation means and "concentration" of scientific and educational centers. On the other hand, the expel Use generated in the world flowing into our country related to organization of distance education systems may be considered adequate for its practical application. Nonetheless, the actually operating models of distance education may be counted by fingers with none of them being completely Russian. Organizations specializing in distance education mainly provide Western education in Russia. The Russian national education is neither "exported" to other countries nor does it work in Russia.

The Institute for Informatics Problems of the RAS, possessing the technology of distance education and persistently offering it to organizations visibly concerned, faced unexpected and interesting circumstances. Educational institutions, as a rule, are not prepared for introducing distance education. This applies both to higher education institutions and commercial education departments of large companies. As far as we can judge, the reasons for such an altitude toward distance education are:

1. Serious obstacles in obtaining state financing supporting this type of education. Western grants support the introduction of Western courses in our country. That is why Western course are offered in Russia but not vise versa. Educational organizations as a rule, face the choice whether to seek a grant or to pay themselves Usually grants are the choice that is favored

2. Absence of technical possibilities both at the education facility and students of distant courses. This controversy is encountered when trying to introduce distance education in higher education institutions and branch systems of advancing the qualification of personnel. The technical side of this issue still remains an expensive effort. Since it actually deals with the application of computer networks, the organization minimally has to purchase computer and a modem for the teacher, become a client of a telecommunication system and make sure that students possess the proper equipment as well. In a number of cases it appears to be an irresolvable problem.

3. Teachers possess an experience of working with standard education and it is uncustomary and undesirable for them to switch to the new teaching methods.

All what was mentioned above, seems sufficient enough to understand that distance education may successfully integrate into the existing educational systems such as extra-mural and standard education, open education, education at home or without suspending major activities. However, today we can mostly speak about the distance education in subjunctive mood or in the future tense. Creation and introduction of a federal program in Russia entitled "Development of the uniform system of distance education in Russia" has to upgrade distance education to the category of practical activities.

7. ABOUT PROSPECTIVE STRUCTURE OF EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

The general prospective structure of the educational course "Fundamentals of informatics" is offered for the system of secondary and higher education in Russia. This structure is built upon a problematic module principle and therefor is quite flexible. It is designed that the contents of this course should contribute to practically ensuring the leading role of education in the process of intellectual development of the Russian society. For this purpose, a section of the course entitled "Theoretical informatics" was expanded and a new section called "Social informatics" was introduced, in which social aspects of the society informatization process are reviewed.

7.1. MODERN CONCEPT OF THE SUBJECT SPHERE STRUCTURE OF INFORMATICS

In Russia's National report entitled "Policy in the sphere of education and new information technologies" which will be presented in July, 1996 at the Second International congress "Education and informatics", shows a structure scheme illustrating the modern concept of the subject sphere structure of informatics (Table 1). This scheme according to authors of the report, shall lay the foundation of the modern course c "Fundamentals of informatics" that is to replace the traditional course in the Russian education system called "Basics of informatics and computers".

The offered course is undoubtedly an advancing step as opposed to the traditional one. The very title of this course "Fundamentals of informatics" already orients pedagogues and students at studying informatics as a fundamental scientific discipline and not solely as a course aimed at obtaining elementary computer literacy. It seems that this is a very critical structural shift in orienting the Russian education system applicably to this subject sphere.

The course contains three major sections which are "Theoretical informatics", "Means of informatization and "Information technologies". The section "Theoretical informatics" includes only studies of mathematical and information models and algorithms as well as methods of designing and projecting information systems and technologies. Naturally, this dot's not make up for the entire number of problems intrinsic to this vital section of the course which shall contribute to formulating a modern world perception among students. It seems to be the **first serious remark** on the contents of the proposed course.

Another serious remark is that the content **of the course practically completely fails to cover the issues of information support** of informatization means which of course is unacceptable

The problem of structuring in section "Information technologies" does not seem quite appropriate either, for there is no distinct boundary between the versatile (base) and problem-oriented technologies.

And finally, the course does not deal with the issues related to the studies of social and economic aspects of society informatization at all, which are exclusively vital and are more and more brought up to the surface by the very development of the modern society. That is why such important notions as "information resources", "information infrastructure" and "information environment of the society as well as its "information potential" and "information safety" will remain ill-understood by the students that will successfully master the offered basic course of informatics. All of it takes place in the conditions when the global process of society informatization is increasingly affecting its social and economic structures and the role and position of people in the society.

It seems necessary that this weak point of the offered course is corrected as soon as possible.

7.2. PROSPECTIVE STRUCTURE OF THE SUBJECT SPHERE IN EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

Paragraph 7.3 describes the general prospective structure of the subject sphere in educational course "Fundamentals of informatics" in which all the remarks concerning its contents are factored in as it seems.

The course contains three major sections which are "Theoretical informatics", "Technical informatics" and "Social informatics" each of which contains several problem modules representing components of the educational program.

The section entitled "Theoretical informatics" contains six such modules: "Philosophic fundamentals of informatics", "Basics of general information theory", "Basics of computer semantics", "Fundamentals of information modeling", "Information intellectual systems" and "Information and knowledge".

The listed titles of problem modules as well as the essence of issues described in them proves that this section primarily aims at forming a modern scientific world perception among students in which information is regarded as a fundamental semantic feature of nature and the information processes - as critical intellectual components of the functioning processes of any technical, social and natural systems including processes of perceiving the world by humans.

Apart from this philosophic task, this section contains issues related to studies of the modern scientific methodology in informatics and primarily theoretical basics of information modeling. It stipulates studies of statistic methods, methods of conducting "computing experiments" (according to A. A. Samarsky) as well as methods of solving ill-formalized problems and problems with incomplete or blurred initial data.

The second section of the course - "Technical informatics combines four problem modules: "Technical means of informatization", "Program means of informatization", "Information support of informatization" and "information technologies"

Contents of this section covers basically all problems that are proposed for including into the basic course of informatics in Russia's National report (Table 1). In addition, it specific, an important problem module entitled "Information support of informatization", and the problem module called "Information technologies" sets forth their more distinct division into versatile and problem-oriented.

The third section of the course called "Social informatics" contains four problem modules which are: "Information resources", "Information potential of society", "Information society" and "Man in information society". Their titles and the contents of the issues described in them proves that the major objective of this course is to render the students a broad perception of the information-oriented character of the modern society development process as well as arising from it of problems and methods of solving them based upon the information approach and prospective information technologies.

Studying this section is extremely important for universities and humanitarian higher education institutions as well as in the system of advancing qualification of state officials and those occupying administrative positions.

7.3. STRUCTURE OF THE SUBJECT SPHERE IN PROSPECTIVE EDUCATIONAL COURSE "FUNDAMENTALS OF INFORMATICS"

Section 1. Theoretical informatics

1.1. Philosophic fundamentals of informatics

- Concept of information as semantic feature of matter. A triad of substance-energy-information.
- Information and evolution in living and non-living nature.

1.2. Basics of general information theory

- Methods of measuring information. Micro- and macroinformation.
- Information and self organization. Synergetics of information processes. Information approach.

1.3. Basics of computer semantics

- Information and knowledge. Semantic aspects of intellectual processes.
- Semantic concept of information systems.

1.4. Fundamentals of information modeling

- Stochastic methods in informatics.
- Computing experiment as a new methodology of scientific research.

1.5. Intellectual information systems

- Artificial intellect information systems. Methods of rendering knowledge.
- Methods of expanding poorly formalized problems in indefinite conditions.

1.6. Information and knowledge

- Knowledge and creativity as information processes. Creative information systems in science and culture.
- Social intellect. Basics of social cognitology.

Section 2. Technical informatics

2.1. Technical means of informatization

- Means of data processing: PCs, workstations, input/output devices, computation complexes and systems, computer networks.
- Means of telecommunication: technical means and links and computer telecommunication systems, audio and video systems, telematic systems.

2.2. Program means of informatization

- System program means: operation systems and environments, systems and languages of programming, user languages, systems of user interface, service nutshells.
- Means of implementing versatile (base) information technologies: text and graphics processors, processors of electronic tables, SUBD, means of object, rocess and system modeling.
- Means of automation of calculations, SAPR, GAP, ASNI, means of solving information and analytical problems and problems of organized administration.

2.3. Means of information support

- Information languages and formats of data and knowledge presentation, dictionaries, classifiers.. thesauruses.
- Means of information protection from elimination and unauthorized access.

2.4. Information technologies

- Versatile (base) information technologies of: integration and collective use of various information resources, their "electronization". Technologies of text processing, that of video and audio information, multimedia technologies.
- Problem-oriented technologies of: training, diagnostics, administration, projecting, modeling.

Section 3. Social informatics

3.1. Information resources

- Methods of formation and quality evaluation of information resources, their structure and topology. National and regional resources.
- Information resources as a factor of social economic and cultural development of society based upon knowledge.

3.2. Information potential

- Information technology. Methods of activation of information resources.
- Information infrastructure and social information environment. Information culture.

3.3. Information society

• Principles and problems of development and evolution of information society Major features of information society. Peculiarities of the transitional period.

• Informatization as a global process. Its impact upon social structures of society. The issue of information safety.

3.4. Man in information society

• New options for character building in information society. Problems of democratization in information society and ways of their solution.

• Information culture and information safety of identity.

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Table 1.

Subject sphere structure of informatics - modern concept

FUNDAMENTALS OF INFORMATICS				
THEORETICAL INFORMATICS				Mathematical and information models, algorithms. Methods of designing and projecting information systems and technologies
MEANS OF INFORMATIZATION	**technical**	**data processing**		PCs. Work stations. Computing systems. Input and output devices
		data transfer		Computer networks. Complexes. Technical means of communication and computer telecommunication systems, audio and video systems, multimedia
	program	**system**		Program means of intercomputer links (systems of teleaccess), computing and information environments Operation systems. Systems and languages of programming User languages, systems of user interface, service nutshells
		implementation of technologies	***versatile***	Text and graphics processors Database administration systems Processors of electronic tables Means of modeling objects, processes, systems
			profession-oriented	Publishing systems Profession-oriented systems of implementing technologies of calculation automation, projecting, data processing (accounting, planing administration, analysis, statistics etc.) Systems of artificial intellect (databases, expert, diagnostic, training systems etc.)

INFORMATION TECHNOLOGIES	Of input/output, collection, storage, transfer and processing of data Preparation of textual and graphical documents, technical documentation Programming, projecting, modeling, training, diagnostics. administration (of objects, processes, systems).

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UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

EDUCATION and INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

PROCEEDINGS
OF THE SECOND INTERNATIONAL CONGRESS

VOLUME II

NATIONAL REPORTS

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES
IN EDUCATION

PREFACE

TO THE 2nd VOLUME OF THE PROCEEDINGS OF THE 2nd UNESCO INTERNATIONAL CONGRESS

EDUCATION AND INFORMATICS

EDUCATIONAL POLICIES and NEW TECHNOLOGIES

We bring to the notice of specialists and all interested persons the 2nd volume of the Proceedings of the 2nd UNESCO International Congress "Education and Informatics" held in Moscow on July 1-5, 1996. The volume contains texts of national reports presented at the request of the UNESCO Secretariat by the official education system control bodies from 32 countries. Most of these reports have been submitted to the Congress before its onset, printed and distributed among the Congress participants as the working materials.

The contributed national reports are in full agreement with the objectives of the Moscow Congress. They represent examples of collaborative experience and joint use of limited resources, examine national tendencies and experience in introduction of information and communication technologies into education systems, set forth peculiarities of national policies pursued by various countries in the education sphere, and suggest recommendations concerning international cooperation.

Significant differences in the content of national reports seem to be quite natural because all countries are now at different stages of developing education systems and using new information technologies in education.

As with preparation of other volumes of the Congress Proceedings for publication, we met in this case with a wide variety of approaches to the problems discussed at the Congress - in ideas, terminology, style and completeness of presentation of particular sections and topics. Based on common principles of forming the Congress Proceedings, the compilers and editors of this volume seek to retain, where possible, original texts and avoided in most papers editorial corrections and especially changes in the content. At the same time, some lingual nuances are possible in the issue of national reports in three official Congress languages - English, French, and Russian, which were difficult to avoid with the best will in the world.

The editors would be grateful to authors and readers for corrections and suggestions. Your references will help to continue discussions started at the Moscow Congress, to approach to the unification of terminology and notions used in this area, and to enhance exchange of information on the topics discussed at the Congress.

The present state of the art of using information and communication technologies in education systems of various countries will serve as a good reference material in the activity of the UNESCO Institute of Information Technologies in Education (IITE) set up in Russia in line with recommendations of the Moscow Congress.

Analysis, selection, and preparation for the issue of this volume were accomplished by the IITE and the International Center of Systems

Analysis of Higher Education and Science Problems (the UNESCO associated center). Readers' references, comments and suggestions will be accepted with thanks by the Editorial Board.

They should be sent to the Center's Address: 117918, Moscow, GSP-1, Mal. Kaluzhskaya ul. 1, General Director of the Center, Academician of the Russian Education Academy, Manushin Eduard Anatol'evich.

PRESIDENT OF THE RUSSIAN ORGANIZING COMMITTEE FOR THE 2nd INTERNATIONAL CONGRESS "EDUCATION AND INFORMATICS",

MINISTER OF GENERAL AND PROFESSIONAL EDUCATION OF THE RUSSIAN FEDERATION,

V. G. KINELEV

NATIONAL REPORT OF AUSTRIA

INFORMATION TECHNOLOGY IN THE AUSTRIAN EDUCATIONAL SYSTEM - THE STATE OF THE ART AND BEYOND

1. INTRODUCTORY REMARKS

Both modern societies in the industrialised world and developing countries are moving towards the so-called information age which is symbolised by the transition from an industrial society to an information-processing society. Information and telecommunication technology plays a vital role in economic, commercial, social and also classroom activities nowadays. The informatization of society seems to take place as a "cultural mutation" affecting not only life styles around the world (Vitalari, 1990), but also our way of thinking (Turkle, 1984). It is a matter of fact that the New Information and Communication Technologies (usually abbreviated as NICT), in particular the computer, have already found their way into schools considered as revolutionary in many aspects (see OECD/CERI, 1986 and 1987; OECD, 1988 and 1989).

Seymour Papert [1] philosophised in his keynote address at the international conference "Children in the information age" in Sofia (19-23 May 1987):

"So we are entering the computer future, but what will it be like? What sort of a world will it be? There's no shortage of experts, futurists, and prophets who are ready to tell us - only they don't agree. The Utopians promise us a new millennium, a wonderful world in which the computer will solve all our problems. The computer critics warn us of the dehumanizing effect of too much exposure to machinery, and of disruption of employment in the workplace and the economy". (Papert, 1987, p. 3/4)

Governments in almost all developed countries have introduced computers into the educational system, meanwhile *"an increasing number of parents are feeling more and more guilty if they do not buy a computer for their children"* - as Jacques Hebenstreit sarcastically pointed out at the 8th international European Conference on Computers in Education (24-29 July 1988) in Lausanne (Hebenstreit, 1988, p. 4). What is now (1996) available to schools would have been unthinkable ten years ago. And while the technology advance in the field of micro-computer and new transmission technology continues - and is even accelerated by the convergence of several technologies [2] including satellite technology to produce even more powerful uses - educationalists and politicians have to accept that the demands for investing in educational hardware and software will go on. Even one of the greatest critics of computers, namely Joseph Weizenbaum admitted at the UNESCO -Congress "Education and Informatics: Strengthening International Co-operation" in Paris (12-21 April 1989) that

"another reason given for installing a lot of computers in schools, ..., is that computers are everywhere and that it is very important for children to learn about computers because the world in which they grow will be full of computers. Almost every job will be somehow laced with computers and so they had better know about them". (Weizenbaum, 1989, p. 7)

On all sides, thus, the computer has been invading our lives, changing our human relations and our relationship with the world. There is no doubt that whether or not we use computers in our jobs or in private life the main thing is to become familiar with and acquire a knowledge of computing. In the information society of today a familiarisation with computers has become a fundamental need of the citizen. The growing significance of information technology was also taken into account in the Austrian educational system (EDP/Informatics 1991; Fischer H.F. (ed.), 1988; Reiter A./Rieder A. (eds.), 1990;) that will be outlined in the following chapter.

2. PROFILE OF THE AUSTRIAN (NON UNIVERSITY) EDUCATION SYSTEM

The sector of pre-primary education consists of crčches for the very young, day nurseries for one and two year old, and kindergarten for children between the ages of three and six and is not compulsory. As a rule children start with compulsory education at the age of six, attending primary school (Volksschule) for four years, if physically or mentally retarded a special school (Sonderschule). After the fourth year of school children either go to the four-year main general secondary school (Hauptschule) with streamings in German, Mathematics and Foreign language (predominantly English) or the four-year first stage of a higher general secondary school (allgemeinbildende höhere Schule, AHS). The syllabi of Hauptschule and AHS differ very little, transfers of pupils on a comparable standard of knowledge are possible. In the ninth year of compulsory schooling choices must be made again. Pupils from the Hauptschule often opt for the pre-vocational year (Polytechnischer Lehrgang) before entering apprentice training colleges. These colleges are specialised institutions for vocational or craft qualifications. An alternative route to vocational qualifications from the ninth year onwards up to five years offer the intermediate and higher technical and vocational colleges (berufsbildende mittlere und höhere Schulen, BMHS). They train students for skilled industrial, commercial, business and agricultural occupations and can also qualify them after having passed the final matriculation examinations (Reifeprüfung) for university tertiary admission. Tertiary education is the aim of the three categories of higher general secondary school (Gymnasium, Realgymnasium and wirtschaftskundliches Realgymnasium) with Reifeprüfung which takes the form of written examinations or project assignment and orals for university entrance. Alternative two-year non-university tertiary technical and vocational (Kolleg) courses (leading to qualifications equivalent to those of the BMHS), specialised technical courses (Speziallehrgang), teacher training colleges (Padagogische Akademie) or specialised university (Fachhochschule) studies as additional tertiary options for AHS graduates and BHS graduates.

Sources for Students: Anticipated Outcomes and Unexpected Challenges, in: MC Dougall A. and Dowling C. (eds.) [1990], Computers in Education, North Holland, Elsevier Science Publishers B.V., pp. 19 - 23.

The institutes of education, organised in four departments (compulsory general, apprentice training college, higher general secondary, intermediate/higher technical and vocational college) carry out the vast majority of in-service training for all teachers. An important sector of education and training in Austria is adult education offered by special adult education departments at higher technical and vocational colleges, at universities, federal adult education centres and "popular universities" (Volkshochschulen).

Education system

AGE					YEAR
5 6	PRE-PRIMARY STAGE				0
6 7 8 9 10	SPECIAL SCHOOLS	PRIMARY SCHOOLS			1 2 3 4
10 11 12 13 14	SECOND STAGE SPECIAL SCHOOLS	SECOND STAGE	MAIN GENERAL SECONDARY SCHOOLS	HIGHER GENERAL SECONDARY SCHOOLS FIRST STAGE	5 6 7 8
14 15 16 17 18 19	PRE-VOCATIONAL YEAR TECHNICAL AND VOCATIONAL APPRENTICE TRAINING COLLEGES	INTERMEDIATE TECHNICAL AND VOCATIONAL COLLEGES	HIGHER TECHNICAL AND VOCATIONAL COLLEGES	HIGHER GENERAL SECONDAR Y SCHOOLS SECOND STAGE	9 10 11 12 13

Table of the Education system in Austria (BMUK 1993, Dep. of Educational Economics and Statistics)

3. EDP/INFORMATICS IN THE AUSTRIAN EDUCATIONAL SYSTEM

The first preliminary attempts at incorporating electronic data processing into school curricula took place towards the end of the 'sixties and, in the following years, it became more and more widespread at the individual types of school (see also Kerner, 1994).

The development of EDP/informatics in Austrian education was closely moulded on its classic approaches; The machine orientation of the late 'sixties was replaced in the 'seventies by the algorithm-orientated model of thought, which promoted the application of programming languages. Since the middle of the 'eighties it is the user-orientated approach that has been put to the fore in many cases in EDP/informatics. This approach sees man and society in a reciprocal relationship with the new technologies and emphasises the aspect of computers as a working tool. Today, the main concern of information technology education in Austria is to acquaint each pupil with the new information and communication technologies (NICT) in the course of his or her general education in such a way that they are able to use them in a purposeful way. In this process, they are to be shown the opportunities and the limitations of the NICT; groundless fears are to be dispelled in the same time as blind faith in technology is to be countered.

Basic education in information technology for all pupils in the 7th and 8th forms is continued in the 9th form at general high-level schools with the subject informatics and complemented at medium and high-level vocational schools with profession and application-orientated EDP knowledge. To help comply with the specialised job profiles that have emerged in EDP and informatics, vocational education offers a five-year education course at high-level secondary schools for electronic data processing and organisation as well as the subject informatics, which is firmly established at several universities.

3.1 BASIC EDUCATION IN INFORMATION TECHNOLOGY

At the start of the 1990/91 school year basic education in information and communications technology (informations- und kommunikationstechnische Grundbildung, ITG) was introduced for pupils in the 7th and 8th forms. All pupils, boys and girls, had now direct access to the new technologies by the age of 13. The so-called "Integration Solution" was chosen as the means of anchoring this basic education. It includes teaching educational elements of informatics within the framework of existing school disciplines.
(see Reiter, 1990, p. 130)

This integration not only complies with the holistic approach to information and communication technologies but also contributes towards reaching the objectives of basic education in information technology, namely:

- Pupils are to gather their own experience with the new technologies in general and the computer in particular and in so doing acquire basic skills and abilities
- They should be capable of analysing with a critical mind the experience acquired in the past and of situating it in a broader context
- The newly acquired knowledge of information and communication technologies should first and foremost be of a general nature; specialist knowledge is not a priority
- An essential element of ITG is to take into account the opportunities and the limitations of the new technologies, their effect on the individual person and the development within society as a whole.

In practice the Integration Concept provides for an introductory phase in the 3rd and 4th class of the "Hauptschule" [compulsory junior secondary general school] and the "AHS" [high-level general secondary school] (7th and 8th forms), with thorough preliminary information in the 7th form and a project phase in the 8th form. Computers are used according to the specific nature- of the subject matter in the subjects German, English, mathematics and geometric drawing.

This basis education places special emphasis on affording boys and girls a like the same opportunities of access to the new information and communication technologies, irrespective of sex. In this connection it has to be taken into account that existing prejudices, which would have it that females are less gifted for technology than males, have in many instances already taken hold of EDP (Clarke V.A., 1990: Sanders J., 1990; Schulz-Zander R., 1990; Brown 1995). For this reason the Federal Ministry of Education and the Arts has outlined an area of research on the social aspects of access to computers and on the matter of interactions in the classroom itself. An independent task force is working on drawing up proposals for ways in which to perceive and dismantle the sex-related obstacles that hinder access to information and communication technologies.

3.2 HARDWARE AND SOFTWARE FACILITIES AT GENERAL SCHOOLS

To implement the Integration Concept a second classroom with 15 AT computers (14 286-microprocessor based pupil workplaces /1 teacher workplace on a 386-basis, VGA monitor...) and laser and/or matrix printer(s) had been set up at 189 state AHS by the 1990/91 school year. Most of the state AHS schools have opted in favour of a network variant (Novell network), which offers a number of advantages for instruction. A videotext workplace is also part of the basic AHS equipment. By the 1990/91 school year the 1,200 "Hauptschulen" [compulsory junior secondary general schools] had acquired between 6 and 8 computers with the same features per school location.

In terms of software a basic package comprising word processing, spreadsheet and CAD (Computer-Aided-Design) programs has been compiled for the general secondary schools to be used in German, English, mathematics and geometric drawing. This basic equipment also includes an integrated package. In the school year 1992/93 the equipment standard at AHS schools has been partly replaced and extended with PCs with CD-ROM-drives and soundcard specially geared for the subjects of physics, chemistry, music and sculptural education. Compulsory junior secondary schools are also aiming to expand their present facilities.

3.3 INFORMATICS AT THE "POLYTECHNISCHER LEHRGANG"

The purpose of the "Polytechnischer Lehrgang" is to prepare pupils for their professional careers upon completion of the "Hauptschule" or (seldom) the first cycle of the AHS. Here again, special emphasis is placed on informatics. Since the 1989/90 school year pupils at the "Polytechnischer Lehrgang" are also given instruction in informatics as part of one of the seminars of their choice (the choice consisting of social studies and biology, economics, natural science/technology and agricultural science). Informatics as a subject of instruction is also part of the alternative compulsory subjects such as book-keeping or typing, and is also taught as an optional subject with one to two hours a week.

3.4. INFORMATICS AT THE SECOND CYCLE OF THE AHS

With the coming into effect of the reformed second cycle of the AHS during the 1989/90 school year, informatics as an existing practical subject became a two-year compulsory subject. Instruction is aimed essentially at teaching the uses of application software and at working out structured problem solutions taking into account the general laws on which information processing is based. The social aspects of HDP uses are also looked into. In the 6th, 7th and 8th classes of the AHS, informatics is available as an elective compulsory subject and as an optional subject. In this way existing knowledge and skills can be improved and additional knowledge gained. In many cases instruction is project-orientated.

3.5. EDP AT MEDIUM AND HIGH-LEVEL VOCATIONAL SCHOOLS

Practical considerations are the main priority for EDP education at the vocational schools. At the technical and trade schools for instance, CAD instruction is a priority subject along with the compulsory subject "EDP and applied EDP" while at medium and high-level business schools the use of EDP in the commercial area is a focal point of instruction.

At the high-level vocational schools for humane studies (secondary schools for domestic science, tourism as well as fashion and clothing techniques), EDP is incorporated as a main point of emphasis in the subjects "accounting", "stenotyping and word processing" and as practical subjects in practical company courses at the secondary schools for tourism and catering or the practical application of the newly-developed data technologies for the textile industry: CAD, computer-aided cutting design and cut-layer optimisation.

At the high-level secondary schools for agriculture and forestry, EDP instruction aims to familiarise pupils with the function, organisation and purpose-orientated use of EDP installations.

The subject-specific use of EDP in medium and high-level vocational education in Austria is rounded off by syllabus adaptations aimed at strengthening, also at vocational schools, the instruction in EDP knowledge and handling that is necessary for the vocation concerned.

3.6 INFORMATION TECHNOLOGY FOR THE EDUCATION OF HANDICAPPED CHILDREN

Priority is given that all children in Austria should get the same opportunities to apply information technology. Handicapped and disabled pupils should be prepared for the private and professional use of computer-assisted learning and communication aids. There is the increasing use of the computer as a communication aid for helping children with a severe sensory impairment or a motor disability, (see Reiterer/Tjoa/Wagner, 1989)

In addition there are also school pilot projects aimed at giving a fundamental education in information technology, taking into account the individual abilities and development of the handicapped child (Busby/Wagner/Zagler, 1994).

3.7 TRAINING, ADVANCED TRAINING AND FURTHER TRAINING

In the course of their studies at teacher training colleges future teachers of elementary schools, compulsory junior secondary general schools and special schools are given an insight into the new information technologies; they learn how to use them in practice and how to draw up useful application possibilities in class. The optional subject "informatics" is available for those wanting to acquire an additional qualification.

The specific EDP/information training requirements for teachers at vocational schools who do not have university or college education are provided by the vocational teacher training colleges. Most of the advanced teacher in-service training for high-level general schools and the vocational medium and high-level schools takes place at the institutes of education. At EDP/informatics courses lasting several semesters they continue to provide teacher training until a sufficient number of teachers with university informatics education are available. Work is still in progress on drawing up a general regulation for university education in informatics for candidates to the teaching profession. Certain universities offer the possibility of acquiring the qualification to integrate computer instruction in the teacher's specific subject.

4. COMPUTERS IN THE DAILY LIFE OF AUSTRIAN SCHOOLCHILDREN

At the start of 1991 a scientific study entitled "Die Spaß-Maschine - Der Computer im Alltag österreichischer Schüler/innen" ("Fun Machines - Computers in the Daily Lives of Austrian Schoolchildren") was submitted by the sociologist Dr Walburga Gáspár-Ruppert, which offered interesting insights into the attitude of youths of both sexes to computers. Her findings have shown that for the majority of schoolchildren of both sexes, computers are primarily an interesting and, compared with other instruments, extremely flexible "toy-cum-tool". While the interesting aspect is further strengthened by informatics lessons at school, in most cases the initial contact with computers usually takes place before tuition is given at school.

The study also revealed that the fact of installing a computer in a child's room is by no means a way for concerned parents to keep their child happy at all costs; indeed, in nearly all of the cases it was the children themselves who asked for the computers to satisfy their curiosity and their craving for "novelties".

Noticeable differences in the attitude objectives in relation to age are due to a large extent to the fact that among the lower age groups the novelty of the computer results in a more intensive involvement with it. The main incentives for schoolchildren, children and youths are curiosity, play and risk-free trial and error. Sometimes there are also instances where children experience a sensation of power as a result of "dominating" a machine.

A direct consequence of "instrumental competence" is the prestige that appears within a group of friends whenever a child or youth becomes expert at handling computers. However, it has been shown that the appeal of computers wanes the more it is integrated in the daily lives of young people. As instrumental competence increases with age and as activities adapt more and more to future careers, computers lose their function as toys or games to become professional tools, which in general are no longer fun. According to the study conducted by Dr Gáspár -Ruppert this is primarily a pragmatic decision on the part of the adult-to-be and not a quality inherent to the computer.

The sex-related differences were also identifiable in the survey. However, they cannot be attributed to the fact that girls are less interested in or not as competent with computers "by nature". Rather, family conditions play an essential role in shaping their behavioural patterns. Girls are as uninhibited and as unprejudiced as boys in their attitude towards computers provided their interest and their curiosity (which are as pronounced in girls as they are in boys), are stimulated and promoted accordingly. It could well be a sign of frustration if girls lose interest quicker than boys. In this case it can only mean that clearly less is done to satisfy the requirements of girls. Possibly another factor is that girls clearly attribute less importance to computers for their future professional activities than boys. The material collected with the questionnaires does not support the assumption that involvement with computers at school and at home will give rise to a generation of "compulsive programmers".

Nor are there any indications that computer technology is causing a loss of social competence; on the contrary, by virtue of its toy or game character, it can even promote and considerably strengthen contacts between children of the same age. A possible withdrawal from social relationships might occur in the case of socially and/or psychologically impaired children; however, the appropriate data is not available at present to substantiate any such claims.

The usually effortless processes of habituation and adaptation, among schoolchildren and children in general should not however conceal the fact that there might be repercussions in the longer term that are not even assessable at present. For this reason it is essential that the possible consequences and effects of using computers be discussed and processed, as is intended by the school curricula. Whenever possible it is not just the social aspect as a whole - as stipulated by the curricula - but also the psychical and psycho-social area that should be integrated. Under these prerequisites the teaching body should in future devote closer and also special attention to the clear difference in behavioural patterns among boys of the lower age groups; certainly it would seem that parents have not yet been able to acquire a sufficient degree of competence to be able to assume tasks such as these, which imply a very intensive involvement with computer technology.

5. PERSPECTIVES OF THE FUTURE: MULTIMEDIA AND TELECOMMUNICATIONS

In the Working Document "Multimedia Educational Software: First elements for reflexion", published in Sept. 1995, the European Commission (EC) states:

"The true convergence of telecommunications, television and computer technology, thanks to a widespread digitisation of data, is ushering in a new era, that of multimedia telematics ... Being aware of such promising perspectives, the European Council has confirmed 1995 that education and training must be considered as priority domains for information and communication technology." (EC, p. 9)

A main challenge for education aside communicating culture, disseminating knowledge and transmitting information is to prepare young people with the technological skills for demands of the future. It has become necessary to promote awareness, understanding and use of information and communication technologies both in regard to learning and teaching and for the future employability of the citizens:

"The future of Europeans - and of their jobs - depends on education and training methods being suitably adapted to new requirements as regards qualifications and the new technological, economic, social or cultural environment of the information society. This adaptation will be facilitated by the introduction and use of interactive multimedia products and services in education or training activities." (EC, p. 21)

Under these perspectives the EC demands that by the year 2000:

- every primary and secondary school should have at least a room of multimedia microcomputers allowing access to remote educational services;
- every university should have access to high speed networks needed for exchanging multimedia educational materials in training activities;
- every firm should be served locally by a centre for multimedia educational resources, an "open university for industry", every town hall, library or Chamber of Commerce should offer free of charge the means of access to telematics tools and services so that all citizens can benefit from information, education and training facilities. (see EC, 1995, p. 6)

Undoubtedly Information Technology (IT) will go on transforming the educational system, by "supporting the learning process at all educational levels and in all curricular areas" as Allan Martin (1995, p. 646) pointed out at the World Conference on Computers in Education (WCCE) in Birmingham (23-27 July 1995). IT has created various instructional possibilities for education. Teachers and learners benefit meanwhile from a broad spectrum of information tools (databases, spreadsheets, DTP, word processing, programming, computer graphics, simulations, input devices etc.) More powerful hard and software combined with rapid advances in multimedia [3]) and communication are providing further potential resources.

Ten years ago the educational systems put computers to the classrooms, recent initiatives concern the implementing of networking. Susan Merrit noted at WCCE 95 the following:

"The telecommunications revolution is about to profoundly change our lives, and is just beginning. It will necessarily affect our schools and perhaps our rooms. In terms of computer applications in the education telecommunications is the most significant development beyond the standard productivity tools which are word processing, spreadsheets, and databases." (Merrit 1995, p. 484)

As a representative of the EC Luis Rodriguez-Roselló described in his keynote-address at the IFIP WG 3.4 Working Conference "Computer Mediated Education" in Soest, Germany (12-16 July 1993) the future scenario of telecommunications:

"Telecommunications will equally make possible new forms of networked training such as linking peers to carry out co-operative learning at a distance by sharing powerful information processing or creating different configurations of groups of tutors and learners by means of advanced interactive telecommunication services giving raise to what we may call the "virtual classroom." (Rodriguez-Rosello 1993, p. 6)

But Multimedia and networking are new to schools and teaching in general, sometimes they are not directly applicable to teaching and learning because of being far removed from the realities of classrooms. To be aware of the technological developments that have an impact on education across a wide range of curriculum subjects pilot experiments on the use of multimedia educational products and projects on networking of schools to promote virtual mobility and exchange of information and experience have to be established and continued. We also need qualitative research that proves the effectiveness of the newest technologies and their integration into the classrooms, the faith that technology will work well is not enough. Pupils and students have to learn first-hand how a computer with a modem and a telephone connection can lead them to a wealth of resources and information far beyond the schools walls and they may even participate in distance learning courses via satellite later.

[3] Martin Hoogeveen doubted the benevolent effects of an overoptimistic multimedia paradigm at ED Media 95 in Graz (17-21 June 1995): "The multimedia paradigm is a dominant conviction that adding multimedia functionality to information systems (ISs) leads to improved information and knowledge transfer to people." (Hoogeveen, 1995. p. 348)

5.1 THE INTERNET AS COMMUNICATIONS MEDIUM FOR TEACHERS AND LEARNERS

The Internet (see Eastment, 1996; Lake, 1995; NCET, 1996) has become one of the most fascinating resources for telecommunications by linking together former separate networks and using a common communication protocol called TCP/IP (Transmission Control Protocol/Internet Protocol). Estimations suggested that there were some 35 million users in 1995 in the world and its use is still increasing. Even though it is not managed by any particular organisation it gives people access to a wide range of material and information. To be able to access it in the cheapest form a computer, a modem connected to the telephone-line and a service provider is necessary. Apart from the registration fee there is the cost of the telephone calls and the (monthly) charge from the service provider. The growing number of people with Internet e-mail addresses indicate its potential as a communications medium. Users of the Internet have access to

- electronic mail
- bulletin boards and computer conferencing systems
- on-line databases (data files)
- catalogues and illustrated guides from museums, art galleries, libraries etc.
- free software (public domain)
- newspapers and books
- graphics, etc.

But the Internet *"is more than an information delivery system-it is also an intellectual environment within which we are beginning to create "places"... it is a place that is not yet here, hut is quickly becoming a world of places.* "(Lake, 1995, p. 25) Since a couple of years the *"Internet has been undergoing a fundamental change that is allowing users to access* *multimedia materials such as digitised images, sound and animation. Ease of access has also been enhanced... users simply click highlighted hypertext links on the World Wide Web."* (Bull et al., 1995, p. 59) The keywords are Hypertext and Hypermedia being essential components of the so-called World Wide Web (WWW). Eastment defines hypertext as *"a system which allows you to click on a word or picture to jump to another part of the document... Once you have connected to a site, you jump to further information by merely clicking on icons... "* (Eastment, 1995, p. 13/14) Hypermedia has become the current buzzword in educational technology:

"A hypermedia environment is the user interface that allows to work with different elements as a whole: text, graphics, images, sounds, simulation software, external hardware, data bases, computer networks, etc. on the base of the specific application. The results of this approach are increased interactively and simplification of the use. Hypermedia technology is important not only for educational applications, because it may prove to become, in the near future, a powerful tool for managing information of all kinds". (Parodi/Ponta, 1993, p. 175)

A WWW page is a multimedia document created by HTML (Hyper Text Markup Language) that contains text, images, sound and even animation and movies. It can be viewed with a browser such as Netscape or Mosaic. In future word processors, telecommunication programs and operating systems will offer support for viewing Web pages that will become as ubiquitous as f. i. electrical service. Using the WWW learners are offered to navigate through, select, assess, manipulate and evaluate information and develop their own skills and network literacy. Educators can easily create their own resources by setting up collaborative projects and displaying their results on their Web page and sharing them with a "global audience". The Web allows immediate access to a world-wide information community and *"is a virtual meeting place to exchange information with distant partners who were previously inaccessible"*, Caroline McCullen notes in an article in the ISTE Journal of Educational Technology Practise and Policy of Nov. 1995, summarising:

"Using the WWW, teachers can develop collaborative projects with international partners, compare data with classes in other parts of the world, share the results on their own home page and get feedback from the global community on the Internet. The WWW makes the virtual classroom a reality." (McCullen, 1995, p.10)

5.2 PEDAGOGICAL RECOMMENDATIONS FOR HYPERMEDIA

Cognitive search has shown that learning in general is driven by the student's intrinsic need to make sense - learning is a natural activity. L.A. Rhodes explains that:

"From birth on, humans seek meaning-then try simultaneously to understand both the world and themselves. They take information in from their interactions with the surrounding environment, conned it to what they already know, and construct new knowledge and skills. These new skills are then tested through continuing interactions. Each interaction increases the individual's capacity to act intelligently in solving problems." (Rhodes 1995, p. 36)

The act of "doing" being essential for a new learning paradigm in the context with hypermedia [4]) develops many other learning skills and evolves a significant amount of intrinsic satisfaction on the part of the active participant. Pientti Hietala from the university of Tampere reported at the IFIP WG 3.4 Working Conference on Computer Mediated Education in Soest in 1993:

"Hypermedia is an exciting new avenue to pursue in the use of computers to empower learning and leaching. Possibilities not even dreamed of before can now be examined through this new concept, but it also requires a special hardware and special kind of pedagogy...The utilisation of this new equipment has to be based on the learner's active and creative engagement, not just passively watching video clips or guided tours chosen by somebody else. The sooner the learner herself is able to have her hands on the hypermedia, the better." (Hietala, 199.\ p. 169)

The pedagogical reasons are given by the cognitive learning theory:

"The findings ... seem to call for a more active and creative role for the learner which is also the message from the contemporary cognitive learning theory... This theory emphasises three primary principles. First, learning is a process of knowledge construction as opposed to knowledge absorption. Second, learning is knowledge-dependent, i.e. people inevitably use existing knowledge upon which to build new knowledge. And third, learning is highly tuned to the situation in which it takes place." (Ibd., 1993, p. 164)

Under these circumstances the role of the teacher will also change. A. W. Bates reported at the IFIP TC3 third Teleteaching Conference in Trondheim (20-25 August 1993) the new approaches of learning and teaching by telecommunications:

"Teacher ... will increasingly be advisors, and managers and facilitators of learning, rather than providers of information. Access to information will be primarily through telecommunications. The teachers' role will concentrate more on developing skills, and in particular skills of navigating knowledge sources, and skills of processing and analysing information." (Bates, 1993, p. 3)

[4] The term "hypermedia" includes also off-line multimedia (educational) products as CD-ROMs T. J. van Weert argued at the 13th World Computer Congress in Hamburg (28 August-2 September 1994) in the same direction:

"The use of open learning and technological support systems will mean that some or much learning will be outside the teachers sphere of influence. The teacher becomes a learning guide or a mentor for the students, co-operating with pupils in a learning experience." (van Weert, 1994. p. 624)

During the last two years several pilot projects on networking of schools have been established by the Federal Ministry of Education and Cultural Affairs in Austria. Many teachers who want to add telecommunications skills to their repertoire of teaching tools today are first introduced to the Internet via a simple modem and electronic mail software. But few schools have the luxury of a computer room where all the computers have Internet access. So only teachers or a small group of pupils/students under supervision of teachers have access. It should also be mentioned, as Eastment reports, that *"often a good deal of class time can be spent simply staring at the screen waiting for information"* (Eastment, 1995, p. 20) when using a conventional telephone line (you wait minutes until a photograph is downloaded) and not the still expensive digital and fast ISDN-lines. The real Information highway will become reality with broadband (fibre optic) connections usable also by the educational system.

6. COMPUTER BASED TRAINING-INITIATIVE AS CASE-STUDY

In order to evaluate the potential of the new educational technologies several pilot projects were established ranging from the "Austrian School Net" (with links to the Internet) via "Portable Computers in the classroom" to the production of "Multimedia Educational Software". As example the initiative "Mobile Computing" at a higher technical vocational school (HTL) in Vienna will be briefly presented.

Within a period of 18 months two classes of a 4th grade (18 years of age) of a HTL were equipped with notebooks (TravelMate 4000) with CD-ROM-dockingstations (SCSI-Interface, sound-card etc.) for multimedia applications in a ratio one portable per one student. During this so called pre-project phase a LAN was built connecting each working place with a router offering access to the Internet. As additional but necessary measure appropriate courseware was selected and purchased by the project-team. The crucial points of the project are the following:

- Availability of portable computers for curricula support;
- Use of multimedia educational software;
- Evaluation of the efficiency of computer based teaching and learning;
- Revising of valid standards of interactive courseware;
- Acquisition of knowledge through electronic networks.

After the creation of the infrastructure the schedule implies the start of the regular project with the objective of integrating newest information technology into the curricula in the school year 1996/97. The following main expectations put forward as working hypotheses are to be verified:

Is portability "a catalyst for cross-curricular Information Technology permeation" as Allan Martin reported a WCCE 95 referring to a project between June 1993 and 1994 in Leeds (Martin 1995, p. 645 ff.): *"One aspect appreciated by both teachers and pupils was the manoeuvrability of the machines... Not only could the portables be moved in and out the classroom; these could also be disposed within the classroom as the teacher wished. This offered teachers flexibility and subordination of the hardware to the learning objectives and organisational requirements of the lesson. "* (Martin, 1995, p. 650/651)

Does the new learning paradigm predicted by cognitive science and manifested by hypermedia bring improved information and knowledge to pupils? (*"Knowledge as a result of the process of knowing, which can only occur as the learner actively constructs what he or she knows, using information in this process "* as Harris, 1995, p. 58, defines)

Does ubiquity in the information age by means of telecommunications enables schools, teachers and learners to share the virtual community that Howard Rheingold compares like that: *"It's a bit like a neighbourhood pub or coffee shop. It's like a salon, where I can participate in a hundred ongoing conversations with people who don't care what I look like or sound like, but who do care how I think and communicate. "* (Rheingold, 1993, p.66)

7. CONCLUSION

The so-called new information and communications technologies (NICT) have been introduced into the Austrian educational system in a broad context in the past decade. Since Austria has become a member of the European Community the integration of multimedia and telecommunications is considered as a major qualification aspect to be taken into account by schools for teaching and learning purposes in regard to the future labour market. A dominant role in this context play the Internet as herald of the information highway and off-line-multimedia educational products (hypermedia). The shortly outlined project initiative at a higher vocational technical school in Vienna by implementing CBT together with mobile computing using portables and direct access to the Internet gives an example of the future scenarios in Austrian schools. The aim is to establish further pilot projects on networking to promote virtual mobility and on the production of multimedia courseware applicable for the curricula.

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[1]

Seymour Papert created the programming - language LOGO which has been used in a variety of educational research projects related to children's learning, and the learning of programming in particular. It should be noted that even if LOGO had been grouped as a crucial theme of the sessions at the 1985, 1990 and 1995 IFIP World Conference on Computers in Education the interest in the LOGO environment seems to be decreasing. The ability to write simple computer programmes is now accorded less importance as standard software packages have become widely available.

[2]

The newest technologies in the field of multimedia and telecommunications (e.g. interactive video, interactive compact disc, CD-ROM, two-way cable and satellite communication, view data and others) offer enormous possibilities to teachers and pupils: in regard to CD-ROM see Baumbach, J.D. [1990], CD-ROM Information

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NATIONAL REPORT OF BANGLADESH

EDUCATION AND INFORMATICS: BANGLADESH PERSPECTIVE

The impact of the Information Technology and the computer on the life and civilisation of nation is very great. Its contribution towards the expansion of knowledge, education and research is surprising. Its revolution has also touched Bangladesh mildly. The Atomic Energy Commission of Bangladesh introduced the system in 1964 with the installation of the IBM 1620 computer. Gradually, the use of computers spread to some important research centres. Universities and administration bodies. Computer Science as an academic course was first introduced in the Universities, then in the colleges and recently in the schools. Short courses/training are also offered by the Government agencies and by private commercial firms. A number of Hardware and Software firms have been developed recently. Bangladesh Television, Radio and Telegraph and Telephone Boards are also contributing towards the generation and dissemination of information on various aspects of education and research. Although general consciousness has developed recently regarding the benefits and uses of computers in the search for knowledge and education, some major limiting factors like lack of specific national policy, shortage of funds, absence of necessary training centres, skilled IT manpower and inadequate information infrastructure are limiting the progress for welcoming the new inventions in the Information Technology. Please find as follows the brief description of the status of Bangladesh in the field of the New Information Technology (NIT). Some recommendations are also given along with the identification of the problems we are facing.

NEW INFORMATION TECHNOLOGY IN OUR EDUCATIONAL SYSTEM

1. Primary level

No course has yet been introduced in the primary level syllabus, i.e. from class I to class VIII.

2. Secondary level

Computer science has been made as an optional subject and a small number of candidates will appear in the Secondary School Certificate (S.S.C) examination in 1996. Moreover, computer science has been made as a compulsory paper of the S.S.C. Vocational course under the Technical Education Board. The Government has also decided to provide 317 Government schools with computers this year.

3. Higher Secondary level and Degree Pass Course

The Government has introduced computer science as an elective subject in the Higher Secondary Certificate (H.S.C.) class and also in the Degree (Pass) class in 1993. The Government has decided to install computer with modem in 136 colleges in the year 1996. NTRAMS, an institution under the Ministry of Education, has also opened a computer course as a paper (part of the course) of Business Management at the H.S.C. level.

4. Higher Education

Computer science has been introduced in the Bachelor's level in various Universities (Government and Private) and in an Engineering University:

- Dhaka University - B.Sc. (Hons) and M.Sc. (3+1=4 years);
- Rajshahi University - B.Sc. (Hons) and M.Sc. (3+1=4 years);
- Islamic University - B.Sc. (Hons) - 3 years recently introduced;
- Shahjalal, Syllnet University - B.Sc. (Hons) in Electronics and Computer Science (4 years) introduced in 1990;
- Khulna University - B.Sc. (Hons) introduced in 1989;
- Jahangirnagar University - One paper in the Hons course;
- National University ' B.Sc. (Hons) in computer science, 3 years, introduced in 1993.
- Two Private Universities recently have introduced a B.Sc. (Hons) in Computer Science with 4 years' duration;
- Open University introducing Diploma Course in Computer Application -1.5 years' duration;
- Teacher's Training College has incorporated computer Science in the B.Ed. course;
- NTRAMS, an agency of the Ministry of Education, provides short course in computer operation;
- Bhuyan Academy and Microland, both are conducting B.Sc. (Hons) in Computer Studies with 3 years' duration under London University;
- Bangladesh University of Engineering and Technology (BUET) introduced B.Sc. (Engineering) in computer science with 4 years' duration, introduced in 1989.

About 700 students in all are enrolled in the 1st year B.Sc. (Hons) B.Sc. Engineering course in different Universities/ Engineering Universities in Bangladesh in the current year. It indicates a good rise from the previous year's record (i.e. 475 students).

TRAINING FACILITIES

a. Computer Training

A number of Government, Semi-Government and private institutions and firms are providing training facilities. Bangladesh Computer Council (BCC) is the most important computer training centre in the country. Other centres are: BBS (Bangladesh Bureau of Statistics); NTRAMS, TTTC (Technical Teachers' Training College), BUET, D.U. (Dhaka University), Ministry of Youth and Sports, Ministry of Establishment, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and Public Administration Training Centre (PATC).

As many as 600 private firms are rendering training services in. the form of computer literacy, awareness programmes, programming and system design.

On the whole, training facilities are most inadequate in relation to our rising demand for computers. . It is very much felt here that training requires to be imparted not only to the computer operators and developers but also to the information users like the Secretaries, Directors and Executives.

The importance of training to the technically skilled persons like programmers and system analysts is not perhaps properly recognised by our administrators, as a result of which an insignificant amount is spent here for training.

b. Present Status of the Information Users in the Education Sector

It is observed that some of the top ranking and middle-level officers and executives of the Ministry/Directors and autonomous bodies engaged in educational pursuits have some training in the computer science and information technology, while others have little knowledge and experience in the current progress of the technology and computer science.

Inadequacy of training or absence of modern training compels them to be ignorant about the recent development in information technology and this may lead them to the wrong decisions at a given time. One gloomy picture in office management depicts that in most of the cases, senior officials are equipped with costly computers of the latest model, but they have neither ever used these devices nor have they any training or time to utilise their services. This is nothing but a sheer wastage of hard earned resources. Provision for Computer Appreciation Training on the part of the top administrators/Directors/Executives may be an appropriate solution for this issue since they have hardly any time for operating/developing or programming through the computer. Again, the middle level officers who may serve the Department for a longer period and who can afford some time for computer work may be trained adequately and properly in computer science. Such executives should be retrained from time to time to cope with the changing environment.

LEVEL OF COMPUTER HARDWARE AND SOFTWARE PROVISIONS

About 5 private firms are assembling micro computers. About 50 private firms are working for software development out of which 10 firms are well-established in the line. Increasing the number of firms need to be encouraged and patronised by the Government in the form of tax concessions and tax holidays. It is noteworthy to mention here that 35% taxis imposed on the import of computer and parts which is discouraging the development of the industry in the country.

POLICY TOWARDS STANDARDISATION

Uniform standardisation is lacking in the installation of hardware and the development of software due to lack of specific policy guidelines and dearth of expertise amount decision makers.

INFORMATION INFRASTRUCTURE

A. Broadcast Technologies in Education

(i) Radio and TV

The Bangladesh Radio and Bangladesh Television (BTV) broadcast are disseminate news (local and foreign) and speeches and organise educational guidelines, advice, lessons and instructions on regular/daily/weekly/ periodical basis on the following socio-economic and environmental topics: Population education (concept, planning and control), nutrition and health education, prevention of diseases (AID, HIV, etc.), academic courses on national and major international languages, special classes for Open University students and also for B.Ed. students, computer science and also provide guidelines, information and technologies involved in various branches of agriculture like cultivation, plantation, forestry, fishery, prevention of environmental pollution and also topics covering development of fine arts. It is viewed by many experts that our BTV and Radio programmes should henceforth be made in such an efficient and effective manner that it suits the current needs of present and future generations and be more capable of keeping pace with the Interment age.

(ii) YCR, VCP and Diss

The number of VCR (18,089), VCP (3,344) and Diss (1.660) is still not sufficient for such a populous country (about 12 crore).

B. Telephone Services

The telephone service in general does not appear to be satisfactory up to expectation, although BTTD is working to expand and improve its services. At present, 331,210 telephone lines are in operation out of which 147,500 are Digital phones. Three telephones are meant for one thousand person currently, which is much low compared to Indonesia, Philippines and Thailand (13, 17 and 47 telephone per thousand respectively). The BTTB's aim is to reach to the following targets (i) at the end of 1996: 503,840 connections including 317,100 digital phones, (ii) By 2000 year .8 million in all. The number of mobile phone is increasing rapidly. The present installation fees are probably discouraging from users' standpoint. These are: for Analog TK. 10,000 and for Digital TK. 20.000 when our per capita income is $ 230.

C. Processing Technology

Computers

Availability of computers in the country at present are as follows: Main Frame 15, Mid-Range 40, PC 50,000.

(i) Computer Literature

In order to popularise the computer science in the country, the Bangladesh Computer Society is functioning very sincerely. A number of monthly journals and periodicals are in circulation in the market (e.g computer Jagat, Computing, Computer Technology and Electronics, Shikhya Barta) and information like type and use of computers, make, origin, modern development of technology, Internet, etc. are being disseminated with a view to making our young readers and information users well-conversant with the modern development and changing environment.

(ii) Data Bank

Five organisations/agencies including University Grants Commission and Planning Commission have jointly developed a Data Bank in order to interchange information among themselves through network. The training of the concerned officers is progressing satisfactorily.

(iii) Database Development

The Bangladesh Bureau of Educational Information and Statistics (BANBEIS) has successfully developed Database of 350 thousand teachers and non-teaching staff and also 22 thousand educational institutions. Moreover, it has also developed teachers' profile of 232 Government Colleges and 9,500 of Ebtedayee Madrasah (religious institutions).

(iv) Computerisation of S.S.C. & H.S.C. Examinations

For the last two year's Secondary School Certificate (S.S.C) and Higher Secondary Certificate (H.S.C) Examinations of 4 Secondary Education Boards are being computerised where about one million examinees appeared.

Internet

Bangladesh is going to Internet very soon. Some obstacles seem to create barriers at the national level in respect of having the advantage of Internet, though it is not expected. Lack of initiative on the part of the Government in general and lack of capacity of the Bangladesh Telegraph and Telephone Board (BTTB) appears to be the major source for the absence of this important technology here. Nevertheless, some awareness has been developed among the citizens specially the younger generation and a number of enterprising private firms. Under the initiative of the University professors and private firms and professionals the Internet Week has recently been observed in order to raise consciousness among the younger generation and information users. Under the private initiative, 256 E-Mail connections are going to be made soon which are envisaged to connect educational institutions, research orsanisations at different levels. It will have access to the Internet.

FACTORS LIMITING PROGRESS IN THE ADOPTION OF NEW TECHNOLOGIES IN EDUCATION

(i) Financial constraints of the Government and other private organisation is perhaps the most important bottleneck.

(ii) Inadequacy of the infrastructural facilities is another major bottleneck hindering the progress of this industry.

Total electric supply is very much insufficient which is again disturbed by frequent voltage fluctuation and load shedding.

Telephone services and lines are still costly, inadequate, defective and irregular.

The total number of computers as noted below is most inadequate for the country as indicated earlier.

License fees are small for Radio owners but seem to be high for TV and VCP owners (e.g. TK 200 for Black and White TV, TK 400 for coloured TV and 500 for VCP).

(iii) Lack of well educated populace, skilled IT manpower and inadequacy of training facilities in the country are some of the most important factors limiting progress in the adoption of new technologies in the country.

(iv) Apprehension of the employees and labour union that they may face unemployment due to the introduction of computers.

(v) Lack of the Government commitment in respect of introduction of the Information Technology and its expansion within and outside the country is another major limiting factor.

PARTICIPATION INTERNATIONAL NIT PROGRAMMES

Bangladesh has already gained much through participation in the following Participation International NIT Programmes. We welcome very much to participate in such seminars/congress:

- GIIC (Global Information Infrastructure Commission);
- IIP (Inter Governmental Informatics Programme);
- RINSCA (Regional Informatics Networks for South and Central Asia).

Recommendations:

*1. **National Commitment**: Government commitment in the development of Information Technology should be considered as a prerequisite wherever necessary.*

*2. **Education and Training**: Provisions should be made for building up a well-educated populace.Provisions should be made for building up an efficient work, force including the operators, developers and users in general.Adequate training facilities be provided to ensure regular flow of skilled manpower and to equip them with the changing environment and new technologies.Provisions should be made for foreign training, study tours and attachment programmes in the relevant fields.*

*3. **Participation in International Seminars**: Government should take initiative to send their delegates to all the relevant international regional seminars/congress in order to exchange concepts and experiences.*

4.Development and patronisation of research work at national and international level is highly desired.

5. International cooperation for the development of Information Technology should be very much welcomed.

*6. **Infrastructure**: Adequate number of infrastructure facilities be provided with the national and international resources and cooperation.*

*7. **Financing:** Necessary financial assistance of the advanced countries, donor agencies, and well established computer companies will be very much welcomed and appreciated by the developing countries like Bangladesh.*

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NATIONAL REPORT OF BELARUS

INTRODUCTION

Today information is one of the most important strategic resources of a society's development. It caused the inflow of tidy investments in the creation of information systems and technologies. So, it became obvious, that the further society's development is widely determined by the level of its informing citizens in the field of their professional activity.

The acquiring of sovereignty by the Republic of Belarus and its economy transition to the market principles challenged the changing of the traditional principles of the society's organisation. This has touched the system of information supply of educational and scientific and research fields. In the conditions of the open economy, higher educational institutions, academic and branch institutions have to agree the level of their developments with the world standards. There has appeared the need for a new system of information services, based on the up-to-date means and new information technologies. This system should cover all the aspects of scientific and research activity and educational process and provide diverse information for consumers.

The former Soviet Union Republic of Byelorusssia was one of the leaders in the development and production of software and hardware, especially in the field of universal computers of the integrated system (ISC), personal computers, system and applied software. However, during the period of making the Belarus nationhood and its entering the new economic relationships after the USSR dissolution the situation had radically changed. Belarus sank in the wave of imported technique of various quality, there has emerged the regional producers of it. Our specialists skills and knowledge became useless.

However, regarding our experience in the field of information technologies introduction in different fields of activity, the advantageous geographical location of Belarus, high intellectual resources of education and scientific systems specialists, we can talk about the advantageous perspectives of information infrastructure creation and development in the field of education and in the Republic on the whole.

1. THE STRUCTURE OF THE NATIONAL EDUCATIONAL SYSTEM

The process of forming and development of the education system in the Belarus Republic is implemented according to the constitutional demands and guaranties in the field of education, providing equal opportunities for its acquiring, the integrity of the educational system and succession of all the educational stages.

The structure of the national educational system is based on the Constitution of the Belarus Republic, laws "About the education in the Belarus Republic", "About languages", "About national and cultural minorities", "About child's rights" and other normative documents, adopted during the recent years and regulating its activity. The structure is based on the principle of continuos education and training, including the following documents: pre-school education; general education; vocational education; family education; self-education.

According to Article 14 of the law "About the education in the Belarus Republic", all national and non-governmental educational institutions, situated on the territory of the Republic, belong to the national system of education of the Belarus Republic, which includes:

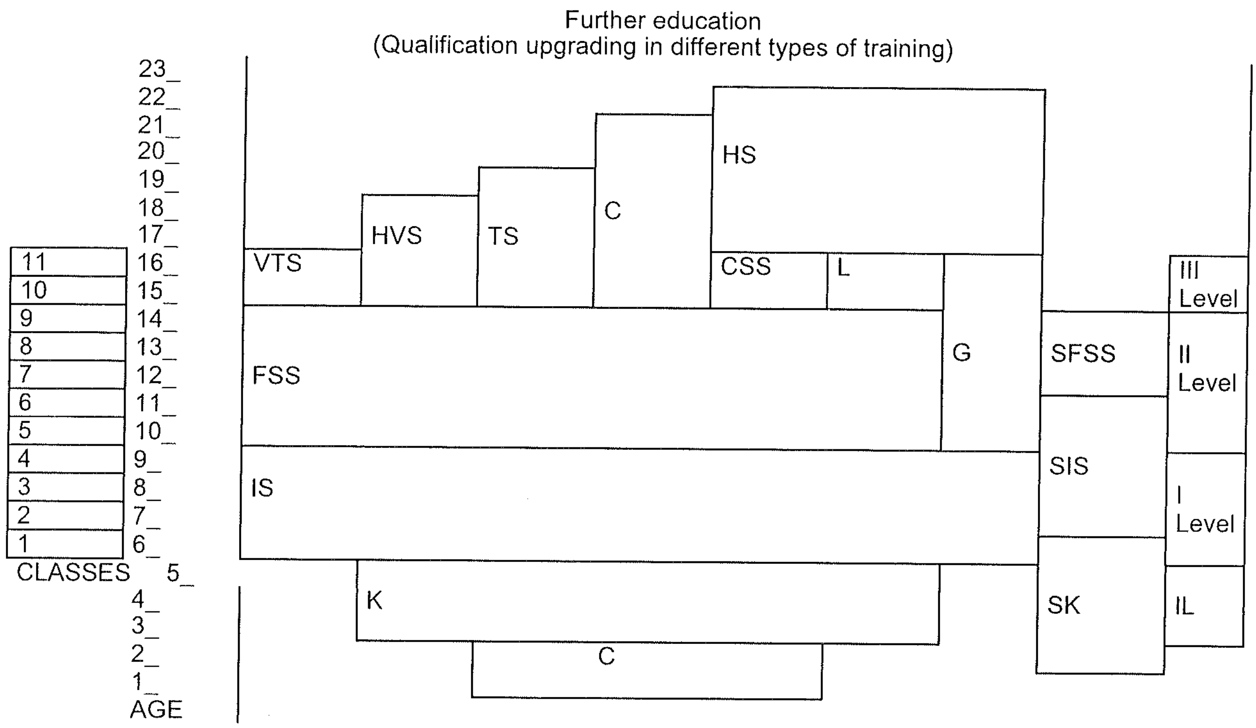
1) pre-school education;
2)general secondary education;
3) extra-mural forms of education;
4) vocational and technical education;
5) special secondary education;
6) higher education;
7) scientific and scientifically pedagogical training;
8) personnel qualification improvement and in-service training;
9) public self-education.

The educational system of the Belarus Republic includes various types of educational and educative institutions: children's pre-school (kindergartens, creches) and out-of-school institutions; general educational (fundamental and secondary schools, gymnasiums, lyceums); special institutions and boarding schools (children's homes, boarding schools, reformatories for minor delinquents, etc.); professional and technical schools and higher professional and technical colleges; secondary special (schools, technical schools, colleges) and higher educational institutions (specialised higher educational institutions, universities and academies); scientific and research institutes and institutes for personnel qualification upgrading and in-service training; the bodies of the educational system management (Ministry of education, the educational administration and departments of the Executive Committees of the Regional Soviets and submitting educational and methodological organisations.

The continuous nature of the educational system, its structure, stages of teaching and types of the educational institutions are demonstrated of the Scheme 1:

Scheme 1

Structure of education in the Belarus Republic



- IL - Initial Level;
- C -Creche;
- K - Kindergarten;
- SK - Special Kindergarten;
- IS - Initial School;
- SIS - Special Initial School;
- FSS - Fundamental Secondary School;
- SFSS - Special Fundamental Secondary School;
- G - Gymnasium;
- VTS - Vocational and Technical School;
- HVS - Higher Vocational School;
- TS - Technical School;
- C - College;
- CSS - Complete Secondary School:
- L - Lyceum;
- HS - Higher School (Universities, Academies, Special Higher Educational Institutions)

THE SYSTEM OF HIGHER EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the System of higher education in the Belarus Republic consisted of 39 state higher educational institutions (HEI), Management Academe under the President of the Belarus Republic and 20 non-governmental HEI:

The number of students

	The number of HEI	The number of their students
State HEI	40	174 189
Non-state HEI	20	23 192
Total	60	197 381

Academical staff:

Staff, total	15 153
including females	6 252
including doctors of science	843
including females	101
candidates of science	7 104
including females	2 312

THE SYSTEM OF SPECIAL SECONDARY EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the system of special secondary education in the Belarus Republic consisted of 146 state special educational institutions (SSEI), including 77 technical schools, 18 colleges and 51 schools. Besides, there are 3 non-governmental SSEI.

The number of students:

	The number of SSEI	The number of students
Govrnmental SSEI	146	121 560
Non-governmental SSEI	3	812
Total	149	122 372

SSEI staff:

Staff, total	10 838
Teachers on the staff	8 414
including females	5 768

THE SYSTEM OF SECONDARY EDUCATION IN THE BELARUS REPUBLIC

At the beginning of the 1995/96 school year the system of secondary education in the Belarus Republic consisted of 4808 schools of general education, 98 special schools and boarding schools for the children with mental or physical deficiency, 25 sanatorium boarding schools, 82 evening schools and 242 professional and technical schools, subordinate to the Ministry of Education and Science. Besides, there're 15 schools and 10 vocational and technical colleges, subordinate to other Ministries and institutions.

	The number of educational institutions	The number of their students	The number of teachers
Day-time schools	4808	1 538 068	126 489
Evening schools	82	20 911	788
Special schools	98	20 095	2 666
Vocational and technical schools	252	130 083	14 064

According to the acting law, the control after the education in the Belarus Republic is realised by the body of state administration (legislation - Supreme Soviet (the Parliament) of the Republic, laws execution - the Cabinet of Ministers) as well as the regional control administration.

The Ministry of Science and Education of the Belarus Republic has the control over the submitting higher and secondary special educational institutions, scientific and educational and methodological organisation, institutes of qualification upgrading, republican departments and organisations. It carries out the general organisational and methodological control after the activity of the educational departments and administrations of the regional Executive Soviets of People's Deputies, which are in charge of children's pre-school and out-of-school institutions, schools of general education, vocational and technical and pedagogical schools and colleges.

At the begging of 1996 there were 4 576 pre-school and 3318 different out-of-school institutions in the Belarus Republic.

2. THE REFORM CONCEPT OF THE SECONDARY SCHOOL OF GENERAL EDUCATION

A) THE FOUNDATION FOR THE REFORMS IMPLEMENTATION

The analysis of the general education school development in the Belarus Republic and the experience of its reforming in the 50-80s revealed its main drawbacks:

- the general education school orientation on students preparing to enter a HEI, and not to breed the citizen, which is the traditional aim of general education schools and it result in:

- the considerable students' overload, especially in the second half of the 80-s (the students of the high grades have pending 40 hours per week, while within the previous years the mean norm was 30-32 hours), the absence of a fixed minimum, necessary for the life activity and compulsory for every student comprehension.

The significant increasing of student's load conditioned the decision to refuse the idea of the overall secondary education and to accept to the conceptions of compulsory nine-years education. However, graduating fundamental school (9-years) doesn't mean acquiring the complete course of education, therefore it can not be considered as the condition for socialisation, which is its main difference from 8-years course. In the 60s 8-years course executed the similar functions. Besides, the 15-years old graduate from the fundamental school is not prepared physically, physiologically, socially and morally neither for self-sufficient activity, nor for making important decisions.

In the conditions of reforming the entire society on the whole, it turns out, that out of the educational institution graduate doesn't meet any support of his or her right to work and social defence.

However, the necessity to conduct the reform of general educational school is related not only with the sharp acceleration of the society's development, which consequent is the need for constant improvement of the general educational training and its corresponding with the world standards. The roots of the suggested reform are laying much more deeper. The home school can satisfy the demands of the new child only with the condition of solving the problems, preventing the development of the system of secondary education.

First of all, it is the necessity to overcame the internal contradictions, proper to Soviet school of general education.

Second, there is the necessity to bring to the logical end the Soviet school reform, carried out during the recent years.

The complex solution of the pointed problems provides the conditions for the individual's self-realisation, for the development of his or her creative abilities, for the increasing the level and the quality of training, for the transition to a new content and modern technologies of education.

B) THE MAIN FEATURES OF EDUCATIONAL INSTITUTIONS

According to the developing Conception, the national system of education in the Belarus Republic will consist of the following issues:

Fundamental (basic) school education

Kindergarten (age - 3-6 years)

the aim of it is to develop the inborn child's abilities with due regard of his individual and age features through his or her involving into the simplest spheres of social life. Usually, attending kindergarten at the age of six is compulsory.

Initial school (1-4 forms, age 6-10 years)

it is oriented at the further development of child's physical, intellectual and moral abilities, his or her studding the integrated educational programmes of literacy basis, necessary for learning the sciences' and arts' bases, during the period of his education in fundamental (basic) school. Teaching the program of the first form may be held either in kindergarten, or at school.

Fundamental (basic) secondary school (5-10 forms, age - 10-16 years)

it is oriented at children's preparing for their life activity (and not for entering the HEI) and for their acquiring the logically complete fundamental secondary education, which allows them to make their own decision of the way of the further educational, social, moral and vocational becoming. The basic secondary education provides thorough knowledge and humanitarian set of education, the necessary applied level of knowledge and skills, creative development of intellectual, physical and moral forces, which condition individual's development.

The implementation of the objective is realised through student's digestion of the basic component of secondary education. In 7-8 forms there is an opportunity to introduce different levels of training (specialised studding certain subjects). Education in 9-10 forms comprises profile training (natural sciences, humanitarians, polytechnics profile, arts and sports).

The successful finishing the 10th form and passing the state certification give a right for obtaining the school-leaving certificate and for continuing free education on the competition basis in a vocational and technical college, or in a SSEI, or in a lyceum.

Pre-HEI training

Vocational and technical colleges (initial vocational school)

- provides an opportunity to acquire a qualification, necessary for a certain professional activity, or in case of extension the period of education to 2-3 years students can take the courses of additional training of general education, preparing them to enter an HEI.

Colleges, technical schools (special secondary school)

- during the period of 3-4 years they provide the opportunity of acquiring a medium-level qualification, as well as the right to enter an HEI.

Lyceums, lyceum classes

- during the period of 2 years they provide general educational training, aimed at the further entering HEIs or technical schools and colleges.

There are supposed to be five types of lyceums: of general education, humanitarian, of natural sciences, aesthetic, polytechnics.

The successful finishing lyceum education provides an opportunity to obtain the document, giving a right to enter an HEI (college, technical school).

Higher vocational school (higher colleges, institutes, academies, universities)

- they organise training, different in content, forms and periods of education and provide specialists training in three levels: Bachelor, Diplomaed specialist, Master.

C) THE STAGES OF THE REFORM IMPLEMENTATION

1st stage: years 1996-1997 - the elaboration of the Conception and adoption of the National Programme of Reforming the Educational System; working out the scientific and methodological and normative and legal bases for the reform; definition of the content of education, development of the new curriculum and syllabuses.

2nd stage: years 1997-1999 - the carrying out of scientific and pedagogical examination of the new syllabuses and curriculum; organisation of experimental grounds for their testing.

3rd stage: years 1998-1999 - the introduction of a new curriculum in the 1st and the 5th forms of secondary schools of general educational in a few regions and cities.

4th stage: years 1998-2005 - the development and introduction of the new textbooks, teachers' pre- and in-service training.

5th stage: years 1999-2001 - gradual introduction of a new curriculum of the 1st and 5th forms of secondary school of general education. Its implementation depends on certain features and the level of fitness of concrete educational institutions and regions.

6th stage: years 1998-2005 - the creation of a updated network of educational institutions: vocational colleges, technical schools, lyceums.

7th stage: years 1998-2005 - the reform of higher education in the Republic, the introduction of the new content of education in HEI.

3. BASIC TRENDS IN INFORMATION TECHNOLOGIES INTRODUCTION

The basic trends of information technologies introduction into the educational system of Belarus are the following:

- using computer as a tool for teaching and the resource of information;
- using computer in managing the educational and scientific systems;
- the development of the means of communication in order to provide an access to the world information resources.

There is a number of groups of specialists and single developers, who are busy with scientific development in the field of information technologies implementation in education in Belarus. Their work is oriented at the creation of tool systems for the preparing educating and controlling systems, their complete software, modelling systems, educative games, etc. It's worth to mention, that most widely there are developed the software on natural sciences (physics, radio electronics) and foreign languages courses. Under the Ministry of Education there is a fund of software. The basic aim of the fund is to carry out the examination of the developments in the field of information technologies and their introduction in educational process.

4. INFORMATION TECHNOLOGIES IN THE SYSTEM OF SECONDARY EDUCATION

The creation of the national system of teaching the basis of information technologies application started in 1985, in the framework of the federal programme. First of all it was based on the introduction of the new subject "The bases of informatics and computers" in the existed curriculum.

The lack of the school teachers of the new subject caused the involvement of the teachers with the different level of informatics knowledge, various fundamental education and working experience. Within the period of two years (1985 - 1986) on the base of universities and pedagogical institutes there was organised the mass pre- and in-service training. In 1985 pedagogical institutes started to train teachers of informatics.

During the first six years the school subject of informatics developed in the republics of the former USSR in common directions and by the common programmes. The school course of informatics pursued the following objectives:

- the forming of student's notions about computer information technologies and their role in society's development;
- providing students with the simplest skills of using computer information technologies.

The achievement of the educational aims in the course *The bases of informatics and computers* was stipulated by learning the programming languages and their application in the solution of computing problems. The passed years witnessed the considerable progress, made in providing students with the skills of programming, and as the result was the successful participation of the Belarus students in the different Olympiads on informatics.

The development of computer hardware and software revealed the necessity of changing the content and the structure of informatics teaching at school.

The analysis of the teaching experience of the course *The bases of informatics and computers*, of computer hardware and software resources, of society's needs revealed in its turn the necessity of the division the process of students digestion the basis of computer literacy at school:

1. VIII -IX forms - the basic course, providing the minimum of student's general educational skills and knowledge.
2. X-XI forms - the specialised students training in informatics, different in its volume and content, depending on student's interests and school

resources.

In order to innovate the content of the course, in 1993-1994 there was developed and introduced the programme of the new basic course, called *Informatics.* The objectives of the new course ware almost the same, but the means of their achievement had radically changed. The content basis of the course consisted not of the programming languages, but of the universal programmes for information processing: text processing, computer graphics, DBMS, spreadsheets, etc.

The programme strengthened a general educational aspect of subject. The basic notions of the course are *computer, information, data processing, algorithm, model.* In 1994-1995 there ware published new textbooks for the course. Now, the specialists are working out the complete methodological set.

In 1995 there were developed the programmes of the specialised courses on informatics for the students of the 9th-10th forms with the extended training in informatics, in mathematics, physics and economy. There was started the preparation for the work with these programmes.

Nowadays, those who are involved in the process of secondary information technologies introduction in education, are solving the following problems:

- the equipment of the fundamental schools of general education (nine years schools) with computer hardware (today, the level of school equipment makes up only 6 % of the demanding level);
- teachers training for fundamental schools;
- the equipment of the specialised schools with up-to-date computer hardware and software;

At present, the situation with information technologies application in the educational system is determined by the three following factors:

- hardware;
- software;
- a professional level of the specialists in information technologies application in the field of education.

Nowadays, computers are used at school to form the basis of informational culture, to form students' skills of the practical work with computer and applied software. 84 % of the available computers allow to realise a basic course of informatics in practice. However, we should obviously take into consideration the fact that computers are more and more often applied as an educational tool in the process of learning the general educational and specialised subjects. And in this context, the capacity of the today available computers, installed in a mass school, is not sufficient. In this connection, educational institutions and organisations are oriented at the application of the IBM-compatible computers.

5. INFORMATION TECHNOLOGIES APPLICATION IN HIGHER SCHOOL

Higher school hardware is based on IBM-compatible computers. The modern multimedia computers are still rare nowadays. However, the software meets the level of the latest world developments.

The mass character of any technical innovation introduction in education depends on the evaluation of its three parameters:

- application effectiveness (reduction of time for studding, increasing of the efficiency of education, the reduction of irrational student's mental work activity);
- convenience of application (the reduction of student's work volume, the low level of special background, the innovation reliability in the educational process, correspondence with the aims of education);
- availability (the availability of purchasing and servicing).

In the present conditions the mass character of information technologies introduction in the system of education of the Republic first of all is restrained by the low level of availability, related to the present financial support of the educational system. The lack of the technical support stipulated the poverty of the other parameters (effectiveness and convenience), though it is also connected with psychological aspects: teachers are not ready to use information technologies.

The perspectives of information technologies application in the Republican system of education are first of all related to the increasing of the financial support of this process, to the propaganda of information technologies through the distribution of the information about the latest developments in this field, to the intra-Republican co-ordination of the home developments and international co-operation, to the organisation of teachers in-service training.

In 1995 the quarter scientific and methodological magazine *Information Technologies introduction in Education* started to issue in order to propagate the progress, made in the field of information technologies in the Republican system of education and science.

The number of educational institutions and organisations are involved in the experiments on information technologies introduction in educational process, scientific researches, the management system of education. The specialists of the Belarus State University (BSU) are now intensively working on the creation of an automated control system (ACS) of an HEI on the base of local and remote networks of personal computers. At present there is a computer network, functioning in BSU, which links

40 users and a network training classroom. Within this network the following subsystems of BSU ACS are exploited: *Matriculant, Students, Stipend, Staff, Salary, Fixed Assets , Control over the execution of the orders and directions,* etc. Data bases on servers contain information about every student of the university (including all marks, got during the period of education), teachers and academical staff, fixed assets, which are on the balance of BSU, etc. The subsystems *Matriculant - Students - Stipend* provide the non-paper technology of data processing about the students of the university since the moment of their entering BSU. The working stations are installed in every Dean's and in the Rector's offices. They are used for data processing and updating. The participants of the international workshop *Higher Education in Belarus: international co-operation and development,* held in Minsk in March 1995, where met the representatives of the leading HEI of the republic, pointed out that BSU ACS doesn't have any analogy in the Republic in the complicity of data bases and in the width of covering such an number of different aspects of a university's activity.

BSU consider the introduction of information technologies in librarian system to be one of the most significant directions in the modern computer technologies introduction. It is the field, where BSU has the long and active co-operation with the Moscow State University (MSU). At present the data bases of the library catalogues of MSU and BSU are functioning in the BSU computer network. This fact gains the special meaning in the conditions, when acquiring information and literature, issued in Russia was obstructed because of some reasons, generally of the financial character. Besides, the users of the university network have the access to the data base of the French Institute of Scientific and Technical Information (INIST), which contains the information on more than 4500 periodicals from all over the world. This data base was obtained by the university in the framework of the project, realised within the programme TEMPUS in co-operation with the Joule Vern Picardy University (France).

The University considers that the strategy of information technologies introduction in HEI on the modern stage should be departamental local networks integration into an integral information network, providing its users access to Internet, as well as their access to the bibliographic data bases of the university and other educational institutions. That is the aim of the developing project of the such a network creation on the base of the optical fibre communication lines, permitting to link separate departments of the university.

6. INFORMATION TECHNOLOGIES IN THE SYSTEM OF EDUCATION MANAGEMENT

In 1992 began the implementation of the project of information technologies introduction in the system of education management in the system of the Ministry of Education and Science of the Belarus Republic. This project is realised according to the Resolution of the Collegium of the Ministry of Education of 30 September, 1992, ? 10-n. The head organisation of the project implementation was fixed the Computing and Analytical Centre of the Ministry of Education and Science - the head organisation of the branch in charge of problems of the development and introduction of information technologies in the educational process, scientific researches and control system. The main results of its activity are the following: the development of the base project for the information technologies introduction in the education management system, as well as the development and installation of a local network in the Ministry machine. Now the following projects are realised: *Telecommunication, Documents turnover, Finances control, Statistics.*

The result of the carried out activity was the acquiring and systematisation of the information on the structure of education management system in the Belarus Republic. This information includes organisational structure, information flows, the functional model of the educational system. There was elaborated the programme set called *Document turnover.* the complex was created for the automation of the works, related to controlling document turnover, including document registration, the searching for a document, the route of transportation, control after execution, access control.

The result of the carried out activity in the framework of the project *Statistics* was the development of the complex software for the automation of processing data on the state statistic accounting, acquired from the regional educational departments and submitting educational institutions and organisations. It allowed to increase the efficiency of acquired data processing and of the taken management decisions.

7. COMMUNICATION TECHNOLOGIES DEVELOPMENT IN THE EDUCATIONAL SYSTEM OF THE BELARUS REPUBLIC

Computer telecommunications are the natural continuation of integration trends in the development of informational systems. The combination of computer techniques and means of communication emerge the new computer function - they become a means permitting to widen the scope of the information space of a given organisation, to expand the opportunities of the information interaction up to the scope of a city, region, republic and, finally, to provide entering the world information space.

In this case a personal computer user finds himself involved into a powerful telecommunication infrastructure, he or she becomes an element of a global computer network. The networks of this kind link, through the up-to-date means of communication (individual and switched telephone lines, telegraph network, radio, satellite communication, etc.), tens and hundreds of users, information resources, centres of data processing, separated from each other by thousands of kilometres. The global networks are covering schools and governmental establishments, public organisations and research centres, commercial companies and universities, etc.

The global networks are covering almost every country in the world, every sphere of one's activity. They don't have any boundaries and any censorship. Most of the networks are connected between themselves creating a global integral information space. The subscribers of a global computer network gains access to the world market of information services. The modern information market can be conditionally divided into several correlative areas.

1. INFORMATION.

Here, different types of information are represented. The sector of scientific and technical and special information comprises: bibliographic and reference information in every field of fundamental and applied sciences, education, culture and other fields of human activity; access to the originals through libraries and specialised services; provision of the opportunity to acquire text data, full size copies, micro-movies and origins, using inter-librarian subscriptions; professional information and special data for teachers, physicians, engineers, etc.

The sector of consumer's information comprises news and mass media information, references, encyclopaedias, mass character and entertaining information, oriented at home consumption instead of business one: regional news, weather forecast , transport time-tables, etc.

2. ELECTRONIC COMMUNICATIONS

The two systems of human interaction - individual and business - should be marked out on the market of electronic communications. First of all it is e-mail, providing quick transmitting and receiving different types of data (text and graphic information, software, data base fragments, etc.). It gives an opportunity to automate almost every operation of processing individual and business correspondence. E-mail laid down the foundations for the so-called teleconferences: mutual exchange of topical information between users - teleconference participants. The means of electronic communication permit to issue electronic newspapers and journals, to organise electronic advertisement desks and bulletins, clearing houses for publicly accessible software, etc.

The structures of all computer networks are similar and represent a system, formed by terminals, units and communicational environment (channels and communication lines). Network structure is implemented with regard of the discipline of connections and topology (geometrical structure).

The computers of national and international units, interacted into one network, offer their users the following services:

- access to remote data bases, programme libraries and applied processes;
- collective usage of the computing resources of network unit computers;
- massages exchange in the interactive regime;
- e-mail services.

At present, a lot of global networks and informational centres are functioning on the Belarus territory. They have different organisation and technique. The most significant among them are:

BelPAK - The state network for data transmission. It has the national status. It is based on the application of the protocol X.25. This network, as the other analogical national networks for data transmission in other countries, offers a powerful technical foundation and a wide range of universal services.

EUnet/Relcom - A commercial international network, offering the services of e-mail, teleconferences, access to Internet, Usenet, etc.

GlasNet - A public non-commercial international network, offering, first of all, e-mail services.

Sovarm Teleport - A powerful commercial network, offering rather expensive services of access to Internet and other networks, which are kept in with protocol X.25.

CITEC - A commercial information system. In fact, it represents the enhanced electronic advertisement desk BBS.

BASNET - The network of the Belarus Academy of Science. Besides servicing the Academy's organisations and institutes, it offers the services of e-mail and access to international networks.

At present, the mentioned networks do not offer the full size direct exit to global networks of Internet. This exit is realised ether through e-mail, which doesn't provide an opportunity to use the on-line regime in the work with information systems, or through protocol X.25, which emerges some technical problems, reduces throughput and increases the price.

One of the most developed computer networks of the Belarus Republic is the non-commercial network UNIBEL. It integrates the leading educational and scientific organisations of the Republic, offers the wide range of correspondingly cheap services. The main aim of UNIBEL is to provide access to the global community of Internet networks for the organisations of social sphere on the non-commercial base.

UNIBE network is a part of common scientific and research computer network (SRCN) of the Belarus Republic. The general system principles of it are the following:

1. SRCN should represent a complex of information and computing networks of the establishments, institutes and organisations, working in the field of education, science and culture. The complex should be based on the abidance of the common system of protocols and rules. The rules and protocols should be based in their turn on the world standards and should define the order of information creation, processing, storing and transmitting, as well as the order of using computing resources.
2. SRCN should be created on the base of supporting networks of different ministries and institutions of the Belarus Republic, on the preferential conditions for the budget organisation of communication channels.
3. SRCN should be organised on the condition of the maximum application of resources of the existing institutional networks.
4. There should be provided co-ordination of the projects, aimed at the creation of local systems and means of data transmission. These projects are the part of the national programme of information technologies introduction in the Republic.
5. In order to acquire access to international computer networks, and consequently to the information of different data bases, there is a necessity to strengthen the co-operation with such well-known organisations, as Executive Secretariat of CIS (Minsk), DFN (Germany), NASK (Poland), NORDUnet (Norway), SSC (Sweden), OSI (USA).

The creation of UNIBEL network pursues the following objectives:

- the overcoming the disconnection between universities, institutes, scientific centres, laboratories, groups of researchers and separate scientists, teachers and students. To provide them with the opportunity of free informational exchange;
- the solution of the problems related to the dissemination of new ideas, scientific results and publications in the field of education;
- the following general technical policy in the field of information technologies introduction in the educational system of the republic. It will allow to increase the efficiency of using the resource of an educational institution and of the concrete worker of education and science. It will provide the opportunity to use efficiently the national informational resources of the Republic;
- dissemination of information technologies; education and popularisation of computer telecommunications in the field of education.

The further stage in the development of the UNIBEL network is supposed to provide the full access to the services of the Belarus national network of data transmission BelPAK and of the other networks, created on the application of the protocol X.25. It is expected to provide the access to the complete set of the services of the protocols X.400 and X.500 and the other ones and of the standards of the pattern model of open system interconnection (OSI).

The development of the UNIBEL network is implemented in the following directions:

- the closer co-operation with the network of the administrative control system after the educational system of the Republic; the creation of an integral republic network on their base;
- promoting long term information programmes, first of all on the base of attaching to the network the largest libraries, archives, centres of scientific and technical information and the expert service of the Republic;
- the development of the connections and realisation of mutual programmes with scientific and research organisations (branch and academical);
- gradual attaching to the network the system of secondary special education and secondary schools, non-state educational institutions;
- attaching (the direct and through BelPAK) governmental and public organisations, funds, etc.;
- the organisation on the base of the central unit of the Centre for specialists training and an inter-HEI research laboratory of network technologies.

Today, the number of foreign organisations and funds are promoting the creation and the development of the educational and scientific network of the Republic. The Institute of the Open Society (USA) gave Belarus a grant for the creation of an optical fibre ring around Minsk - MINSK INTERNET PROJECT. The implementation of this project provides our educational institutions and scientific organisations with the full access to the global computer network Internet.

There was gained a grant from UNESCO for the attachment to the computer network of the educational departments of the Regional Executive Committees of the Belarus republic. Our activity was promoted by NATO Scientific Committee of the informational filling of the creating network.

The creation of a real information infrastructure has only started in the Belarus Republic. However, people realise that, that information is an extremely valuable and perspective commodity, and the information market is one of the most dynamic and roomy. Nowadays, many governmental, commercial, scientific and public organisations are promoting their activity in the field of computer communications and information technologies on the whole.

Regarding the considerable scientific and technical, educational and industrial resource of the republic, Belarus has real chances for the soon entering the world information space and becoming the competent member of the world community of global computer networks of Internet. In order to achieve the objectives, Belarus should increase the efficiency of the educational process through the wide application of information technologies.

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NATIONAL REPORT OF BOTSWANA

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES: THE CASE OF BOTSWANA

1. INTRODUCTION

Computers are becoming more and more common in all aspects of life. They are simply tools that help to be more productive. More and more jobs require applicants to be familiar with computers. As this new technology of computers has become so pervasive and thus more prevalent in everyday life and in the workplace, use of computer has gained in importance over the computer itself. Botswana like other countries has recognised the need to increas the technological background of its people to complete better in world markets. The new Education Policy is based on the general goals as stated in the Revised National Policy, which are to prepare Botswana for the transition from a traditional Anglo-based economy to the industrial economy to which the country aspires. The industrial worldwide economy is driven by Information Technology, which uses computer technology to process, analyze and communicate information in an increasingly efficient and effective way. Thus the contemporary society must be computer aware and likewise and workforce to make the best use of Information Technology. Computer technology, when used in education, encourages the development of problem solving, analytical and research skills. The revised National Policy on Education of 1994 has therefore made a call for the inclusion of a computer awareness programme as a requirement in all Community Junior Secondary Schools.

Botswana tertiary institutions are also commited to the provision of computer awareness courses for their students.

The introduction of the programme within the basic Education Structure ensures a basic level of computer competence for most, and in the long run, all young people throughout Botswana. Tomorrow's world of information Technology is one where information handing skills will be needed to improve the standarts of learning and living. The world is becoming connected electronically by the Internet world wide network through which we can all share information. The computer Awareness programme aims to incorparate section on Telecommunication later, when the time is ripe to enable young Botswana to use this giant network to communicate with the rest of the world.

2. REVISED NATIONAL POLICY ON EDUCATION

The development of the Computer Awareness Programme for the Junior Community Secondary Schoools was prompted by the recommendations made by the Revised National Policy on Education og1994. The process of the syllabus development was started with a consultancy which looked into the logics to be considered in the development and implementation of the programme. The consultancy consulted widely and reached out to a variety of stakeholders.

This is a new programme which is designed to inroduce pupils to the use of computers as tools which help to increase productivity by automating a lot of tasks undertaking in the world of work. Unlike a typewriter document, the computer generated document can be corrected without having it retyped, and this increases productivity. The intent of the programme is not to produce computer experts out of the students, but to give them computer literate. The programme will give them the basic skills to enable them to pursue computers studies without being intimidated by the computer.

The computer awareness programme is not a stand alone programme, but has to be infused into the other subjects in the school curriculum. It should be divided into global topics or modules as follows.

Computer skills

Productivity tools:

- word processing spread sheets
- databases
- graphics will have to be taught prior to the use of productivity tools.

The basic skills i. e. computer skills and keyboarding skills have to be created in order to accommodate this part of the Computer Awareness programme. The productivity tools will then be taught and used within other subject areas. These cannot be taught during specified times but they are best learned through practice over a period of time. The aims of the Nine Year Basic Education Programme are commited to the integration of computer skills as exemplified in the part that follows.

3. AIMS OF THE TEN-YEAR BASIC EDUCATION PROGRAMME

On completion of the Ten-year Basic Education Programme students should have:

1. *Developed compentency and confidence in the application of computational skills in order to solve day- to-day problems.

2. Developed an understanding of business,

everyday commercial transactons, and entrepreneurial skills.

3.Developed critical thinking, problem-solving ability, individual initiative, interpersonal and inquiry skills.

4. Developed desirable attitudes towards different types of work and the ability to assess personal achievement and capabilities realistically in pursuit of appropriate career/employment opportunities/possibilities and or further education.

5. Acquired knowledge, skills and attitudes in food production and industrial arts for self-reliance and self sufficiency.

6. *Developed awareness, and or literacy and understanding of the signififcance of computers in the world of work.

7. Acquired knowledge and understanding of their environment and the need for sustaining utilisation of natural resources.

8. Developed desirable attitudes/behavioral patterns in interacting with the environment in a manner that is protective, preserving and nurturing.

9. Acquired knowledge and understanding of society, appreciation of their culture including languages, traditions, songs, ceremonies, customs, social norms and a sense of citizenship.

10. Developed the ability to express themselves clearly in English, in Setswana and a third language both orally and in writting, using them as a tool for further learning and employment.

11. Acquired the basic science knowledge and knowledge of the laws governing the natural world;

12. Acquired a good knowledge, practice of moral standards and helth practices that will prepare them for responsible family and comunity life.

13. Developed their own special interest, talants and skills whether these be dexterity, phisical strength, intellectual ability, and/or artistic gifts.

14. *Acquired and appreciation of technology and technological skills including basic skills in handling tools and materials.

15. Gained the necessary knowledge and ability to interact with and learn about their community, the government of their country and the world around them.

*Note: The asterisks show the items associated with computer awareness.

4. OTHER RECENT DEVELOPMENTS

Recently a Task Force has been appointed whose main aim is to develop the syllabus that is to be used for computer awareness programme. The Macintosh Computer has been identified as the most appropriate computer to be used for the awareness programme. Four zones were established to provide maintenance as shown in Figure 4.1.

Table 4. 1

Established Zones for the Provision of Maintenance

Zone	Areas	Response Time
One	Gaborone and around	4 hours
Two	Lobatse, Molepolole	12 hours
Three	Mahalapye	24 hours
Four	Maun, Kasane, etc.	Bring in

To keep pace with the Information Technology explosion, the University of Botswana has developed awareness courses so as to provide its students with the required skills. The Faculties of Social Science and Humanities offer compulsory computer awareness courses to all their students.The Faculty of Education and Teacher Training institution likewise, are considering to fall in the same footing with the other Faculties of the University in providing their students with computer awareness courses. All these developments regarding the provision of computer awareness as both the secondary and tertiary levels is gradually gaining support from the Government of Botswana as indicated by recent policies.

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NATIONAL REPORT OF BULGARIA

I. CURRENT STATE OF TEACHING INFORMATICS AT SCHOOL

In 1981 the production of 8-bit Apple compatible personal computers was given a start. At the end of 1984 the Government took a priority decision to create conditions for training the youth in working with computer-based equipment. Following the State policy a new compulsory subject - Informatics - was introduced in the upper grades of the high school, vocational schools and high technical schools since the school year 1986/87.

Those three factors reflected the urgent social needs and speeded up the process of immersion of computers and information technologies in the Bulgarian Educational System. Although, these were necessary, they were not sufficient conditions for running the hardly-known and specific in kind Training in Informatics. Normal and effective realization of the educational processes leading to acquiring and using the computer and the information technologies in the social practice requires the presence of a system of mutually related didactic factors. Until 1986 no didactic system that could be widely used in the Bulgarian schools, existed for teaching of Informatics.

Despite the lack of experience (both Bulgarian and foreign), the Ministry of Education introduced Informatics as a compulsory school subject from the school year 1986/87 within the following restrictive conditions:

1. Informatics was introduced as a general compulsory subject. It started from the second term in the 10th grade (second year of the vocational and high technical schools) with two hours per week (for the total of 34 hours) and continued in the 11th grade (third year of the vocational and high technical schools) again with a two hours a week. The total number of hours allocated for Informatics in the curriculum was 98.
2. Schools were equipped with at least ten 8-bit Apple compatible personal computers, while not all of them with peripherals (disk drives).
3. The programming language was BASIC, and the Operational System was DOS 3.3

With the available technical, software and methodical facilities existing by that time in schools, the three developed and implemented variants of subject contents were restricted to studying the following topics:

1. Introduction in Informatics.
2. Principal structure of the computer and the computer system.
3. Algorithms and ways of expressing them.
4. Introduction in programming.
5. Drawing geometric figures and shapes and animation.
6. Data. Type of data.
7. Data Structures
8. Basic informational activities and algorithms for inputting, outputting, actualizing, processing, finding and sorting.
9. Stages of problem solving by means of computers.
10. Utilization of the computer and the information technologies for problem solving through computers.

During the first stage (1986 - 1991), the introduction of the subject contents is related to the computers and the information technologies and was motivated, introduced and acquired mainly in the process of solving a suitably chosen (by the authors the actual text-books by that time) system of specific problems.

The existing conditions, the ideas of the authors and the chosen educational strategy led to a groundless domination of programming in teaching in Informatics during the first stage of its introduction in the Bulgarian school.

It is known that the study contents reflects the level and needs of the economical, social-political, cultural and scientific - technical level of society. The deep social and political changes and the economic crisis in Bulgaria in the beginning of the nineties, affected the educational system.

Though slowly, the attitude and the aspirations of society towards education were changed. A tendency is observed towards decline of society' interest in education, that are expressed in the following:

- reduction of the relative share of funds, allocated for education from the national budget
- lack of motivation and common attitude of the youth towards the general and vocational training.

In the conditions of an economic crisis the educational system is gradually being re-oriented and reset in accordance to the changes taking place in the society:

1. Symptoms of decentralization have appeared, expressed in the emergence of private schools.
2. Since 1992 a new curriculum has been adopted, according to which part of the study time (number of hours per week) is used in conformity with students' interests and the priorities of the specific school.

As far as organization is concerned, the variable part of training is accomplished in classes through:

- compulsory elective preparation;
- profile training;
- free-elective training.

In the comprehensive schools in the 9th and the 10th grades the subject "Technologies" is studied. The subject contents is specified locally in accordance to the profiled technological trends, chosen by the relevant school.

3. The Ministry of Education, Science and Technology promotes a tendency for decreasing the relative share and level of the theoretical component of subject contents in the comprehensive schools

and increasing of potential possibilities of the study contents for acquiring skills, abilities and methods of learning.

The new curriculum dramatically changed the approach of allocation and use of teaching hours in Bulgarian schools.

The following is regulated for each grade in the curriculum:

1. Compulsory subjects and their weekly horarium. The number of these subjects and study hours defines the General Compulsory Training (GCT) for the students from the specific grade.

2. The number of hours per week, used obligatory for expanded study of one or a couple of disciplines. These are the hours for "compulsory elective training" (CET). The number of hours per week for the GCT plus the number of hours for CET specify the compulsory study time per week.

3. The number of hours per week, that can be used for additional training range. These are the hours for "free-elective training" (FET). In order to carry out a FET, groups of students (occasionally from different classes) with similar interests should be formed. The FET is not compulsory by nature and is carried out when supplementary funding is available.

4. The number of study weeks.

5. Scheme of allocation and usage of the study hours in GCT, CET and FET.

The CET appears in the curriculum with 2 hours per week in the 9th grade. In the upper grades the hours for CET are gradually increased.

IMPLEMENTATION OF THE TRAINING IN INFORMATICS

The new curriculum and the tendencies for development of the secondary education, launched by the Ministry of Education, Science and Technology offer possibilities for a differentiated introducing of subject contents, related to computers, Informatics, and its implementation in the various forms of education, existing in the schools:

1. Non-profiled education in general secondary and high schools.

1.1. Informatics is part of the GCT. It is studied in the 11th and 12th grades with 2 hours per week. Practically though, training in the subject in the 12th grade is not common, as most general secondary schools do not offer 12th grade. Compulsory secondary education is completed in grade 11.

1.2. Part of the hours for CET can be used for training in Informatics. The number of hours and subject contents are specified locally for the school and the different groups in accordance to:

- equipment (hardware and software) in the computer classroom;
- teachers qualification;
- students' interests and potentials;
- orientation of the school.

1.3. In the frames of the GCT in the 9th and 10th grades the school subject "Technologies" is studied with the total horarium of 140 hours and under the following specific conditions:

- availability of at least seven 16-byte (or more powerful) personal computers;
- suitable software;
- qualified teachers;
- willingness of the students and the school authorities.

The study time defined for the subject could be used for acquiring some concrete information technologies knowledge in word processing, data base, spreadsheets, etc. at the relevant textual or graphical interface. Training is done on a modular principle, in study programmes approved by the Ministry of Education.

2. Profiled training in general comprehensive secondary and high schools

In the form of profiled training students choose (in 9th grade) and study (since 9th to 11th or 12th grade) extensively three school subjects, called the first, the second and the third profiling subjects. The name of the profile and its course are specified by the first profiling subject. In 9 - 11th (12th) grade hours for the CET are distributed according to a certain scheme between the three profiling subjects. Thus the number of hours for the GCT in the profiling subjects is increased and conditions for their extended and intensified study are provided.

When graduating high school, school-leaving examinations (matriculation) in two profiling subjects are taken.

2.1. Studying Informatics as a profiling subject

In this case training in Informatics and its implementation is carried out in:

- GCT in Technologies (Information Technologies) in 9th and 10th grades, in a total horarium of approximately 140 hours;
- the hours for profiled training in Informatics, that are formed from the GCT Informatics plus a part of the hours for CET in 11th and 12th grades.

2.2. Studying Informatics in a profiled training, when no profiled subject is chosen.

In this case Informatics is studied only in the frames of the GCT, with two hours per week in the 11th and 12th grades. Practically, training in the subject in 12th grade is not common, as most general secondary schools do not offer 12th grade. Compulsory secondary education is completed in grade 11.

3. Training in Informatics in vocational and high technical schools

3.1. The compulsory general-educational training in vocational and high technical schools does not include training in Informatics.

3.2. The vocational training in some types of high-technical schools includes training in Computer Science and/or Informatics and its implementation. For example:

- all students in high technical schools in economics and high technical schools in trading study the subject "Informatics and computers" for the total of 140 study hours. Some specialties in these schools - "Machine processing of information" and "Business and administration" study Informatics and computers extensively or in other school subjects;
- vocational training in high technical schools in electronics includes the following subjects - "Programming" (approximately 140 hours), "Microprocessor-based equipment" (approximately 120 hours) and "Software applications packages" (approximately 70 hours).

3.3. Part of the study hours (classes) for CET (compulsory elective training) in the vocational and the high-technical schools can be used for studying and acquiring computer hardware, Informatics and Information Technologies. Training takes place where there is hardware, software, a teacher and most important - willingness in the students.

Equipment

1. In the period 1986 - 1989 computer classrooms were set up in almost all secondary and high schools in Bulgaria. They were equipped with 8-byte Apple compatible personal computers, but not all of them had floppy-disk drives.

2. In the period 1988 - 1992 some schools changed their equipment entirely (through self-funding or centralized purchasing) with home-made personal computers "Pravetz 16" (IBM XT compatible).

3. In the recent years the Ministry of Education has allocated almost nothing for the modernization and upgrading of the computer equipment. Schools are supplied with computers through self-funding, following an initiative of their own. The restricted sums given at their disposal force the schools to buy mainly particular, usually second-hand units. That is why a significant part of the computer classrooms were equipped with hardware and software that is different in kind and type, which makes specification of study contents and the actual training with up-to-date tools and means quite difficult and rather frustrating.

4. During the last 2 - 3 years some Bulgarian schools were supplied with high-quality up-to-date software at preferential conditions or as donations from world-known software companies, the Open Society Fund, or through International Educational Programmes.

4.1. Twenty-five computer classrooms and one Centre for Teachers' Qualification are equipped with 7 - 8 Macintosh computers (mainly LC II and LC III models). They are using the Bulgarian version of System 7. Basic education is carried out with the integral package Claris Works.

4.2. In May 1994 started the fulfillment of the contract "Educational Initiative of IBM for Bulgaria", signed between the Ministry of Education, IBM and Open Society Fund. Under the patronage of that very contract IBM practically granted 240 personal computers to Bulgarian schools as follows:

- 28 pieces IBM/APTIVA/486/DX/66
- 196 work-stations IBM/APTIVA/486/SX/25

This equipment supplied 27 modern computer classrooms in schools and one Centre for Teachers' Qualification. Open Society Fund completed the equipment in the classrooms by multimedia accessories, laser jets, modems and last versions of software. The Fund, the schools and the Ministry of Education allocated funds for the special training of teachers, working on the initiative.

In conclusion, it can be pointed out that by the end of 1995 almost all secondary and high schools in Bulgaria had their computer classrooms. Unfortunately most of the hardware and the software is old-fashioned and worn out now. This can be seen from the approximate data given below:

- 70% of computers in the classrooms are 8-byte, Apple compatible, with, or without disk drives;
- 21% are IBM XT compatible;
- 4% are IBM AT 286 or compatible;
- 3% are IBM 386 and IBM 486 or compatible;
- 2% are Macintosh computers, mainly LC II and LC III models.

Subject Content

The subject content in Informatics is determined in each concrete school, class or group, according to the curriculum, the interests of the students (identified through the choice of compulsory electives or free electives), the equipment and software available and the expertise of the teachers in the school. The wide range of factors influencing teacher and student activities in the classroom call for variety in choosing the subject content. The concrete topics, their scope and depth, and the structuring of the subject content is done by the teacher on a modular basis. Teaching the different modules follows syllabuses designed and approved by the Ministry of Education, which act as broad frameworks.

1. Subject content within the core curriculum.

1.1. When the school has provided only 8 byte PCs (with or without floppy discs), the subject content in Informatics is being introduced in the process of solving appropriate sets of tasks (or problems) and generally covers the following themes:

- introduction in Informatics;
- algorithms, basic algorithm structures and ways of describing them;
- introduction in programming (Basic or versions of Logo in Bulgarian are explored);
- Database. Type of data. Symbols, logic and numeric types of data. Compound types of data - one-size bulk (Basic) or linear lists (Logo);
- Basic algorithms for input, output, accumulation, search and sorting information;
- Drawing out geometry figures. Moving simple geometry objects;
- Applications - DOS, electronic sheets or word processors.

The following software is in use in schools:

- File study system - a didactic tool for introducing and learning topics related to creating, editing and data processing saved on files;
- Programmme study environment in informatics - it is an adapted programming environment which imitates the basic opportunities available with MS DOS, study text editor and symbol editor.

1.2. When the school provides 7 16-bit PCs at least (or more powerful than this type), learning Informatics is organized in two stages:

- theory - within a school term;
- applications - word processing, electronic sheets, database, graphic design, etc.

Bulgarian versions of widespread and used software are used - Word, Lotus 1, 2, 3, DBase, etc.

2. When Informatics is among the subjects in the group for extended study, about 60% of the time (over 180 teaching hours) is set for compulsory study of the following topics:

1. Structure and basic elements of the

computer. Classifying. Historical ,information.
2. Arithmetical and logical basis of computers. Countable systems. Representation of information in computer memory.
3. Algorithms. Properties. Ways of describing. Programming languages.
4. Operational systems. mS DOS;
5. Algorithms and programmes (PASCAL).
5.1. Outlines of PASCAl.
5.2. Simple data types.
5.3. Basic algorithmic structures.
5.4. Compound data types.
5.4.1.Array. Basic algorithms.
5.4.2. Records. Basic algorithms.
5.5. Procedures and functions.
5.6. Recursion.
5.7. Problem solving with the aid of computers.
5.8. Files. File types. Basic operations. Algorithms for working with files.

About 40% of the teaching hours is devoted to introducing and learning the subject content, determined in the schools. The topics to choose from vary within:
1. Application of Informatics in mathematics - using the Plane Geometry System GEOMLAND.
2. Programme packages - word processing, electronic sheets, database, computer graphics, etc. under DOS and /or Windows.
3. Numeric methods. Close equation problem solving. Close functions.
4. Combinatory algorithms.
5. Dynamic data structures - lists, stacks, tails, dual trees. Basic algorithms. Applications.

II.COMPUTER SCIENCE IN THE SECONDARY SCHOOLS - TODAY!

1. INTRODUCTION

Whenever we treat and discuss the future of teaching Informatics in the secondary school, no doubt we have first to pose the problems and to report the results obtained in this field today. That is why our report is concentrated on those problems, approaches and methods used at present which will be applied to teaching Informatics in the secondary school in future as well.

The implementation of computer technologies in modern society is unthinkable without well educated people in this field and no doubt this sort of education should start in the secondary school. Some of the basic notions of computer science and computer applications are studied in Bulgarian secondary schools in the Informatics classes.

Those who study Informatics as a subject according to the curricula offered by the Ministry of Education, namely ({1,2}, {3,4}, {5,6}, {11,12}, {13,14}) are supposed at graduating from the secondary school to have acquired knowledge on:

- computer hardware, principles of computer operation and some computer applications;
- some types of software and the ways of using a certain operating system in order to write and execute simple programs and programming systems;
- the main methods of coding and representing data, some data types and data structures, the principal management structures. In addition, pupils are expected to be skilful in creating algorithms and programs for solving some unsophisticated problems.

2. USING MODULES AS A METHOD OF TEACHING INFORMATICS IN THE SECONDARY SCHOOL AND AN INTRODUCTION TO THEIR IMPLEMENTATION

The process of introducing Informatics as a school subject in secondary school in 1986/87 was accompanied by some problems which we could summarise as follows {15}:

- As a "new" subject, Informatics had to "be inserted" in the high school curriculum among the other, well established subjects, which naturally resulted in decreasing the number of classes in some of them. Some of the experts in the Ministry of Science and Education adopted a negative attitude towards the new subject which led to a multiple shifting of the place of the classes in Informatics in the curriculum from one grade to another and to a crucial decrease in their total number. That inevitably resulted in destabilising the attitude of most teachers, primarily mathematicians. The latter insisted on classical teaching of Mathematics pleading the new Textbooks and School Aids to be introduced in other school grades within another syllabus.

Also we cannot assume that "blurring " Informatics knowledge into Mathematics classes is a successful attempt. As an argument we can point out that not all Mathematics teachers have the qualification needed to teach Informatics as well and for this reason we could hardly expect any achievements in teaching Informatics in this way.

- The available computer technique (both in quantity and quality) does not prerequisite a general and unified Informatics teaching, even when the education is integrated. This impression could hardly be influenced substantially by the recent changes in equipping some schools with new computer classes. One of the possible ways to solve the problems caused by the great diversity in teachers' qualification, in the computer technique available as well as the very lack of computers in some schools, is to teach Informatics at two levels, namely:

- *first level* - all pupils graduating from the secondary school should acquire an obligatory minimum of Informatics knowledge;
- *second level* at which the knowledge acquired by the first one is upgraded by including additional knowledge which may vary in topics and in volume depending on the desired professional qualification of pupils and on the hardware and software available. The teaching materials supporting such an education could also be created according to the module principle. The idea of module approach is a prerequisite for differentiating Informatics teaching

with the obligatory minimum as its lowest boundary and with a free upper boundary which may vary according to the desires of pupils and the hardware and software available.

The changes of the syllabus for specialised and non-specialised education in the secondary school introduced recently have shown in practice how Informatics might be taught in different ways.

The textbook "Informatics II" {6} is an attempt to illustrate the real implementation of this idea; it comprises some modules {7}, {8}, {9}, etc. oriented to practice. Next follow the basic parameters of three of them. The modules given are TEXTPROCESSING, SPREADSHEETS and DATABASES and they comprise three modern, popular and simple (as far as the hardware required is concerned), programming systems, namely WORD, LOTUS 1-2-3 and dBase III+ in their Bulgarian versions. The modules are unified in structure and reveal both the basic and the specific facilities of the systems under consideration. Also some practical examples have been given so as to illustrate how these systems can be implemented for solving real problems. Each topic ends with a Topic Summary. Next follow the main topics of the modules:

Textprocessing

I. Introduction to Textprocessing Systems

1. Computer Texts
2. Starting with MText
3. MText Commands
4. First Computer Text and Text Writing and Correcting
5. First Steps to Formatting Texts
6. Text Printing

II. Specific Facilities of Textprocessing Systems

7. Screens, Windows and Operations with Them
8. Table Creating and Editing
9. Calculating Expressions; Text Sorting and Searching
10. Formatting through Masks

III. Implementation of Textprocessing Systems

11. Staff File of a Company
12. Mail Automation of a Company

Spreadsheets

I. 1. Introduction to Spreadsheets Management Systems

2. Starting with MPlan
3. Creating Spreadsheets
4. Editing Spreadsheets
5. Fields and Operations with them. Addressing
6. Additional Information about Calculations in MPlan

II. Some Specific Facilities of Spreadsheets

7. Displaying Spreadsheets Data
8. Business Graphics in MPlan
9. Databases and Spreadsheets
10. MPlan mosaic ... or Something else about MPlan main Commands

III. Implementation of Spreadsheets

11. One Hundred Levs Today is More Than One Hundred Levs Tomorrow
12. Each Loan is Paid Back with Interest

Databases

I. Introduction to Database Management Systems

1. Databases
2. Relational Systems
3. Starting with dBASE
4. Creating a Main File
5. Up-dating a Database
6. Using Restrictions at Processing a Database

II. Some Specific Facilities of DBMS (Database Management Systems)

7. Sorting and Indexing Files
8. Operations with Two Main Files
9. Introduction to Programming in dBASE
10. Management Structures in dBASE

III. Implementation of DBMS

11. A Card-Index of Addresses and Telephone Numbers
12. Stock Control of a Store for Building Materials

3. INFORMATICS AS A SCHOOL-LEAVING EXAMINATION SUBJECT

The problems mentioned above have already been solved and standardised for the cases when Informatics is studied as a chosen obligatory or specialised subject. The Ministry of Education approved a syllabus for that type of education in 1993 and in May 1994 a Textbook was approved by anonymous competition {10}.

Principal ideas observed when writing the textbook

The classes of Informatics envisaged are 216, distributed as follows:

- classes for new lessons about 70
- exercises in class about 40
- drills and practice in a computer classroom about 90
- tests about 5
- revision about 10

a) Structure of the textbook.

The textbook consists of Introduction, where some historical notes are given, four Sections and a concluding part. Each Section covers several topics comprising one or more lessons. Wherever possible lessons begin with some examples or problems. Thus an introduction to the root of each topic is made. The basic headings of each topic are:

- autotests;
- questions and answers;
- topic summary

The autotests comprise one or more problems enabling students to test what they have learnt by themselves. Thus some additional problems whose solutions are given at the end of each topic are added to the lessons.

b) Why PASCAL is chosen as a programming language in the textbook?

PASCAL is a universal programming language. The first idea of its author, Professor N. Wirt, has been to use this language as an educational one. The passed twenty years have shown that he was right. During that period PASCAL has proved not only to be the most taught programming language but also the one most often used in different programming systems. Probably this is due to the fact that it is:

- a programming language with a wide scope of problems which can be solved through it;

- a structural programming language;
- a module programming language;
- a standardised programming language ;
- a language supplied with relevant media for programming on almost all models of large computers, mini- and microcomputers.

c) Didactic features of the textbook.

The main guiding principles at creating the different methodological units of the textbook have been systematisation, consecutiveness, scientific rigour, simplicity, visuality. New notions are introduced relying on pupils' intuition and wherever necessary they are formally defined as well. Topics are ordered so as to enable the implementation of the following three parallel types of activities:
- teaching new lessons;
- class exercises;
- practice in a computer classroom.

d) Brief content of the textbook.

The History of a Dream which Became Reality - instead of an Introduction
1. Mathematical Foundations of Computers;
Numerical Systems;
Predicate Algebra
Algorithms
2. Computer Systems
Structure of Computers
Operating Systems
Programming Media and Applied Systems
3. Introduction to Programming
Structure of a PASCAL Program
Numerical Data Types
Use of Standard Subroutines
Conditional Operator. Boolean Data Type
Loops
Character Data Type. Multiple Choice
Simple Types: Completion and Generalisation
4. Subroutines and ...Data Types:
Functions
Procedures
Arrays and Character Strings
Computer Graphics and PASCAL Programs
Recursive Definitions and Programs
Records
Files
How Fast Can Computer Programs be Run? - Instead of Conclusion

School-leaving examination in informatics.

Pupils will sit for a school-leaving examination in Informatics this year. Naturally they feel excited and embarrassed. What will a school-leaving examination topic in Informatics look like? Though there exist a number of opinions in this field, the problem is not clarified yet. Let us even add another one.

The school-leaving exam in Informatics will consist of two parts called conventionally theoretical and practical.

The theoretical part will be a written exam consisting of a test and a problem. The problem will be formulated so that its solution should be written as a PASCAL program. The topic for the written exam will be one and the same for all graduates and it will be given by the Ministry of Education, Science and Technologies.

The practical part of the exam will be absolutely independent of the theoretical one. It will aim at testing the actual skills of pupils to implement a certain applied system, for example, a textprocessing system, spreadsheets, a DBMS, a computer graphics system, etc. The use of different hardware and software in high schools will hamper the formulation of a unique practical topic at first. Teachers might be given the opportunity to prepare these practical topics in the form of exam tickets. If the number of computers in a school is not sufficient, the practical part of the school-leaving examination might be carried out in several consecutive days but it should precede the written examination and only pupils who have passed it would be admitted to the theoretical one.

Next follow some problems which might be items of a test included in a topic for a secondary school-leaving examination. More detailed information about tests in PASCAL can be found in the journal "*Mathematics and Informatics*, 1994 {see 16}. In 1995 on the pages of the same journal under a new heading called Info Secondary School Leaving Exam will be published some exemplary topics for such an exam.

Three hot points.

1. No more than 10% of the high schools in the country possess 16-bit PCs. Then, can we talk about Computer Free Informatics in the secondary school in Bulgaria at all? Does not this percentage mean that studying Informatics without computers in the secondary school is still a hot problem?

Note: The authors of this paper make a distinction between the notions of "Computer Free Informatics" and "Studying Informatics without Computers"

2. Are the 11th and the 12th grades the most appropriate ones for studying Informatics? How could we introduce new technologies in schools if future teachers do not face the problems of Theoretical and Applied Informatics while being school or university students?

3. The obligatory minimum of Informatics to be covered by pupils in the non-specialised schools is not formally determined yet. This is an essential obstacle for teachers and especially for pupils who would like to sit for a secondary school-graduating examination in Informatics. There are such pupils.

WHAT ABOUT TOMORROW?

Informatics as a school subject is entirely dependent of computer (hardware and software) technique available in high schools. That is why no essential changes are expected in the near future. But since the necessity of implementing information technologies is undoubtedly growing, then the position of Informatics in the secondary school will be strengthened. And if we have to answer the question "*What shall we do tomorrow*", the reply inevitably will be: *Tomorrow we are going to implement what we experiment today in secondary school and in training future teachers in Informatics.*

III. INTEGRATING INFORMATION TECHNOLOGIES IN THE HIGH SCHOOL CURRICULUM

I. DEFINITION OF THE NOTION OF INFORMATION TECHNOLOGIES

The term *information technologies* is comparatively new. It became popular in the 80s and in the early 90s in connection with the rapid development of microelectronics and the implementation of personal computers in administration, economics, technology, etc.

In general, the term *information technologies* is used to denote the set of technical devices, tools, methods, knowledge and skills required for data processing.

Thus defined, the scope of the notion of information technologies is very wide. Since we are interested in the specific purposes and problems of education in the high school, further on information technologies would mean computer-based information technologies in the high school defined as follows:

Technologies related to developing and/or using software products and systems for computer-based automation of the main information processes (compiling, processing, displaying and distributing data).

This definition is used to narrow the scope of information technologies to those used in the secondary high school and it enables us to determine some educational criteria.

Next follow some corollaries of these definitions:

1. Technologies directly connected with hardware and its elements are excluded from the high school syllabuses (they are not supposed to be studied in high school).

2. Primarily ready-made software products are to be studied, in the secondary high school since we suppose that most pupils should be well qualified users of computers and some often used software packages such as textprocessing systems, spreadsheets, DBMS, etc. In this case information technologies appear to be an object of studying in high school and they are not treated as a tool through which this process is optimized (as a tool for optimizing this process)

3. Except as an object of studying, some information technologies can be treated as a tool for optimizing the learning process in some school subjects.

4. The scope of studying information technologies in high school is reduced to those which presuppose an extensive use of computers (the computer-based ones). Thus the basic idea of studying information technologies in the high school is concentrated on training pupils to be skillful in working on computers, i.e. to become well-qualified computer users, who on the one hand, can operate with the most often used representatives of software packages and on the other hand, are capable to learn by themselves how to use some new software products.

Is such an education necessary for pupils in high school?

In my opinion - yes, because nowadays, the use of computers in the above-mentioned manner becomes an element of mass culture typical for the end of the 20th century (due to the implementation of PCs) and it is no more (it is far from being any more) an occupation of special groups of experts.

That is why from now on the problem will be not whether to study computer-based information technologies but what and how should be studied - topics, their volume, methods, organization of the learning process, etc.

II. SOME POSSIBLE SOLUTIONS FOR ORGANIZING THE EDUCATION IN INFORMATION TECHNOLOGIES

The possible ways of organizing the study of information technologies in high school are two - either through integrating them into the school subject of Informatics or by separating them in another subject.

In the second case the study of Informatics should include some fundamental knowledge in information technologies as well, but at a more principal, conceptional level, while education in the other subject should focus on implementations and applications.

What is the present situation in the high school?

Informatics is studied as a school subject in the 11th grade of the high school twice a week. The syllabus envisages pupils to acquire knowledge on some fundamental notions of Informatics and some information activities and processes; on algorithms and their representation; on some essential constructions of a given high level programming language and to use them to write some elementary programs. Also, in addition, pupils are supposed to get some idea about the essence and the functions of the operating systems and the description of the functions and structures of the main types of software products such as textprocessing systems, spreadsheets, data bases, data base management systems (DBMS), etc.

Evidently, pupils could hardly acquire any stable practical skills for operating with software products with such a curriculum and for such a period of time and probably that should not be the main purpose of studying Informatics in the high school.

Starting from 1993/1994 the curriculum envisages studying information technologies as a school subject twice a week in the 9th and 10th grade of high school.

A special guide for studying information technologies in high school was worked out in 1994/1995.

In conformity with this guide and with the general guide for the organization of work in high school in 1994/1995, each school could choose the concrete trends and technologies to be covered by the school subject of information technologies. Thus information technologies could be one of the probable choices and some syllabuses for them had been worked out.

Does such an approach to the organization of education give any advantages?

In my opinion, yes, because it is up to each school to judge and choose to study information technologies. But they should meet some requirements concerning the number and model of computers available, the qualification of staff, etc. At present asking all the schools to study information technologies as an obligation might fail because of their inadequate conditions in school computer studies.

III. GOALS, ORGANIZATION AND SYLLABUS OF THE EDUCATION IN INFORMATION TECHNOLOGIES

The main goals of education in information technologies are as follows:

1. To enable pupils to acquire knowledge and skills needed for using computer systems and ready-made software products in different fields of economical and social life.
2. To help pupils in the high schools for natural sciences and Mathematics to extend and deepen their knowledge by applying some special information technologies to studying other school and special subjects.
3. To stimulate pupils in the specialized classes in Mathematics in combination with those in Informatics to get knowledge in programming and to use modern programming media in creating applied software products.

A main organizational approach to fulfilling the above-mentioned aims is the creation and development of separate modular syllabuses in information technologies to be approved by the Ministry of Education and each school might combine them in one or two-year course in information technologies, according to its profile, or through including them in the extracurricular or optional subjects.

Education in information technologies should be based on the names of concrete information technologies and types of syllabuses, approved by the Ministry of Education. Education in other syllabuses or other information technologies may be accomplished only in extracurricular or optional classes but only if the school meets the relevant computer and staff requirements.

The principle of the obligatory minimum of required computers and teachers is observed when permitting education in a certain information technology and these requirements are described in the relevant syllabus so as to avoid education where no adequate base is available.

Education on each module terminates with pupils' course reports which aim at testing their knowledge and skills acquired on the respective software product.

Types of syllabuses had been worked out for the following modules in 1994/1995.

Names of the information technologies for which	*there are syllabuses*
1. Operating Systems with Text Interface	36 classes
2. Textprocessing	36 - " -
3. Spreadsheets	36 - " -
4. Databases	36 - " -
5. Computer Graphics	36 - " -
6. Information Technologies for Research in Mathematics (for mathematical investigations)	at least 36 - " - minimum

A module of 72 classes or a combination of two modules of 36 classes, chosen by the teacher form the syllabus for a school year.

It is planned to work out syllabuses on: programming techniques; numerical methods; operating systems with graph interface; network and multi-user operating systems; pre-printing systems; graph processing; multimedia; information technologies in education, etc.

The planned variety of concrete information technologies aims at enabling schools which have the equipment and teachers needed to make their choice according to the profile of the school and pupils' desires.

IV. SURVEY ON SOME OTHER EDUCATIONAL PROJECTS AND MODELS

I would like to review the work of the two centres for training teachers founded in conformity with two different agreements.

These centres are located in the Department of Information Technologies at the Faculty of Mathematics and Informatics at the University of Sofia.

In 1993 a Centre for Training Teachers to work on Macintosh was founded according to an agreement among the Ministry of Education, the Department of Mathematics and Informatics at the University of Sofia and the company "Bulgarian Business Systems" in connection with equipping some with Apple-Macintosh computers.

In the summer of 1995 an IBM Centre for Training Teachers was founded in cooperation with IBM Bulgaria and the Fund Open Society under the terms of the contract "Educational initiative of IBM in Bulgaria".

The goals, the work and the perspectives of the IBM Centre are treated in details in the report of Mrs. Iliana Nikolova. I would like to add that the Ministry of Education considers that the activity of these two centres and especially the work on "Educational Initiative of IBM in Bulgaria" might be a good chance of experimenting with some models of organization and interaction in the field of School Informatics and the application of information technologies to studying other school subjects in some schools, namely: developing and experimenting some syllabuses and educational projects, creating a system for permanent training of teachers, on their working places as well - through modern systems of communications, connecting the schools they work in and the educational centres.

If, in this two-year period of work with the agreement with IBM, some useful school projects and models of organization occur, they could be submitted to the Ministry of Education for approval and further implementation in high school.

At present a project for implementing the well known system "GEOMLAND" in the High Schools for Mathematics and Informatics and in some other specialized classes has been worked out. In the beginning ten High Schools for Mathematics and Informatics and some specialized classes in different schools in the country would participate in the experiment.

In conclusion, I would like to point out that further study and use ofinformation technologies in the learning process would inevitably develop with the growth of their applications to different fields of economic and social life. This perspective and the equipment of schools with modern computers and tools would result in some more efficient changes of the organizing the process of education in the high school related to widening the scope of studying and using information technologies in the high school.

IV. STUDYING INFORMATICS IN THE MATHEMATICAL SCHOOLS IN BULGARIA

In 1970 several schools specializing in Mathematics - the so-called Mathematical schools- could be found in Bulgaria. Informatics was started, being taught together with an increased number of lessons in Mathematics. At that time courses of Numerical Methods and Programming were presented. At the end of the 1970s computer laboratories using computers type IBM-360 were present in some of these schools. In 1983 the pupils in the Mathematical schools were given the opportunity to specialise in Computer science as "Operator-programmers for computers".

It is known that teaching Informatics depends to a large part on the computer equipment. In this connection the present study focuses on teaching Informatics in the Mathematical school in Plovdiv which has traditions in this sphere. This school is known to be outstanding with:

- its own computer laboratory, the first of its type in Bulgaria established in 1975;
- its computer laboratory on the basic of APPLE-computers first found in the country in 1982;
- its teachers - authors of textbooks and curriculum in Informatics for the secondary schools, etc.

At the present time the Mathematical school in Plovdiv has 4 computer laboratories with 68 IBM PC computers, 1 laboratory with MACINTOSH computers, 1 laboratory with BBC computers and a lab in Robotics. Informatics is studied every year in this school - from the first-preparatory class to the end. In the first four years of education the pupils have two Informatics lessons a week.

The program includes:

- •Introduction on Using a Computer;
- •Introduction to Operating Systems;
- •Introduction to Text Processing;
- •Introduction to Working with a Spreadsheet;
- •Introduction to Robotics;
- •Introduction to Programming in BASIC and PASCAL.

In the final year of education the emphasis is on the professional training of the pupils as Operator-Programmers for computers. This training includes 470 teaching hours. The working plan for school terms and subjects is as follows:

Professional Training	I Term	II Term	Lessons
School Weeks	17	15	
1.Theoretical Training:			
1.1. Programming and Algorithmic Languages	5	3	130
1.2. Operating Systems	2	1	49
1.3. System and Applied Software	-	5	75
2. Practical Exercises:			
2.1. Programming and Algorithmic Languages.	2	2	64
2.2. Operating Systems.	2	1	49
2.3. System and Applied Software	-	3	45
3. School practice			60
Total:			472

Thematic Plan: "Programming and Algorithmic Languages":

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
I. Introduction to Programming		
1. Historical data. Algorithms and programmes. Programming languages. Classification. Metalanguages. Solving problems with the help of a computer.	3	-
2. Basic objects in the programming languages-identificators, variables, expressions, arrays, functions.	3	1
3. Operators in the Programming Languages. Sub-programmes. Structure of the programmes.	4	1
II. Algorithmic Language Pascal		
1. Introduction to the Pascal language-historical data, alphabet, key words, integer and real numbers, strings. Structure of the programmes in Pascal, classification of the operators. "Turbo Pascal 7.0" system.	8	2
2. Data types in Pascal.	3	2
3. Constants, types and variables.	4	2
4. Standard functions.	5	3
5. Expressions.	5	5
6. Input and Output in Pascal.	5	5
7. Driving Operators-IF .. THEN .. ELSE, CASE, FOR, DO..WHILE etc.	15	8
8. Procedures and functions.	15	8
9. Records, Files, Sets.	15	10
10. Additional functions of the "Turbo-Pascal" System 7.0.	15	10
III. Programming Technology		
1. Programming style.	4	1
2. Program design.	10	2
3. Program verification.	8	2
4. Program documentation.	8	2

The basic textbook used is: *Informatics with Pascal*, Pavel Azalov, Fanny Zlatarova, Sofia, 1994.

Thematical plan "Operating System" (OS)

Name of the Theme	Lessons: Total Number	
	New knowledge	**Exercise s**
I. Introduction to the OS		
1. Operating systems-role, importance, types.	2	-
2. Stages of development of the OS.	1	1
3. Basic functions of the OS.	4	2
II. Functions of the operating system MS DOS		
1. Starting MS DOS.	1	2
2. File system.	2	4
3. Command classification.	1	1
4. Command description:		
4.1. Commands for working with directories.	3	3
4.2. Commands for working with files.	3	5
4.3. Commands for working with disks.	3	4
4.4. Other commands.	3	3
5. BAT Files.	3	3
6. Service Programmes.	3	2
III. Other Operating Systems		
1. Operating System VMS.		
1.1. General information.	1	-
1.2. File system.	3	1

1.3. Terminals. Command characters.	-	2
1.4. Starting VMS.	1	2
1.5. A general format of the commands.	1	-
1.6. Basic commands.	5	2
1.7. Exit of the system.	-	1
1.8. File editing.	1	1
1.9. Basic work schemes.	1	1
2. Operating system Apple DOS		
2.1. Basic commands.	2	2
2.2. Sequential files.	2	2
2.3. Direct files.	3	3
2.4. Other functions.	2	2

The basic textbook used is *Operating Systems for 11th Class*, A. Hachikyan, A. Rachnev, K.. Garov, Sofia, 1990.

Thematic plan: "System and Applied Software"

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
1. Mathematical and Logical bases of the computers-number systems, logical operations and functions, realisation and application of the logical functions, logical schemes.	8	4
2. Representation of the information in the computer memory and operations with it.	15	4
3. ASSEMBLER for IBM PC.	15	10
4. Applied Software.		
4.1. Working with Database. Working with "WORKS" package.	15	10
4.2. Text processing. Text processor WORD.	12	10
4.3. Spreadsheets. Working with the spreadsheet LOTUS.	10	7

At the end of the school year the pupils work out and defend their projects in Informatics.

The extracurricular work in Informatics is very-spread in the Mathematical Schools. Talented pupils are organised in study groups. A system for working with talented pupils in the Mathematical School in Plovdiv has been functioning for 20 years. Here is a thematic plan for working with talented pupils in Informatics.

Thematic plan for working with talented pupils in Informatics

Name of the Theme	Lessons: Total Number	
	New knowledge	Exercises
1. Numeric problems-arithmetic of the real numbers, computing of formulas. Fibonacci, Bernoulli and Stirling numbers.	8	8
2. Arrays, matrix algebra, sorting and searching, polynomials.	10	10
3. Geometry and Programming.	10	10
4. Data structures-stacks, decks, tables, hashing methods.	15	15
5. Elements from the theory of the Graphs.	20	20
6. Combinatorial algorithms.	15	15
7. Methods for constructing algorithms.	25	25
8. Algorithms and games.	15	15
9. Numerical methods.	25	25
10. The Theory of Coding. Fano, Shenon, Huffman codes.	15	15

Besides the participation in the Olympiads in Informatics every talented pupil works upon a particular problem in Informatics and prepares a report. Here we offer a list of such reports which gained prizes at national conferences and competitions.

"*MDL-System for Processing Mathematical Objects*"- a system for input, support and processing of the mathematical objects. The programmes are written in Turbo C and Scheme Lisp.

"*OOEP-Object-Oriented Extension of Pascal*"- that is a language extension of Pascal by means which show the main characteristic features of object-oriented languages. The programmes are written in Turbo C.

"*A Program System for Modelling* 3-

Dimensional Objects." - a graphic system for modelling 3-dimensional objects.

"An Information System for Computer Service of Bridge-Tournaments"-this system was used at the European youth championship in 1989 in Plovdiv.

"Interpretator Lisp-8 for Computers APPLE-8".

"Program Model of the Post Machine and its Application in the Lessons in Informatics."

"A Package of Programmes for Computer Teaching in Mathematics,Biology, Chemistry."

"Program System for Working with Polynomials"

The analysis of the results of our pupils shows that the Mathematical Schools train young people who can successfully use the modern Information Technologies.

V. THE STATE-OF-THE-ART IN INFORMATICS EDUCATION IN THE BULGARIAN SCHOOLS AS PROVIDED BY THE IEA COMPED SURVEY

INTRODUCTION

Teaching informatics at school has a long history and tradition in Bulgaria. The first steps were made in the late sixties when some optional informatics courses were taught for secondary school students in mathematics and in vocational schools. In 1979 the Research Group on Education (RGE) under the Bulgarian Academy of Sciences and the Ministry of Education started an experimental teaching of informatics in twenty seven schools both at elementary and secondary school level. Informatics has been taught as a compulsory school subject for all secondary schools in Bulgaria since 1986. The procedure for introducing computers into the secondary schools, the relevant stages, objectives and tasks, were part of a Program for the implementation of computer technology, was worked out and approved by the Higher Council for Education at the Ministry of Education in Bulgaria in 1985. Since then a large number of computers have been delivered to schools, a compulsory course on informatics has been introduced in all secondary schools, several informatics textbooks have been published, a great number of teachers have passed computer education courses, many scientists and university teachers have done valuable research in the field of computers in education. However no significant research on present situation in using computers in education has been undertaken in Bulgaria so far. The International Association for the Evaluation of Educational Achievements (IEA) Computer in Education (Comped) Study, Stage 2, gave us an opportunity to draw up a realistic picture about application of information technologies in Bulgarian schools and to compare it with the situation in the other participating countries.

1. SOME GENERAL FINDINGS OF COMPED STUDY

The study showed that the integration of computers in classroom practice is being impeded by obstacles of which the most important are [1]:

- lack of good educational software;
- restricted access to computers at schools;
- teachers do not receive enough support and do not have the necessary training for computers to play a meaningful role in the classroom.

The IEA has drawn a number of conclusions from the study:

a) Having a computer at school does not mean in itself that it will be used regularly in the classroom. The effective integration of computers into lessons demands more time and targeted activities, such as the provision of information on the added value of integrated use of computers, software development and training. It can already be concluded that progress will be slower than originally anticipated when computers were first introduced into schools.

b) It is essential that teachers receive full training and support and that more hardware and software is available.

c) For students who do not have a computer at home, the school is an important provider of equal opportunities to learn about information technology.

National educational systems will have to work hard to keep pace with the social changes caused by further digitalisation of information flows. There has been a striking increase in the availability of computers at school in recent years but the computer is still marginally used as a tool for teaching and learning.

Schools, parents, and policy makers should be aware of the differences in knowledge and attitudes between boys and girls towards using computers. Lack of familiarity and experience with computers could be socially disadvantageous for girls.

Any participating country could benefit a lot by analysing the data available according to its concrete needs so that to answer many questions related to computer education. Some findings based on the analysis of Comped data made by the International Co-ordinating Centre [3] and by the Bulgarian Comped research team follow.

2. ACCESS TO HARDWARE AND SOFTWARE

Lower Secondary Schools

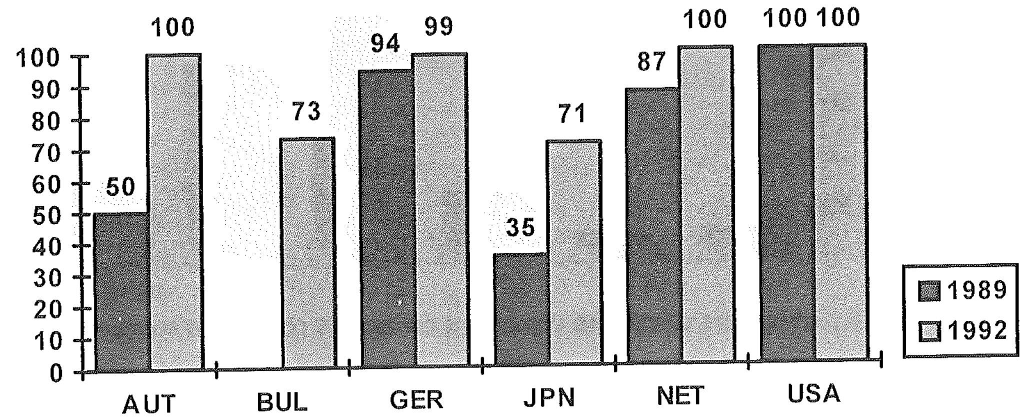


Figure 1

Upper Secondary Schools

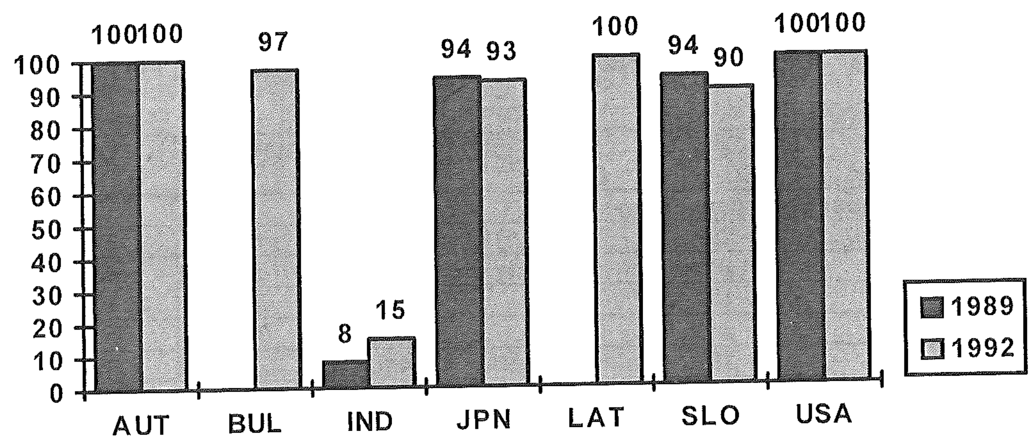


Figure 1 (cont.)

Lower Secondary Schools

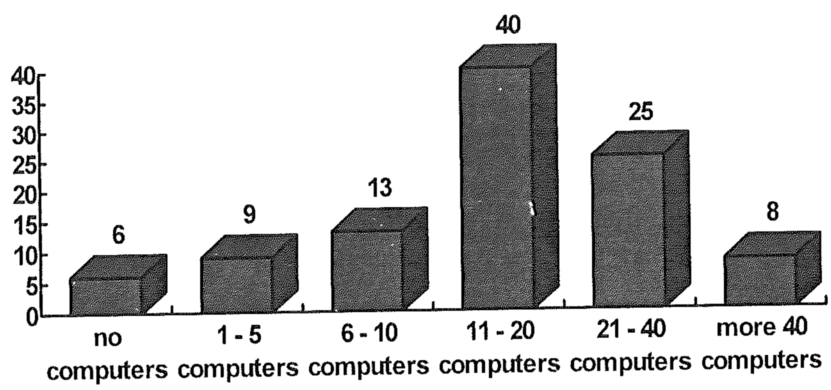


Figure 2.

Upper Secondary Schools

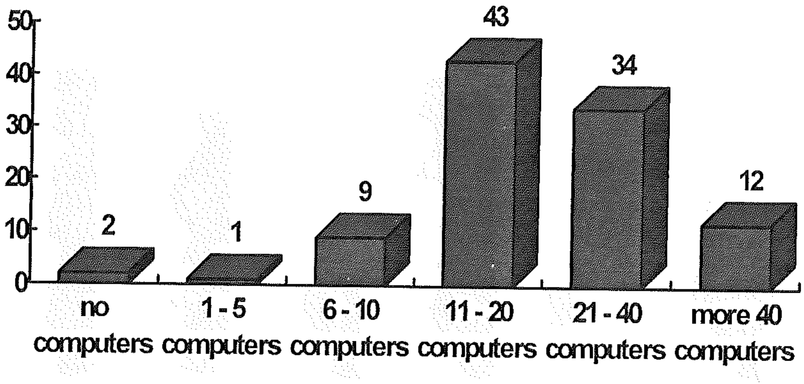


Figure 3.

As it could be seen from Fig. 1 the percentages of Bulgarian schools having computers in use for instructional purposes by the end of 1992 are: 73 % at LSS and 97% at USS. Only in Austria, the USA, and the Netherlands (at LSS) and in Austria, the USA and Latvia (at USS) all schools are supplied with computers. Fig.2 and Fig.3 show that most of the schools both in LSS and USS have more than 10 computers available and can rely on a well equiped computer laboratory. The median number of computers at computer using schools in Bulgaria is 17 in LSS and 18 in USS.

Table 1

Country	School + Outside	Only School	Only Outside	Not	At Home	Hours
Lower Secondary Schools						
AUT	62	28	6	4	43	5.2
BUL	15	24	14	47	5	4.9
GER	59	18	16	7	58	7.0
GRE*	55	41	1	4	31	5.5
JPN	13	19	24	44	21	1.9
NET	60	17	16	6	57	4.0
USA	74	21	2	3	51	2.1
Upper Secondary Schools						
AUT	62	26	7	7	53	4.7
BUL	18	61	2	20	6	5.6
IND	2	6	3	89	1	4.4
JPN	23	26	16	35	27	2.3
LAT	27	53	3	17	11	6.6
SLO	40	29	12	19	28	4.2
USA	77	19	1	3	51	2.2

Notes:*Students in computer using schools only.

All data mentioned above give the impression that the Bulgarian schools are very well supplied with computers. However in order to find out the real access of students to computers we could analyse Table 1 which shows that many of the Bulgarian students (e.g. 61% at USS and) rely only on using computers at school while a great number of the students do not have access to computers at all, e.g. 47% in LSS and 20% in USS. Another indication of the real access of students to computers is the availability of computers at home. Only 5% of the students in LSS and 6% in USS in Bulgaria report that they use computers at home. According to this indicator Bulgaria is far behind the well developed countries. It is behind the other Central and Eastern European countries participating COMPED - about 28% of the students in Slovenia and 11% of students in Latvia in USS report of using computers in school. The reported high number of computers in LSS are mainly due the fact that a lot of the Bulgarian schools are so called Unified Secondary Schools and they comprise students from 1st to 12th grade, i.e. these schools cover both LSS and USS level and the students there share the same equipment. Great problem for our schools is the quality of the school computers. As it can be seen from Fig. 4 and Fig. 5 about 30% of LSS and 39% of USS report that they have more than 6 computers out of order. The percentages of computers with 16 bit processors offers a good indication for the extent to which the schools keep the quality of their equipment close to the recent technological developments. According to this indicator (see Fig.6) Bulgaria is at the last place among all participating countries - the mean percent of 16 bit computers is only 3% for LSS and 4% for USS. The quality and variety of computer peripherals are also quite low in the Bulgarian schools. Very few schools have local area networks and the access to Internet or Bitnet is still (almost) impossible. The majority of the computer teachers report that they face problems like: "insufficient peripherals available" (58% in LSS and 62% in USS), "difficulty with maintenance" (66% in LSS and 74% in USS), "limitations of computers" (64% in LSS and 70% in USS), etc.

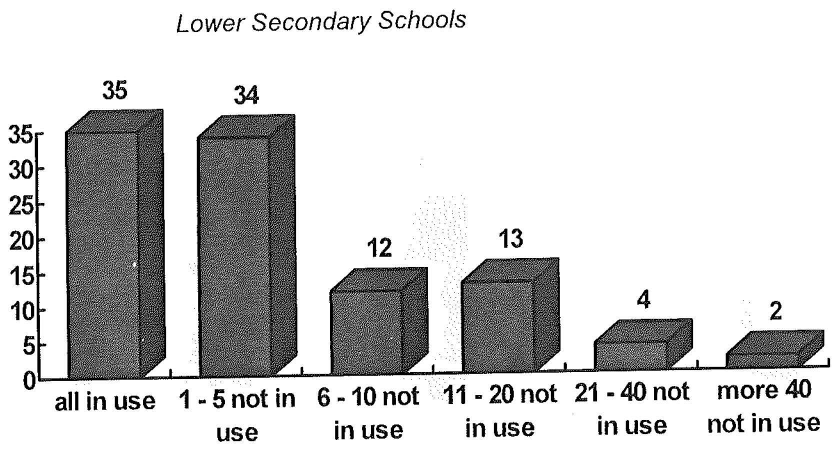


Figure 4.

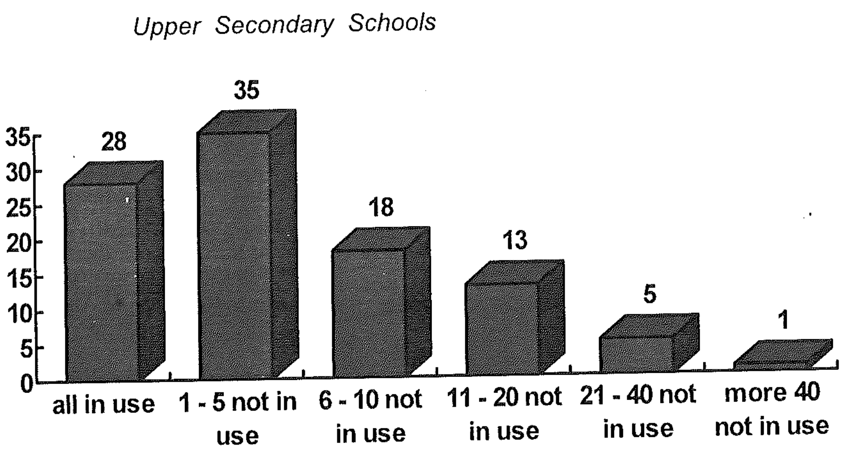
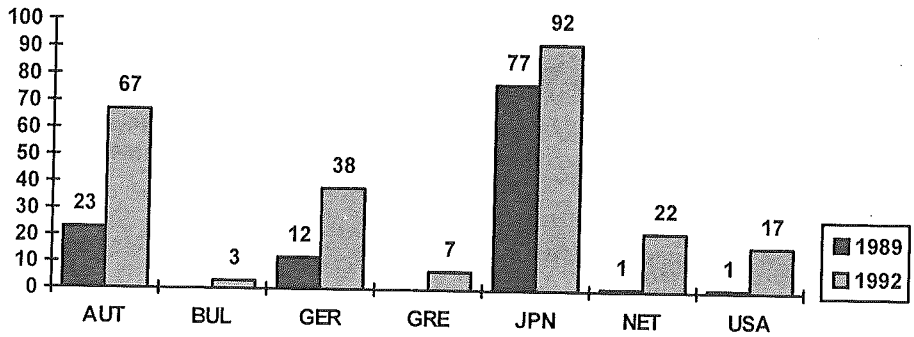


Figure 5.

Lower Secondary Schools



Upper Secondary Schools

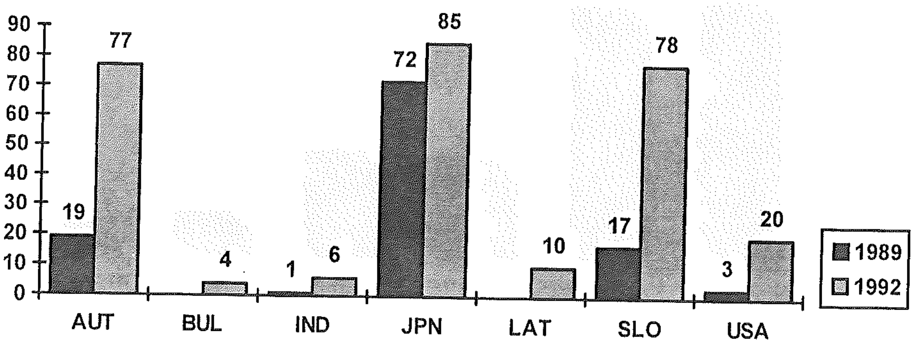


Figure 6.

Although the availability of educational software is reported to be relatively high in Bulgaria compared to other participating countries, 64% of the computer co-ordinators in LSS and 67% - in USS find that "insufficient instructional software" is among the major problems. According to our personal impression and the interviews with school teachers the amount of legal software used at schools is not much and after the Low for Copyright and Author's Rights has been approved by the Parliament the situation is expected to be dramatically changed to worse. The quality of the educational software available or which is possible to be run on the school computers is also very poor and this software is usually written by teachers or by students.

Some conclusions for introducing computers in education in Bulgaria can be drawn:

- there are not enough funds for computer education;
- there are not enough peripheral devices;
- there are many difficulties in hardware support;
- computers are not powerful enough (mainly 8-bit)
- the teachers do not have enough time for computer lesson preparation;
- the teachers face great difficulties in integrating information technologies into other school subjects;
- there is not enough educational software.

A new national computer in education programme should be launched in order to help schools keep the quality of their equipment, software and education close to the recent developments in that field..

3. HOW ARE COMPUTERS USED AT SCHOOL

The information concerning application of computers at school should be interpreted in the context of why schools started to use computers [3]. The reason most frequently mentioned by school principals was: *To give students experience with computers that they will need in the future*. Another reason: *To keep curriculum and methods up-to-date.* was ranked at the second place. Many school principals in Bulgaria (78% in LSS and 84% in USS) consider computers as tools for improving quality and effectiveness of education. This purpose implies a very deep integration of computers in all school subjects and activities. However Table 2 (p.33) shows that computers are used mostly for computer education (*learning about computers*) and a real integration in the other school subjects (*learning with computers*) is still expected in the future. We can also infer that the level of integration of computers little depends on the number and quality of hardware and software available - the students in both well developed and developing countries report that they rarely use computers in mathematics, science, mother tongue, and social studies.

Table 2.

	Lower Secondary Schools							Upper Secondary Schools						
	AU	BUL	GE	GR	JPN	NET	USA	AU	BUL	IND	JPN	LAT	SLO	USA
A.	90	52	78	96	49	78	95	87	81	40	52	80	73	96
B.	71	52	81	71	10	86	67	84	84	51	73	86	90	83
C.	7	13	15	9	2	7	7	2	5	20	2	4	3	6
D.	2	5	M	8	2	M	2	1	4	13	5	2	3	4
E.	5	6	9	8	1	7	9	0	4	8	1	2	0	9
F.	1	M	M	7	1	12	3	0	3	8	1	0	0	2

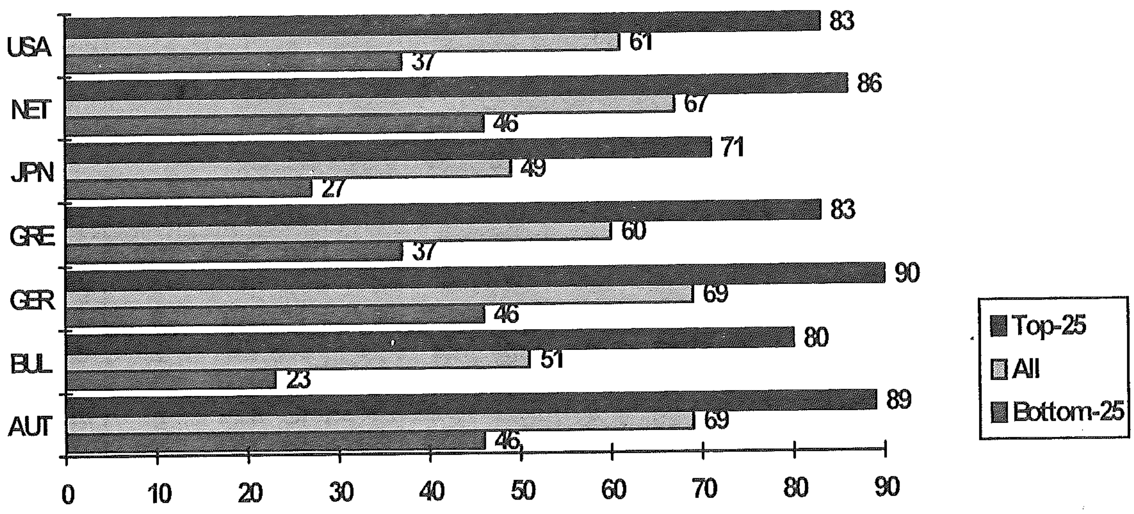
Notes: M = number of valid cases too small (< 250)
or too many missing cases (> 20 %)
The original wording of the computer use/subjects is:
A. Computer used; *D.Science;*
B. Computer Education; *E. Mother tongue;*
C. Mathematics; *F. Social studies.*

In order to clarify the extent of application of different types of educational software the computer teachers were asked to indicate how often they use any of them. It can be seen from Table vvv and Table Www that the *favourite* type of software is tutorial or drill and practice. Application software packages like word-processors, data bases, spreadsheets, simulation, etc. are used rarely by the Bulgarian teachers. For instance about 90% of teachers at both LSS and USS never used spreadsheets, about 90% at USS and 80% at USS never used simulation software, more than 70% at LSS and 50% at USS never used word-processors, about 90% at LSS and 75% at USS never used data bases. Educational software packages for statistics, authoring, item banks, communication, multimedia, etc. are almost unknown at schools. Most of the computer teachers use BASIC as a programming language and about 40% of the teachers at USS report that they use it every period.

The statistics provided above shows a non optimistic picture for computer application in the Bulgarian schools. There is an urgent need of a new national programme for integrating new information technologies in school.

4. STUDENTS' KNOWLEDGE ABOUT COMPUTERS

Lower Secondary Schools



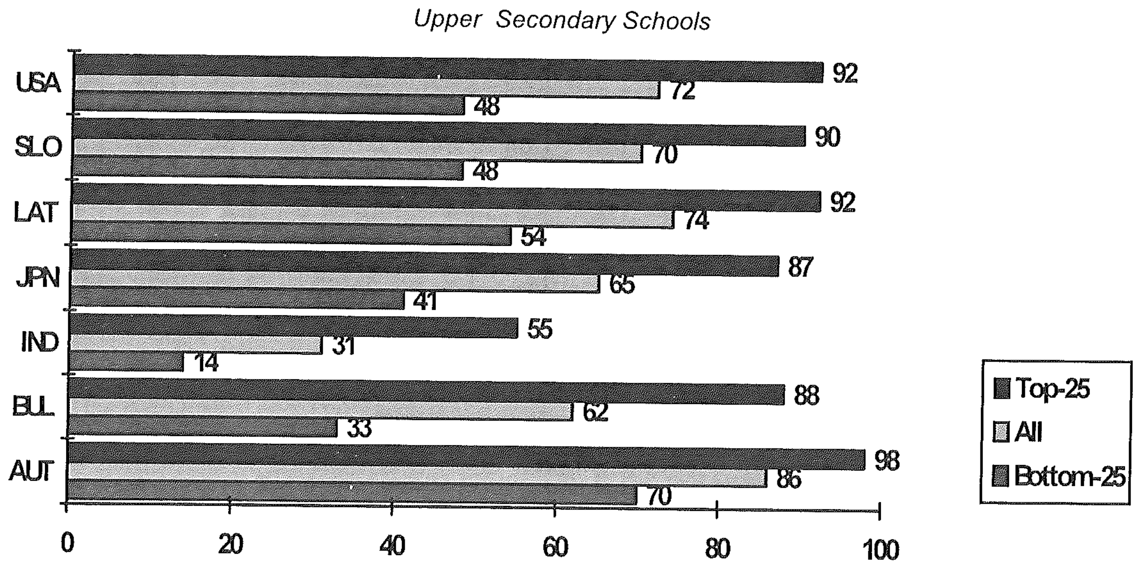


Figure 7.

The level of students knowledge and skills was measured by so called Functional Information Technology Test (FITT). The 30 item test was the same for LSS and USS. The average score of the total sample in the target grade level and for the 25% highest and lowest scoring students as well as the accuracy for estimating the score for the total target population in a country (95 % confidence) are displayed in Fig. 7. As it could be seen from the data the scores of the Bulgarian students both at LSS and USS are holding a lower than the average position. The Austrian students showed highest scores both for LSS and USS. However the test scores do not show only the effect of learning and using computers at school but rather the total experience and knowledge gained within and outside school. The relatively low achievements of the Bulgarian students are due the lack of enough additional sources of information about computers and the low percentages of the FITT topics having been studied in advance at school - 22% in LSS and 47% in USS. The highest correspondence between FITT topics and the content the students have learnt at school is in Austrian schools - 85% in LSS and 94% in USS. For Slovenia and Latvia this correspondence is respectively 87% and 82% (in USS).

The main implication from the FITT for Bulgaria is that the low scores do not mean a lack of learning abilities for Bulgarian students. For instance they are quite successful in the international programming Olympiads. Computer education in Bulgaria should be drawn towards the European standards. In addition better supply of computers, software and other teaching materials should be ensured for the Bulgarian schools as the students can not rely on access to computers outside school.

5. STAFF DEVELOPMENT

Table 3.

	Lower Secondary Schools							Upper Secondary Schools						
	AU	BUL	GE	GR	JPN	NET	USA	AU	BUL	IND	JPN	LAT	SLO	USA
A.	22	59	81	57	9	23	21	42	60	29	15	57	32	19
B.	57	39	31	29	54	16	43	63	36	29	49	24	90	52
C.	25	3	19	4	19	11	29	21	8	3	10	22	33	26
D.	0	1	1	0	0	0	3	0	2	0	3	0	0	5
E.	42	66	13	17	7	47	29	27	74	27	7	49	20	29
F.	6	19	9	19	31	15	11	11	22	7	37	46	20	12
G.	2	1	7	9	21	20	26	2	2	2	14	0	6	40
H.	95	13	23	7	62	80	43	93	21	32	68	M	22	40

Notes: M = information not available or too many missing cases (>20%).
The explanation of the agencies is:
A. Ministry of Education;
B. Local Educational Authority;
C. Teachers of other schools;
D. Parents;

E. Universities/(teacher training) colleges;
F. Teachers associations/ other associations;
G. Business and industry;
H. Support institutions/resource centers.

Teacher training is a key problem for a successful application of computers in education. As it can be seen from Table 3 the highest support for teacher training in Bulgaria comes from universities and other teacher training institutions. For instance the teacher development programme at Sofia University has been providing courses covering the most important aspects of application of computers in education since 1984 [2].During the courses the teachers have access to powerful computers and software and gain self-confidence in experiencing new styles of teaching. Unfortunately their enthusiasm does not last very long. The informal interviews and meetings with some teachers showed that once they returned to their schools and face all the problems - technical, organisational, curriculum, human, etc. - they could not overcome the burden and only a few of them applied what they had learned. During the last few years (mainly due financial reasons) teacher training and retraining courses have been rarely organised. According to the COMPED data the Bulgarian teacher feel lack of enough knowledge about computers and their application - 58% in LSS and 66% in USS report about such problem. They also can not find adequate support and guidelines for instructional use of computers - 59% in LSS and 57% in USS. More than 40% of teachers both in LSS and USS report for lack of enough training opportunities and enough time for computer lesson preparation.

6. CONCLUSIONS

On the basis of the above said the following suggestions for improvement of computer education in Bulgaria could be maid:

- a careful analysis of Bulgarian COMPED data should be made in order to better determine the current problems and needs in the field of computer education;
- a new national strategy for integration of communication and information technologies in education should be developed by taking into the consideration the new economic and social circumstances;
- relevant educational standards in communication and information technologies both for students and teachers should be adopted;
- a new national teacher training programme should be launched for providing continuing teacher education. Some advanced training methods such as flexible and distance learning by means of new information technology should be applied as well.
- following the tendency of decentralisation a network of teacher training and resource centres where teachers can refresh their knowledge, share ideas and experience, keep in touch with new trends in the field, receive educational software and literature, rely on competent help, should be established.
- the co-operation of Bulgaria with other leading in this field countries should be extended and strengthened. For example - the International Programme "Children in the Information Age" should be re-established.

VI. TEACHER DEVELOPMENT SUPPORT IN USING INFORMATION TECHNOLOGIES IN SCHOOLS

1. TEACHER DEVELOPMENT AND INFORMATION TECHNOLOGY (IT)

It is recognised that the teacher's role is essential in the adoption of any change in education. Teachers are the key factor for the successful integration of IT in schools too. Therefore the qualification of teachers to use IT competently in their professional practice is considered here an important task. After an initial training to provide a background in IT and make them aware of the potential of IT in education, teachers need further development and continuing support in the integration of IT into teaching and the learning process.

1.1 Some Observations.

According to recent studies related to teacher education and IT and proved by our own experience, the following are important factors influencing the process of teacher development:

Teacher's motivation: Convincing examples of applying IT in education have to be presented to the teachers. The teacher's efforts to enter a new field and adopt her/his teaching style to a new technological environment have to be encouraged and stimulated. Nationally approved standards for teacher development in IT have to exist [2].

Content of training: Building a basis in IT is necessary [4]. It will help teachers gain competence and feel confident. A balance between theory and practice in their further training - activity-based training taking into account classroom reality - is needed. Teachers have to be able to decide on the content of training and choose their own paths in a flexible training program [3].

Methodology and technology of teacher education: A demonstration of the usefulness of IT is necessary. The technology has to be extensively used in the training process by the trainers themselves. Discussions, reflections and support in generating ideas of what can be done with technology in the teaching and learning process should also be included in the training. Teachers need to develop transferable skills.

Organisation of the training: Flexibility is essential: full and part-time courses, school-based training, "cascade" training [1]. Distance delivery of those could also be a useful option.

Dedicated course managers and tutors: Constant efforts are needed in the process of training and co-ordination of on-going activities.

Continuing support: Teachers need to be supported in their work after the training course. Information resources and consultants have to be accessible. The availability of teacher-supporting materials is important.

1.2 Where are we now?

There are traditions in Bulgaria in teacher-training concerning IT. Mainly higher education institutions offer teacher training programs. Most of them require a mathematics background. The experience gained so far shows some of the problems which have to be taken into consideration:

Content: The training is more theoretically oriented and often not related to classroom reality. Training programs are fixed and do not allow flexibility. Teachers can not decide on the training content.

Technology: Equipment in the training labs usually differs substantially from that in schools.

Course materials: Specially developed course materials for teachers are usually not provided.

Further support: Teachers come and go - the training units are not responsible for further support of teachers after the training period.

One step towards a better match of teachers' needs could be the establishment of Resource and Training Centres, where teachers can periodically update their qualification in a more flexible way, find up-to-date information and get continuing support in the process of their work.

2. SUPPORT OF TEACHER DEVELOPMENT IN THE FRAMEWORK OF THE PROJECT "EDUCATIONAL INITIATIVE OF IBM FOR BULGARIA"

2.1 Description of the Project.

The project "Educational Initiative of IBM for Bulgaria" was initiated in 1994 by IBM-Bulgaria, the Open Society Fund-Sofia and The Bulgarian Ministry of Education and was planned for a period of 2 years. The scope of the project is supporting the integration of computers and information technologies in Bulgarian schools. 28 secondary schools participate: 1 pilot school in Sofia and 27 country schools. These schools have been chosen on a competitive base. Each of them has been equipped within the project with a computer lab: Server (PS/1 486 DX2/66) + 7 Workstations (PS/1 486 SX/25). The software initially installed is: DOS 6.2, MS Windows 3.1, MS Works 3.0, NetWare LITE, LINKWAY.

A Teacher Training Centre with exactly the same equipment has been established at the Faculty of Mathematics and Informatics, University of Sofia, with the task to provide training and support for teachers from the participating schools.

The project activities are co-ordinated by an executive body in which each of the initiators is represented. IBM provides the initial hardware and software equipment. The Open Society Fund supports financially the starting-up activities: a 3-week initial training course for one teacher per participating school; upgrade of the existing hardware at the Teacher Training Centre with additional RAM, printers and screen projection system; the establishment of a library with relevant books, periodicals and software. The Ministry of Education is responsible for the overall organisation of the project activities relating to schools.

2.2 Teacher Development Scheme.

The Teacher Training Centre is hosted by the Faculty of Mathematics and Informatics at the University of Sofia. The main purpose of the Centre is to provide courses, information services and continuing support for teachers. The courses are carried out by the Educational Computer Systems Laboratory (ECSL) which has experience in pre- and in-service training of mathematics and informatics teachers. A project co-ordinator (a member of ECSL staff) is responsible for the overall activities of the Centre.

The teacher training during the first year of the project is planned in two phases: initial and specialised.

2.2.1 Initial Phase

The initial phase consists of a 3-week full-time course, offering a basic acquaintance with the hardware and software installed in each school lab. Such a course will be offered to all school project co-ordinators (one teacher from each school participating in the project). Until now one initial course has been carried out. Here are some details about the course:

<u>Participants' profile:</u> 12 teachers (school project co-ordinators) with a background in Mathematics or Engineering and with varying previous experience in teaching Informatics at Secondary School level.

<u>Duration</u>:3 weeks;

<u>Daily schedule:</u> 6 hours (tutorials and guided practice) + 3 additional hours free practice (with a consultant available)

<u>Programme:</u>

DOS 6.2 - an overview.
Working in WINDOWS 3.1 environment
Working in a Network: NOVEL LITE NetWare
MICROSOFT WORKS 3.0 in Education:
Text processing
Spreadsheets
Database
Integration
Classroom Applications
Computers in Education: Approaches and Methods, Versions of the Curricula adopted by the Ministry of Education
Presentation of Link Way
Closing seminar and discussion

This content of the initial course was chosen by the executive body to ensure that school project co-ordinators would feel comfortable with the available hardware and software and can immediately start working with it as well as helping their colleagues to start. The integrated package

"Microsoft Works" was presented in a project-oriented way and during the course every teacher developed a small project related to some school activity.

2.2.2. Specialised Phase.

This phase will provide more individualised training for school co-ordinators according to their competence, interests and the particularities of their schools. Every teacher will be offered 3 one-week courses until the end of the school year 94/95. To match better teachers' needs and to define the appropriate paths for their further training, a special questionnaire, "Support and Further Training Need Identification Questionnaire", was developed and filled in by the teachers during the initial phase. Here follow some details:

The participants were invited to choose topics for further training among different groups of modules (open questions for suggesting additional modules were also included).

- Suggested Topics for Further Training:
- Learning Environments ("Mathematics", "Geomland")
- Subject-oriented Software (Physics, Chemistry, Biology, Languages)
- Programming Languages (Logo for Windows, Turbo Pascal, Visual Basic, Prolog)
- Theoretical Aspects of Informatics (Program Verification, Program Synthesis)
- Applications (Textprocessing, Graphics, Databases, Spreadsheets, Statistics)
- Desktop Publishing
- Hypertext and Multimedia
- Communications (e-mail based school projects, BBS, global networking)
- Other .

These "self-definitions" of further training needs are useful, but teachers will not be left to determine completely by themselves what they need. It is the training team who will make the final decision about the emphasis in the content of the training and about the style of using IT in education which will be promoted by the Centre. In this sense, creating a feeling and appreciation of using open learning environments will be stimulated. As far as application software is concerned, a project-oriented style will be followed. Teachers will be stimulated to search for cross-curricular projects.

2.2.3. Course materials

The training team has the ambition to provide the teachers with relevant materials in Bulgarian. A set of handout materials was developed by the trainers for each module of the initial course. Each set consists of a reference part (structured information about the module itself) and a methodical part (teaching notes and hints for possible classroom applications). These materials were given to the participants at the beginning of each module. Thus each participant had a handy copy of necessary and useful information to use during the course and take home at the end. This turned out to be essential also for overcoming the language barrier - all the accompanying documentation which schools get, together with the equipment, is in English.

2.2.4. Evaluation.

At the end of the initial course the participants were invited to fill in (anonymously) a *Course Evaluation Sheet*. They were invited to share their impressions, opinion and recommendations as relating to:

Course structure and organisation;

Each module in the programme, according to:

- content,
- teaching performance,
- adequacy, sufficiency and quality of the handout materials prepared by the instructor,

Other comments

This provided a useful feedback and will be taken into account for the next courses.

2.3. Further support..

2.3.1. Studying the needs.

During the initial course the level of competence and needs of the participants was studied on the basis of specially developed questionnaires. The information collected gave the Teacher Centre coordinator an impression of the individual teacher's needs and helped him form a better view of the appropriate future activities of the Centre. Here are some details about the questionnaires:

The *Participant's Profile Questionnaire* is aimed at compiling a project on the participants' database and comprises the following items:

- full address for correspondence;
- current position;
- professional background and qualification;
- track of in-service training;
- experience in teaching and using IT at school;
- areas of competence;
- areas of interest;
- English language skills.

The teachers were also asked about the RESOURCES AND FURTHER SUPPORT by the Centre they would welcome:

- Literature (topics, acceptable languages).
- Software
- Specially developed materials for teachers (to be specified)
- Specially developed materials for students (short references, worksheets, etc.)
- Expectations and suggestions relating to the Teacher Centre's future activities.
- Suggestions on the form of contacts and co-operation with the Centre.
- Other.

2.3.2. Providing Information and Communication Resources.

A small library collection was gathered and made available to the teachers. It contains recent books on Computing and Education, textbooks in Informatics, Reference Guides and Handbooks, periodicals. The next step is to establish a software library.

A telephone "hot-line" is open for the teachers to contact the Centre when problems arise in their own school settings.

Providing Internet connection for the Centre and establishing e-mail links among the participating schools is also a priority task for the near future. A Bulletin Board System could also be a solution for providing information and communication.

3. A CONCEPT FOR FUTURE TEACHER DEVELOPMENT SUPPORT

On the basis of the experience gained so far and the analysis of the filled in questionnaires, conclusions were made and a concept for further teacher development support was developed. It was recognised that Resource and Training Centres (RTC) for teachers using IT is a necessity and it should act as a focal point offering up-to-date information, courses, seminars, discussions, software demonstrations and continuing support for teachers. These should include:

3.1. Information services.

The RTC team has to permanently search for up-to-date information about research and developments in the field of IT in Education. Having an Internet connection and access to relevant publications, international conferences and expert groups meetings is essential. Special arrangements with hardware, software and publishing companies for a regular supply of relevant materials would be helpful.

Inexpensive and reliable communication links between the teachers and the RTC are required: telephone "hot-line", fax, e-mail connection, an RTC newsletter, bulletin board system.

RTC should provide library facilities for teachers. These should not only have books and periodicals, but also copies of diploma theses on relevant topics. A software library must also be maintained.

3.2. Training.

A research approach - integrating research and practice - has to be adopted in RTC [6]. A team of specialists and trainers has to be formed at RTC to discuss and decide on the content of training. A modular training scheme has to be developed [3]. Careful planning for a continuing training is necessary, taking into account the existing pre-service training programs and aimed at establishing a smooth relation between pre- and in-service training. Links and collaboration between MA students in Mathematics and Informatics and in-service teachers can be beneficial.

A *teacher-centred model* [5] has to be adopted - the training scheme must be individualised as much as possible and the support offered must take into account the concrete situation - tasks and school environment - in which the teacher works. Flexible forms of delivery of the courses have to be found - full and part-time courses, optional short modules, school-based training, distance delivery.

3.3. Continuing support.

Keeping teachers informed about new developments in the field has to be an important task of the RTC. This should include discussions between experts and practitioners to find out the most appropriate way of IT application in education as a whole and in a particular setting.

"Listening to the teachers" - the RTC must provide a forum for teachers to express their needs and findings; to exchange ideas, experience and examples of good practice between themselves. This could be done personally (seminars, discussions) or in an electronic form (e-mail, BBS), or through a newsletter.

Building a national human network of specialists and practitioners ready to devote some of their time to help solving teachers' problems would be helpful and useful. Communication in this network should be supported electronically as well.

RTC has to help teachers in the establishment of international contacts for a collaborative work in international educational projects.

Creating a stimulus for teachers and contributing to a higher social esteem (formal and informal) of teachers working with technology should also be a RTC task. Encouraging and supporting future teachers to participate in the development of teacher and/or student-oriented materials and in the development of courseware and educational software could be motivating.

If RTC proves to be successful, local branches in different geographical regions can be established. These could be build around active and future teachers.

VII. THE CONTRIBUTION OF PROSVETA PUBLISHING HOUSE TO THE TEACHING OF INFORMATICS IN THE SECONDARY SCHOOLS IN BULGARIA

There is a long-standing tradition in every Bulgarian family to respect the scholar. Most parents strive to provide as good education for their children as possible. This ambition of the Bulgarian to study was one of the reasons - even 170 years ago when the nation was still under the Ottoman yoke - for publishing a *Primer with different instructions.*

For 50 years every Bulgarian has begun to learn the alphabet from the primers published by *Prosveta* Publishing House. *Prosveta* has published and is still publishing textbooks, supplementary school and methodological books. The publishers strive to publish books with the latest scientific information.

The development of informatics has not missed the attention either of Bulgarian scientists nor of *Prosveta*. The books published on informatics confirm this statement.

We shall trace the publishing of textbooks and books separately in this paper beginning with *Cybernetics and thought* by Konstantin Kostov, which was published in 1969 (1). It is a matter for debate whether to include this book in informatics literature but we have decided to do so since in it, for the first time, thought is discussed as an object of management. Seven years after the subject

Programming was included in the curricula for the mathematical classes in some schools and mathematical schools in 1974 *Algorithms and Their Preparation for Machine Realisation* (2) by Miroslav Ivanchev was published. The book was addressed mainly to teachers of informatics, because until that time a textbook had not been published. The book included short preface on the theory of algorithms and an elementary idea of machine languages and description of FORTRAN IV was presented. The examples of algorithms were related to the already studied material in algebra, geometry and numerical methods.

In 1978 four books were published on informatics. These were among the first books addressed specifically to students in Bulgaria. The first of them was *Elementary Knowledge of Cybernetics* (3) by T. Boyanov. It was addressed to a wider circle of readers - these eager to learn could become acquainted with terms like information, its measurement, information structures, algorithms and management.

The second book was *Algorithms* (4), written by P. Barnev and P. Azalov. General information about algorithms and their presentation through block diagrams was given in the book, and a number of concrete algorithms connected with funny questions and serious problems.

The principal construction of computers was presented in the third book published in 1978 called *Mathematical Bases of Computers* (5) by Hristo Hitov. This book was addressed to students and treated historical information, elements from the Boolean algebra, and the presentation of data in computers.

The last book, published in 1978 *Information and Management* (6) written by P. Barnev, was addressed to teachers. The meaningful terms information and management are explained in it.

The coming of information systems as helpers in all spheres of life was the reason in 1981 why A. Radensky's *Information Systems* (7) was published. It explained the essence of information systems using examples, and then discusses database management systems through which they are realised.

The book *Algorithms and Algorithmic Computing* (8) by D. Skordev as one of the series for students *Alef* was published in 1981. Some basic ideas from a relatively new field of mathematics - the theory of algorithms are discussed in the book. It tries to express in a simple way these ideas to students.

For teachers, who know the classic parts of elementary mathematics and wish to know the fundamentals of programming in 1983, a second book by A. Radensky *Mathematics and Programming* (9) was published. It shows the connection between some traditional methods for solving classical mathematical problems and methods for solving problems using computers.

For students with a great interest in maths and informatics a new series of books introduced was *Mathematics and Informatics - Extracurricular Work*. Within a period of six years, six books on informatics were published in this series. The first book, published in 1985, was *FORTRAN in Examples and Problems* (10) by P. Azalov. By giving a number of examples the language FORTRAN is explained. Problems given at students' competitions were also included in the book. In 1985 the next book from the same series was published, namely *Coding of Information* (11) by St. Dodunekov and I. Denev. Its aim was to provide opportunities for the serious students to get acquainted with elements from the theory of coding. In 1986 the first *Pravets* computers (Apple-2 compatible) were produced in Bulgaria but there was no available book for these wanting to work with them. So the book *Computer for Beginners* (12) by Morgan was translated into Bulgarian. It offers a system for learning on *Apple*, and its introduction, written by T. Boyanov, differentiates between *Pravets* and *Apple*.

From 1986/1987 informatics began to be studied in all schools. Students have already studied programming at school. At that time the book *Datastructures* (14) by P. Azalov and F. Zlatarova was published. With the knowledge from that book, students and specialists could make a qualitatively new step towards improving programming and also improve their style of making programs. With the expansion of the production of computers *Pravets* children also had more free access to computers and, as usually happens, children were the first to overcome the barrier of working with them. However, there was no book available for children. Thus we published the book *I Can Program at the Age of 9* (17) by P. Stanchev, which discussed an elementary course in programming on Basic for small children.

There were schools in which children started using computers at an early age on the Logo language. The authors R. Nikolov and E. Sendova have had great experience in their work with children and they offered the book *Informatics for Beginners* in 2 parts (23), (24). The ideology of the Logo language was explained in them and ready computer programs were used in the working up of the themes.

In 1990 *Basic in Examples and Problems* (28) by Rahnev, Garov, Gavrilov was published. The very title of the book reflects precisely its contents. Using it the reader learns some methods of programming. It includes also problems given at students' competitions.

So far we have presented in succession published by Prosveta dealing with questions from informatics books which filled the vacuum existing because of the lack of textbooks. But they also served as the basis for the writing of textbooks.

Now we shall consider the textbooks publishing for the 2 stages of the secondary comprehensive schools.

In 1967 the subject "programming" was included with a resolution from the Ministry of Education in the curriculum of some mathematical classes and mathematical schools, as we already mentioned. Until that date no textbooks had been published for these students. That was not an omission on the part of the publishers as textbooks are published only if ordered by the Ministry of Education.

The curriculum for 1986/1987 provided for the second school term informatics to be studied as a separate subject. So the Ministry of Education assigned *Prosveta Publishing House* to publish two textbooks on informatics for the students in 10th and

11th grades (15), (16) and (18), (19). These two textbooks written by different teams of authors - Barnev, Azalov, Dobrev, Bisterov and Angelov, Gavrilov, Garov - with different syllabuses aimed at teachers in informatics to enable them to choose the appropriate textbook for their students. The textbook by Barnev, etc. explain basic questions from informatics illustrated by the language of Basic while in the other textbook by Angelov, etc. programming on Basic prevail. Students who studied using that syllabus could choose the second stage of education which had a different duration. For the students studying in educative industrial schools where informatics was taught, three textbooks were published by Prosveta:

In 1986 *Informatics for 11th Grade (II stage)* (13) by M. Barneva and S. Stoykov; *Operating Systems* (27) by A. Hachikyan, A. Rahnev and K. Garov; *Programming and Algorithmic Languages* (29) by P. Azalov (1990).

Education in 8th Grade began with new syllabuses in 1988. These textbooks treated elements solely from informatics. For this batch of graduates textbooks were published in mathematics written by two teams of authors. The first one, led by Sendov, wrote *Mathematics and Informatics* in 4 parts (20), the second wrote separate textbooks in algebra, geometry and optional maths. The two teams used different approaches to the writing of their textbooks. The textbooks written by Sendov, etc., republished in 1992, contained "information corners" which presented programs with the language Logo and that approach continued in the textbooks for 9th, 10th and 11th grades. The textbooks for 8th grade in algebra by other team of authors has elements from the language of Basic.

In 1989 textbooks by two teams were published for 9th grade students. One by Barnev, Azalov, Dobrev and Bisterov, *Informatics for 9th Grade* (21), treated programming by INFO (hypothetical language), and for each example in the lab, practice was given with a version in Basic.

The textbook was republished in 1992 with the title of *Informatics I* (30). The basic examples for programming also contained the programs in Basic and Pascal.

The other team, led by Sendov, wrote a textbook in informatics under the title of *Mathematics and Informatics*, part I. The language of Logo was used. The second edition of this textbook is *Informatics I - a Reference Book* (31).

Two textbooks in informatics for 10th grade students were published in 1990. They were also written for different syllabuses. *Informatics for 10th grade - a Reference Book* (25) by Barnev and Azalov does not use any concrete language for programming while the other textbook written by Sendov, etc. again uses the language of Logo (26).

The second unrevised edition was published under the title *Informatics II - a Reference Book* (32).

The authors Barnev and Azalov of *Informatics II* had new ideas for this textbook and the Ministry of Education ordered it to be rewritten as the main textbook with five appendixes separately. Thus the new textbook *Informatics II* (33) by Barnev and Azalov was published in 1993. The five appendixes *Word-processing* (34) by Azalov and Zlatarova, *Database* (35) by Azalov and Kouneva, *Spreadsheets* (37) by Azalov and Hikov, *Bureautics* (38) by Barnev, *Computer Graphics* (37) by Barnev, Banchev were published in 1994.

The last textbook written by Azalov and Zlatarova is *Informatics with Pascal - a Reference Book* (39). The Ministry of Education announced a competition for its publications. From the three applicants *Prosveta* Publishing House won the competition and the textbook was published. We have given a complete survey of the published by Prosveta books and textbooks in informatics until today. We firmly believe in our contribution to the teaching of informatics.

APPENDIX A

List of books and textbooks in informatics published by Prosveta

No.	*TITLE*	*AUTHOR/S/*	*YEAR OF PUBL.*
1.	*Cybernetics and Thought*	Konstantin Kostov	1969
2.	*Algorithms and their Preparation for Machine Realisation*	Miroslav Ivanchev	1974
3.	*Elementary Knowledge of Cybernetics*	Todor Boyanov	1978
4.	*Algorithms*	Peter Barnev, Pavel Azalov	1978
5.	*Mathematical Bases of Computers*	Hristo Hitov	1978
6.	*Information and Management*	Peter Barnev	1978
7.	*Information System*	Atanas Radensky	1981
8.	*Algorithms and Algorithmic Computing*	Dimitar Skordev	1981
9.	*Mathematics and Programming*	Atanas Radensky	1983
10.	*FORTRAN in Examples and Problems*	Pavel Azalov	1985

11.	*Coding of Information*	Stephan Dodunekov, Yordan Denev	1985
12.	*Computer for Beginners*	Morgan	1986
13.	*Informatics for 11th Grade /II stage/*	Margarita Barneva, Stoyko Stoyanov	1986
14.	*Datastructures*	Pavel Azalov, Fanny Zlatarova	1987
15.	*Informatics for 10th Grade*	Barnev, Azalov, Dobrev, Bisterov	1987
16.	*Informatics for 10th Grade*	Angelov, Gavrilov, Garov	1987
17.	*I Can Program at the Age of 9*	Peter Stanchev	1987
18.	*Informatics for 11th Grade*	Barnev, Azalov, Dobrev, Bisterov	1987
19.	*Informatics for 11th Grade*	Angelov, Gavrilov, Garov	1987
20.	*Mathematics and Informatics for 8th Grade, p. I, II, III, IV*	Sendov et al.	1988
21.	*Informatics for 9th Grade*	Barnev, Azalov, Dobrev	1989
22.	*Mathematics and Informatics for 9th Grade, p. I, II, III, IV*	Dicheva, Nikolov, Sendova	1989
23.	*Informatics for Beginners, p. I*	R. Nikolov, E. Sendova	1989
24.	*Informatics for Beginners, p. II*	R. Nikolov, E. Sendova	1989
25.	*Informatics for 10th Grade*	P. Barnev, P. Azalov	1990
26.	*Mathematics and Informatics*	Dicheva, Nikolov, Sendova	1990
27.	*Operating Systems*	Hachikyan, Rahnev, Garov	1990
28.	*Basic in Examples and Problems*	Rahnev, Gavrilov,	1990
29.	*Programming and Algorithmic Language*	Pavel Azalov	1990
30.	*Informatics I /II ed./*	Barnev, Azalov, Dobrev	1992
31.	*Informatics I*	Dicheva, Nikolov, Sendova	1992
32.	*Informatics II*	Barnev, Azalov	1992
33.	*Informatics II*	Barnev, Azalov	1993
34.	*Word-processing*	Azalov, Zlatarova	1994
35.	*Database*	Azalov, Kouneva	1994
36.	*Spreadsheets*	Azalov, Hikov	1994
37.	*Computer Graphics*	Barnev, Banchev	1994
38.	*Bureautics*	Barnev	1994
39.	*Informatics with Pascal*	Azalov, Zlatarova	1994

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NATIONAL REPORT OF BURUNDI

NEW INFORMATION TECHNOLOGIES (NIT) IN THE EDUCATIONAL SYSTEM OF BURUNDI

The use of information technologies in the system of education of Burundi cannot be considered as widespread. The situation·in this field is close to critical, on the one hand, because of the lack of finance, and on the other, because of inadequate attention paid to timely application of NIT in the educational system and all advantages they can give to a user.

First steps in this field were made around 60s, when tape-recorders, compact-cassettes for languaue studies, slide-projectors, educational films etc. were first used as teaching aids. But these educational tools were not used to a full extent at secondary schools, especially in case of Church-run schools.

SCHOOL RADIO

In 1975 in the framework of the Program of the Education Bureau responsible for primary schools curricula, the Rural Schools Education Bureau (RSB) initiated so called School Radio with the aim to improve a professional level of teachers and to broadcast educational programs for school students and general public.

The programs of school radio were started at local broadcasting stations, at which all programs including educational ones were made by professional producers. At that time , they faced a lot of problems with hard- and software.

In 1979 a decision was taken to form an autonomous RSB-based "Regi-Studio" system for school needs only. The project was accoplished under UNICEF and French assistance. The programs were produced and recorded by the RSB and broadcasted over local channels of the National Radio.

School Radio provides educational programs for primary school teachers, and students through nourishing their constant interest to the process of learning by means of all sorts of radio-competitions.

Here is an example of School Radio broadcasting schedule:

day	time	program type	audience
Tuesday	3pm	preparatory programs	primary school students
Thursday	8pm	teachers' information	teachers and parents
Friday	3pm	preparatory programs	primary school students
Saturday	4pm	games & competitions	teachers, students, public

Thursday and Thursday programs are just only for school year period while the rest are broadcasted even at vocation time.

Saturday competition programs are used in primary or secondary classes as educational and instructive simulation games.

The format of a program can vary from a lecture-type to pure informative or containing elements of a competition game or a reportage. The progams can be used by teachers for enriching their teaching experience. According to them the programs help to prepare classes and to use teaching aids. Any of novel teaching tool is immediately reflected in broadcasting and incorporated into teaching process.

CURRENT PROBLEMS

- the majority of teachers are extremely busy working at two jobs and they cannot sacrifice classes to get time to listen to the radio;

- there is no proper feedback system; the broadcasting producers therefore cannot use teachers requests in later releases.

- teachers request model RSB lessons on the subjects which are considered complex. Unfortunately, radio broadcasts can reach only auditory recepters of the audience. Radio cannot show pictures, graphs and tables.

A possible solution could be found through use of audio-visual tools. TV sets must be used both at primary and secondary schools.

TV PROGRAMS

The Telecommunicaions Section of the Education Bureau and Secondary School Program has its own airtime on Television - half an hour a week beginning with February 1996. This program consists of five headings:

a). INFO

This heading covers some urgent news items from:

- EBSSP Directorate and other Ministerial Departments
- EBSSP Publications
- School Administrations which can provide interesting information on their schools

36 stories mainly about secondary school were issued under this heading. However, after December 1992 this program ceased to exist as it covered a problem of possible leadership change far too often.

b). "Come on, find an answer"

This heading deals with competition games for students. Participants are asked questions relating to general intellectual development of a child. Winners get prizes.

c). "Do you know?"

This heading covers specific EBSSP-based documentary projects.

Among numerous accomplished projects were:

•Bujumbura Port

•weather forecast
•calculations
•chimp
•snakes
•COTEBU
•deaf and dumb' programs
•hydroelectric dam

d). "Let's talk frankly"

This heading covers some problems of school life. Every month a new topic is chosen to be discussed in four sessions. The first session is normally an introductory one providing a general presentation of the problem. The second gives a chance to several participants to speak out their viewpoints on the problem. The third is run with expert participation on the issue. The fourth deals with the letters and responses received during the program time. Several programs on school failures, how to learn to learn, buildings repairs, water and hygiene, sexuality of the young, have been issued under the heading.

e). "IRABIR"

This heading has as its aim an introduction of trades which students can opt in the future.

Conditions of using School TV.

Environment in schools may differ. Out of the list of 16 schools, selected at random, all 16 have TV facilities (all in all there are 68 secondary schools, to say nothing of colleges. 80% of them have TV sets).

3 TV are out of working condition

1 recorder is out of work

4 recorders stolen

3 schools do not receive National Padio or Television at all

many (12) schools have a problem with students, namely, those who watch TV take their seats first, while the rest cannot find a seat to watch a program. In many schools the TV center is placed in a small room with windows overlooking the inner yard so that the students may watch TV programs through a window. The number of viewers may exceed 500.

INTERNATIONAL CONCORTIUM ON DISTANCE LEARNING TECHNOLOGIES IN FRENCH-SPEAKING COUNTRIES - ICDLTFSC

In 1992 a distance learning project was created by ACCT especially for Burundi.

The project is designed for transmitting French courses for non-qualified secondary school teachers, i.e. teachers who work and study at universities at the same time and those who haven't been trained to teach in French or those who haven't got a higher education in teaching.

In summer 1992, university professors who developed the distance education program and who wished to up-date it, created an AD program for further training of French teachers at secondary level.

The team of teachers of French was formed to update the program in several days. Now the trainees can learn the materials, form their own vision of the program and use methods of distant training in their work. Trainees can take home the materials, a student's guide and a questionnaire in which they can express their opinion with further return to ICDLTFSC.

All these undertakings are aimed at improving the program which was subject to criticism at the Closing Session in Bordeaux.

According to ICDLTFSC project at its advanced stage it was planned to open a new French school. Unfortunately, necessary documentation was not signed on time and the crisis that later broke out in the country made it impossible to continue experiments in this field.

However, the development of FAD concept of preparing materials goes on. Distance education is supposed to be included into the process of teaching in the nearest future.

COMPUTERS AND SOFTWARE.

We could say that the process of computerisation had little effect on the school sector (leaving aside Technical Schools and some University departments).

At the Central Administration level each separate agency (Departments, General Directorats, Offices, Ministerial services) is equipped at least with one computer and is using WP, LOTUS, EXCEL, and Dbase software.

There is a re-training center in Bujumbura for teaching office employees to use this software with respect to their functions. There are a lot of privat centers as well, that provide paid training in computer science. Many office workers refered to these services in order to learn how to use WP/Dbase, Lotus, Windows and other software.

DIFFICULTIES OF INTRODUCING NEW TECHNOLOGIES INTO TEACHING

- shortage of man-power that could widely introduce NIT into teaching process;
- lack of finance for prompt introduction of NIT into teaching process;
- problem of distant location of most rural schools from major communications and power grid which impede introduction of NIT into teaching;
- lack of due attention to NIT introduction into teaching.

PARTICIPATION IN INTERNATIONAL PROJECTS ON NIT APPLICATION

At present in Burundi there is a shortage of professional staff participating in International programmes on NIT application.

The participation in the Second International Congress UNESCO will be useful to the country. We hope to get much new and useful information on NIT application out of international cooperation. Burundi will consider international experience of, for instanct, TV-education to be able to form her own plan of applying this new leading system into National education.

PRESENTED BY
THE MINISTRY OF HIGHER AND SECONDARY EDUCATION AND ACADEMIC RESEARCH

NATIONAL REPORT OF CHAD

PREFACE

Chad, as it will be illustrated in this Report, is far behind in teaching of new information technologies. This gap is clearly observed on the levels of higher, secondary and technical education. Among the various reasons of this situation, one should point out the political instability, that has deorganized the country's education system.

The stabilizing measures have certainly been undertaken, but the absence of national policy in the informatics sphere, the lack of funds and qualified personnel still remain the main obstacles on the way of informatics development in Chad.

Crucial steps must be taken in the shortest possible time before the situation becoms irreversible. Probably, the channels of information transmission is the solution? Chad must find the answer shortly.

1. THE PRESENT-DAY SITUATION

THE NDGAMEN UNIVERSITY

The Faculty of Exact and Applied sciences

Computer facilities of this Faculty include:

1. Laboratory

- 2 IBM-compatible computers PC 80286;
- 1 IBM-compatible computer PC 80386;
- 1 computer IBM PC 80286;
- 1 computer «Macintosh», classical type;
- 1 computer «Macintosh» , IICX type;
- 1 printer of Image Writer II type;
- 1 printer Epson LX-800.

2. Office of Math Department Director

- 1 computer Compaq Prolinea 486.

3. Dean's secretariat

- 1 computer «Macintosh», classical type;
- 1 computer «Macintosh», DC 475 type;
- 1 printer of Image Writer II type.

4. Dean's office

- 1 computer «Macintosh», classical type;
- 1 printer of Laser Brother type.

Computer laboratories are intended for the second year students of Faculties « Mathematics and Physics» - 15 students, «Physics and Chemistry» - 15 students, « Natural Sciences» - 50 students and for 10 students of technical Faculties. The curriculum offers introduction courses on MS-DOS operation system and programming language Turbo Pascal. The disciplines are taught by two part-time teachers.

The project

The project of creation of informatics department has been worked out by the Technical College of the Orleans University for the Faculty of exact and applied sciences.

The project's fulfillment plan:

- year (n-2) - year (n-1): training of teaching and operating personnel;
- year n: introduction of the first year of studies (15 students, 32 weeks with 15 hours per week);
- year n+1: introduction of the second year of studies (10-12 students, 22 weeks with 15 hours per week and 10 weeks for field training at an enterprise).

Curriculum and teaching hours

Discipline	**1st year**	**2nd year**
Informatics	480	330
Mathematics	160	110
Management	160	110
English Language	80	55
Communication studies	80	55

The assessment of computer classroom construction
(in French Francs without taxation)

Items	Quantity	Sum
Tables and chairs	-	30 000,00
Micro-computers DX4100 RAM 8 Mb HDD 420 Mb Monitor 15Inc Ethernet cards Ne 2000, compatible	15	135 000,00
Server Pentium 90 MHz 16Mb HDD 2 GB Ethernet/bus cards PCI Monitor 15Inch CD-ROM discs	1	20 000,00
Inverter and anti-overload device	16	32 000,00
Laser printer HP4ML	2	15 000,00
Wiring	-	10 000,00
Total		242 000,00

The Analysis of the business circles' opinion on the necessity of informatics studying has proved the existence of demand (though limited , but real) for specialists in informatics of a senior technician qualification level. According to the Survey's conclusion, it is necessary to train highly-qualified technicians, possessing the following skills:

- operation of complicated information network system, that can be used simultaneously by several people;
- provision of an access to information and data compatibility in the system «Client-Server».

The Faculty of Law and Economics

Computer facilities of this Faculty include:

1. Laboratory

- 2 IBM-compatible computers PC 80286 (two of them are out of order);
- 1 dot printer (out of order).

2. Dean's secretariat

- 1 IBM-compatible computer PC 80286;
- 1 IBM-compatible computer PC 80486;
- 1 dot printer Epson LX-800;
- 1 dot printer Epson LQ-1070 (out of order);
- 1 printer of Laser Brother type (out of order).

Training is available from the first to the third year to 300 students of the «Economics» specialization. The discipline is taught by two teachers. The curriculum consists of:

1st year: operation system MS-DOS, WordPerfect and Lotus;

2nd year: introduction into programming , based on Turbo Pascal language;

3rd year: introduction into algorithmics, Dbase III+.

The secretariat of the Faculty of Law and Economics uses information tools daily. But the «Personnel control» function is not computerized in most of the faculties of the University and this causes mistakes and time expenses.

The Faculty of Philology and Humanities

In comparison with the others, the Faculty of Philology and Humanities is the best equipped one and it has the following computers for scientific research at its disposal:

1. Linguistic Department

- 1 computer «Macintosh» LC 630;
- 1 computer «Macintosh» LC 475;
- 1 printer StylWriter II;
- 1 printer Laser Writer 320.

2. Philological Department

- 1 computer «Macintosh» LC 320.

3. Geographic Department

- 1 computer «Macintosh» (multimedia);
- 1 printer StylWriter II.

4. Geographic Department

- 1 IBM -compatible PC 80486;
- 1 dot printer Epson LQ 1070.

5. Dean's secretariat

- 1 IBM -compatible PC;
- 1 dot printer Epson LX 800.

With the exception of the Office Informatics Course for post-graduates (16 students), this faculty doesn't offer any teaching courses of informatics.

Medical Faculty

Medical faculty doesn't practice the studying of informatics course, and all the equipment (one IBM-compatible computer PC and a printer Epson LQ 1170) is used for administrative purposes.

National Institution of Humanities

The National Institution of Humanities is equipped with one IBM-compatible computer PC and a printer Epson LX 800, used for administrative purposes. Though put in the curriculum, informatics and statistics haven't been studied in this institution because of the absence of laboratory, equipped with the corresponding hard- and software.

Central University Library

The Central University Library and its four divisions (Library of Exact and Applied Sciences, Humanitarian and Philological Library, Library of Law and Economics, Medical Library) has one IBM-compatible computer PC and a printer for control of their funds. In 1990, supporting the informatization process, the French partners granted the University 18 micro-computers, 12 printers, a large amount of expendable material. But the lack of funds has actually ruined the program and, though part of the personnel has learnt the software for word processing, it cannot be of practical use because of the lack of equipment.

University Administration

The University Administration possesses:

1. Rector's secretariat - 1 IBM-compatible computer PC and 1 printer LaserJet 4M;
2. Deputy Rector's secretariat - 1 IBM-compatible computer PC and 1 printer LX 800;
3. Chief Secretary 's secretariat - 1 IBM-compatible computer PC and 1 printer Laser Brother;
4. Personnel service - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070;
5. Bachelor training service - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070
6. Central service of school training - 1 IBM-compatible computer PC and 1 printer Epson LQ 1070.

Computer is daily used by all the University Administration services. The best equipped sector is the Bachelor training service, the worst equipped - the Central service of school training.

CENTER OF INFORMATION PROCESSING

According to the PRIMTAF project, Canada presented 19 micro-computers, 8 printers, software and expendable materials to the University of Chad in 1995. A part of this equipment (12 IBM - compatible computers PC, linked in the network; one printer LaserJet 4MP; one printer DeskJet 560c; two printers Epson LQ 1070) was transferred to the Computer center, aimed at training as upgrading or re-training of people, working in governmental, mixed and private sectors.

Software of the Center of Information Processing and the Ndgamen University:

- Text processing: Word 6.0, WordPerfect 5.1, WordPerfect 6.0;
- Table editor : Excel 5.0, Lotus 1,2,3;
- Databases: Dbase III+, Dbase 5.0, FoxPro 2.6, Clipper;
- Control: Ciel (accounting), Saari Major (business control), Saari Major (accounting), Saari Major (wages).
- Documentation flow control: Texto;
- Project management: Project Bridjet Modeler, Project Workbench, Microsoft Project;
- Integral functions: Works 3.0;
- Graphics: MapInfo 3.02, PowerPoint;
- Statistics: SPSS;
- Polls: Survey Pro;
- Programming languages: Turbo Pascal, Turbo C, Basic.

NATIONAL CENTER OF SCIENTIFIC RESEARCHES SUPPORT (NCSRS)

At the National Center of Scientific Researches Support every service has its own modern micro-computer. Recently, a new computer network has been installed in the Publishing Department. The Manager of this Department has taken a 3 months' training period in France.

As the consequence of the visit of one of the Center's representatives in Dakar in May 1995, NCSRS has managed to arrange for the installation of an INTERNET provider at its premises. Unfortunately, the Chad's network is not linked with the international network, though this problem is being under discussion.

On October 27, 1995 the American delegation, headed by the United Nations Development Program adviser made evaluation of the situation in Chad. They declared about a possibility of granting necessary equipment and linking to international network, but the problem still remains unresolved. By now, only several international organizations (including the UN Development Program) are linked with this network.

NATIONAL INSTITUTION OF PUBLIC WORKS

Curriculum of the Institution pays proper attention to informatics. It has the following equipment:

- 1 IBM-compatible computer PC 80286 at Secretariat;
- 3 IBM-compatible computers PC in the Departments, dealing with basic training;
- 3 IBM-compatible computers PC 80486 in the system of professional upgrading and re-training .

Possessed software: Word 5, Winword, Autocad, Page Maker.

Project: National Institution of Public Works expects financing for the new computer-information center, which will be equipped with:

- 6 IBM- compatible computers PC Pentium;
- 1 drawing table of A3 type;
- 2 laser printers;
- 1 color laser printer ;
- CD-ROM Drivers.

CENTRAL SERVICES OF EDUCATION SYSTEM

The majority of the Departments of the Ministry of Education have informatics tools at their disposal for managing administrative problems. Some operation services, listed below, are equipped better then the others.

1. Statistics Department

Facilities - 4 IBM-compatible computers PC

Software - Word 6.0, WordPerfect 5.1, Excel 5.1, Lotus 1,2,3, Dbase IV.

2.Evaluation and Control Department (evaluates and controls the qualification level of teachers and the extent of students' knowledge).

Facilities - 3 IBM-compatible computers PC, 3 laser printer, 2 portable computers.

Software - Word 6.0, Excel 5.1.

HIGH INSTITUTION OF PEDAGOGICAL SCIENCES

Today , the students of the High Institution of Pedagogical Sciences don't study informatics. The limited micro-informatics course is organized in the framework of the «Teachers Training» program and the «Educational Masters Training program.

Equipment:

- for current administrative problems settling - 8 micro-computers, 1 portable computer, 1 printer.
- for teaching process - 2 micro-computers;
- for school printing facilities - 1 micro-computer

Software : Word 6.0, WordPerfect 5.1, WordPerfect 6.0, Excel 5.1, Lotus 1,2,3, Dbase IV.

Project: furnishing of a computer class with the equipment for teachers training.

TECHNICAL COMMERCIAL LYCEE

Informatics is not studied in the Technical

Commercial Lycee.

Equipment: 2 computers IBM PC XT (for the management)

Software: WordPerfect 5.1, Lotus 1,2,3, Dbase.

Project: to purchase 20 new computers under the program «Education - Occupational training - Employment» .

TECHNICAL INDUSTRIAL LYCEE

Informatics is not included in the curriculum. Micro-computers, used by the Administration, broke down many months ago.

FELIX EBOUE LYCEE

The Association of Students' Parents was planning to buy two micro-computers in the school year 1995/96.

* * *

The acquaintance with the role of informatics in large organizations of the Capital gives no hope that the situation in provincial lycees and colleges may be better. With state education system failing to provide informatics studies, there are private schools that include informatics courses (mostly for settling administrative problems) in their curricula. The largest of them are the Center of Occupational Training and Upgrading at the Ndgamen Chamber of Commerce and the High Management Institution.

2. STANDARDIZATION POLICY

There is no standardization policy for new information technologies in Chad. However, in the framework of the program «Education - Occupational training - Employment», the priority is given to the studies oriented to market needs and employment. As informatics is thought to be a necessary field of knowledge, one should expect the standardization policy to be worked out in a short time.

3. DIFFICULTIES

Obviously, Chad is falling behind in studying new information technologies. There can be a number of underlying reasons:

- political instability disrupting the whole education system;
- low level of National Revenue compelling the government to settle only the most vital problems. In the sphere of education the government can afford to finance the minimum program, based on the cheapest technologies;
- insufficient skills of teachers. The majority of them haven't received proper knowledge and are unable to estimate the advantages of new technologies and promote their studying.
- difficulties with the uninterrupted electricity supply which is, by the way , the most expensive in the world. Numerous unexpected disconnections cause the loss of time and data and break computers down;
- absence of well-equipped technical services. Computer's breakdown is known to be a catastrophe.

These factors themselves don't explain the gap. The weak political will at the national level should be added to the list. Otherwise, it is impossible to understand the absence of informatics courses in curricula of the most prestigious colleges of the country.

4. SUGGESTIONS

In order to narrow the growing gap, Chad has to establish the National Body , accumulating human, material and financial resources, for elaboration of programs, fitting the political strategy of the country.

After the Congress closing it is necessary:

to arrange a national seminar on the problems of new technologies role in education system and in occupational training and their significance as of Chad's development factor;

to establish a national body promoting new technologies studying and their introduction into companies' and government bodies' activity.

All the measures, that should be taken, can be divided into the main groups:

Step 1

- analysis of the present situation;
- elaboration of a general plan;
- evaluation of needs;
- making out an operation graph.

Step2

- teachers training;
- working out teaching programs;
- promoting informatics studies in the University;
- executing experimental programs

Step 3

-inclusion of new information technologies studies in secondary technical and occupational education

Step 4

- inclusion of new information technologies studies in secondary education system.

* * *

Naturally, studying new information technologies can't be successful without changes in the professional sphere. But this process requires favorable environment for application of informatics in all spheres of life. This purpose can be achieved with the help of seminars and upgrading and re-training programs.

NATIONAL COMMISSION OF CHAD FOR UNESCO

NATIONAL REPORT OF CHILE

1. INTRODUCTION

The given report presents the major results of the Enlaces Project second year official implementation (Enlaces Interconnection). La Frontera University is responsible for the project development for the 4-year period since March 1993 in Araucania area and in lesser degree in other regions. The Enlaces project in the capital district is being coordinated by the Pope Catholic University of Chile.

Main objective of the Enlaces Project is to organise a net of educational centers for studying contents, costs, positive and negative sides of initiatives in the field of Educational Informatics. The Project includes the evaluation methods for its results and is aimed at defining the part of computer technologies and telecommunications for municipal schools, especially, in state funded, which do not possess oflarge budget.

By December 1994 there were 81 centers and 19 establishments in the network. Major part of them are situated in the 9th District including Angol, Vilcun, Lautaro, Temuco, Pitrufcen, Viliarica, Freire and Gorbea. The project base was yet enlarged due to agreements with Concepcion University and Los Lagos University in Osorno. These educational establishments and subnets in Santiago (Pope Catholic University), in Viliarica (the same) and in Angol (La Frontera University) enable setting of the basis for future decentralized growth. There are already three rural schools involved, two of them operating with mobile phones and one directly with radio.

The Net covers schools as a result of projects' tenders and it depends upon the equipment available and switch-in possibilities. Municipal and subsidized schools constituent the majority on the net. They recieve hardware equipment from the Ministry of Education: 3 computers, 1 printer, 1 modem and 1 CD-ROM and software (educational programs, La Plaza); have the possibility to teach their staff and recieve Enlaces support. Other funded schools can join the net as a result of projects' tenders while Enlaces provide software, teaching and net support. Private schools can obtain partially software and partially net support.

La Plaza program inside Enlaces teaches the use of computer both for learning programs and for communications (local, metropolitan, wide-area and international ones), for participation in educational projects, for finding and sending information in the net.

Right now, the experience gained shows that computer technologies should be introduced at schools paying special attention to the work with teachers and to the special features of every school, its situation, priorities, basic activities at the moment of technology installation. The succes of the project is basically achieved due to the job done by teaching staff and school principals of the schools involved in the net. The strategy of support, learning, continuous help, staff meeting, document procedures were designed for teachers. And that made technology implementation easier for many schools and enable the use of computer in administrative management.

2. BASIC POSITIONS

The Enlaces Project is a part of the MECE program with the Ministry of Education. It is an experimental one and its objectives are to evaluate the role, costs, negative and positive sides of computer use and telecommunications at schools. There are three major factors to dominate it:

- Chile Education System
- Learning Technologies Implementation experience in Chile and in the world
- Achievements and Tendencies in Information Technologies and Telecommunication development.

The analysis of these factors and the experience gained during the project development determined the definition of principles on which the Project should be based:

Informatics is a means, an instrument easy to use and to serve to teachers, other educators and students. That is to say that learning computer use should not be for the sake of learning only and should not become the restricted area "for experts only".

People have the leading part in education: students, teachers, administrators and not machines. Even the most powerful and perfect computer is yet an instrument of support for the educational projects where people are involved. That's why we are armed at organizing a computer laboratory in every school where both students and teachers could work over different subjects and different projects, instead of providing every student with a computer.

Educational objectives of a school should define the use of a computer in it. As well as, the social and cultural grounds and geographic location should do. There are no common prescriptions for every school but there is a possibility of knowledge and experience exchange which can be modified and suit a special case.

New technologies and telecommunication bring new roles for hardware and software:

Pedagogic: support instrument and didactic material for teachers and students; motivation instrument to develop linguistic, communication, mental and art abilities and skills.

Social and Professional: personal contacts and experience exchange between teachers and students; widening life vision of students.

Administrative Support: important element in modernization and acceleration of a school administration process; education administration support.

The presence of a computer at school cannot serve as a guarrantee of learning effect. Internationally the hopes of the 80^s for the learning effect of technologies failed to come true. Now we can use the positive and negative experience of the past and witness the gradual process beginning with the adaptation of technology, taking it in, followed by the creative impulse to use it. The process is very slow - all teachers are being involved in it gradually - so it needs long-term support. It is difficult to use this reliable principle in developing countries because they concentrate on equipping their schools.

The mentioned principles show the frame of the Enlaces project development. We will go on with the positive moments of information and communication technologies for Chilean schools:

Equal opportunities and decentralization: schools can join the Schools Community regardless of location. For example, any teacher in the net has an access to the same information as others and participate in interschool projects on equal grounds regardless of where he lives: in Temuco, Las Condes, Freire or Boyeco.

Professional Growth: teachers can exchange experience, material, succes and advice if united by the net. They can also take part in group sessions and discussions over different subjects issues, eg. Spanish, Mathematics, teaching kids with learning difficulties, History, etc.

Management development: teachers and school principals can raise their job efficiency and make it easier through the use of computer technologies to keep diaries, notebooks, data bases, to prepare materials for exams and tests, students lists and for book-keeping.

Educational process modernization: teachers and students can use new learning software as didactic material. New learning programs' quality and quantity is improving every day. To use it we should change the pedagogic process structure, ways of delivery and aquiring knowledge, to stimulate abilities and develop gifts and skills of students.

Students demonstrate strong a wish to work with computers: teachers can use computer to stimulate education and to stimulate creativity.

The named positive moments have good influence over quality of education in school system. But we can expect informatics implementation to bring results in a social sphere. For example:

Having got access to the technology at school young people will bring changes to production field and a service sphere developing those technologies. To use technologies properly, to manipulate information one should have a high degree of knowledge and skills in the field which are necessary in today's world. Those skills are to be developed during school period. Eg., searching, underlinig important things, sythesis and information providing.

Due to the fact that young people will be having access to the world information nets for the whole of their school life regardless of the geographical location, their vision of the world is sure to widen. It teaches them to contact other people of different cultures, races, languages and interests. These skills are important in the world where international contacts have become necessary and usual.

3. PRIMARY OBJECTIVES AND TODAY'S SITUATION

1. INTRODUCTION

Futher we give information on the project objectives realization by January 1995.

PRIMARY OBJECTIVE 1: *To organise educational net* covering 100 schools and 10 establishments during the period of 1993-1997. 70 % of the net is located in Araucania, 20 % are in Santiago and 10 % are in other regions. The network will be based on computers, they be connected by means of telephone or radio. The software will provide net support for schools. The net will be open for other schools and establishments to join if they have necessary equipment and want to participate with their projects.

Today's situation: The set 100 schools are to be on the net by March 1995, and by the end of the year the number will be 300 schools. Now there are 81 schools 19 establishments on, including those who joined with their own equipment. The Enlaces net is a part of Internet that's why teachers and students have possibilities to contact schools, universities, libraries, discussion sites and similar projects around the world.

PRIMARY OBJECTIVE 2: To organise at La Frontera University and Pope Catholic University Educational Informatics Centres (EIC) with the right staff, equipment and funds to support school net. Centres should control traffic in the net, to design and implement Learning Strategies for users and continuos education, to support school provided projects, to create and evaluate software, to provide schools involved in projects with technical and pedagogic support.

Today's situation: Now EIC at La Frontera University is organised. It occupies 600 sq.m. The team of teachers of various subjects, psychologists, telecommunication engeneers, software writers, computer designers, journalists and administration experts work over the Enlaces Project. Also it includes the computer centre at Pope Catholic University at its Programming Department in Santiago and in Viliarica. Later the University of Concepcion (8th District) and University of Los Lagos (10th District) joined the net.

PRIMARY OBJECTIVE 3: To convert three schools into experimental ones and on their basis to implement experimental job with new technologies and teaching and learning methods.

Today's situation: One school in Temuco is founded.

2. MAJOR

ACHIEVEMENTS

This project started in 1991 in several Santiago schools and was primarily experimental. Its objective was to evaluate the existing technologies to research the input capabilities of telephone lines for computer links, to settle a professional level necessary for computer use and basic multimedia, and also to look into ways of computer implementation at schools. In 1991 the project covered 3 schools in Santiago and Pope Catholic University. In 1992 in Santiago 8 new nodes appeared and they got stable connection with foreign schools.

That experience confirmed the importance of designing new implementation strategies and use of technologies at schools. It also proved that school educators of all levels should participate in that process. The experiment showed that children took in new conversational possibilities enthuasiatically, as well as the use of learning programs and that children should be taught minimum users skills to use computer efficiently.

1993 saw the net growth up to 33 nodes: 17 in Santiago and 14 in Temuco. The contacts with foreign schools grew. Main job was to create methods of joint use of technologies for teachers in different schools through various interschool projects and to modify and to widen software. And in general, it was the task to evaluate main areas for computer use at school.

The network grew up to 100 nodes: 81 schools and 19 establishments. Many of them had their own equipment.

Here is the joint table of the schools in the Districts, showing the origin of the equipment:

District	***Equipment provided by Ministry of Education***	***Own Equipment***	***Total number of schools***	***%***
Capital	13	7	20	24,7
6TH (*)	0	5	5	6,2
8TH	4	0	4	4,9
9TH	46	6	52	64,2
TOTAL	63	18	81	100
%	77,8 %	22,2 %	100 %	

* The 6th District net came to life with the help of the San Vincente Municipal Council in Tagua Tagua community. The Council equipped all schools of which 5 have joined the Enlaces net. Enlaces provided them with communication software, taught staff and students minimum computer use and switch them in. This example can be followed by other communities in other regions of the country. We expect such forces to bring other schools to Enlaces.

Establishments in the net are schools, faculties and departments of various Universities (La Frontera University, Pope Catholic in Santiago and Viliarica, Concepcion with the centre in Los Anjeles, Los Lagos University, ORT Chile, Acsis, etc.).

3. EXAMPLES FOR USE OF LA PLAZA (THE SQUARE) PROGRAM

The La Plaza program was designed to possibly ease the use of computer for teachers and students. It is a simple one and combine several items named Post Office, Newsstand, Museum, Culture CentreThe Square - access to the system.

We choose the image of a Square because every student and every teacher knows it immediately in any part of the country. This place doesn't evoke bad assosiations, it is an attractive and familiar one serving as a meeting point for community members. Also there are different services here: banks, shops, City Hall, school, entertainments.

3.1. Post Office

The Post Office at the Square is a e-mail office one can have simple access to, teachers and students can easily send and recieve messages. Its aim is to build up informal atmosphere for first contacts and then to create a workgroup in Culture Centre sliding to personal contacts between teachers and students.

Children use the Post once a week: to write letters in different subjects, eg. looking for friends, quizzes exchange, their pets, interests, dreams, etc.

Teachers use the post in experimental regime because they have understood that learning telecommunications, looking for people of the same views in the net would demand patience and consume time. This is a universal phenomenon. In developed countries the use of nets has grown significantly though it took them several years to get accostomed to them and to study their use. The same picture is true for school teachers.

3.2. Newsstand

Newsstand is a window into the world of electronic information but it changes as time goes, as any paper or magazine does. It contains electronic newspaper section (environment, sports, for teachers only, etc.) which is being edited by teachers and students themselves.

In Newsstand there are short stories of educational contents with sound, animation, texts stimulating desire to read or write something. The number of the stories grow and every school has access to them.

The most popular sections of the electronic newspaper

Position	Name	Number of news in 1994
1	Thoughts	823
2	Interesting Facts	611
3	Sports	553
4	Schools	402
5	For Teachers Only	388
6	Ads	395
7	Environment	326
8	Information about the country	232
9	Information about the world	189

All those sections are of experimental character. In the future schools will be able to subscribe to them through computer as their number grow. In this case sections can be written by "agencies" (Museum, City Hall, Environmental Protection Ministry, News Agency, Library, etc.).

3.3. Museum is an information centre where the learning programs data is stored. Generally, it's the easiest data base oriented for a teacher who needs didactic materials. One can travel from Museum to Information, to the experience exchange section and new programs demonstration. CD-Roms are being used since 1994. Here's a licenced programs' list:

- Graulier's Multimedia Encyclopedia
- Animals (San Diego Zoo CD)
- The Language of Lyrics (music)
- A Tortoise and a Hare
- Carmen San Diego
- Decisions - Environment
- Juanito and His Magic Beans
- Earthenware in Chile
- XXth Century
- The Earth
- Lessons in Mathematics: Functions

In addition to those they work over programs that are difficult or impossible to buy on the market:

- Chilean Artists
- Architect's Workshop
- Peoples of the Earth
- Human Body
- "La Plaza" Program Manual
- NESCO: Healthy Teeth (delegated to the Dentistry Department of La Frontera University).

Here is the list of other programs sent to schools:

Claris Works: text editor, calculator, data base, graphic and drawing editors included

Kid Pix: drawing programm for kids

Hypercard: multimedia production

The most used-by programs for the last month of 1994:

1. Kid Pix
2. Claris Works
3. Human Body
4. Chilean Artists
5. Peoples of the Earth

3.4. Culture Centre

Culture Centre is a meeting point for those who realise joint projects of teachers and students from different schools. It also helps teachers to find colleagues of similar interests so they can exchange experiences, opinions, materials and documents (Eg. physical training instructors, professors of English, Literature Workshops, foreign connections, etc.).

Culture Centre and its working sectors
Here is the list of the most popular sectors and topics with Culture Centre

Number	Topic or Program	Number of Messages
	"ABC Teaches"	370
	"Mathematicing"	325
	Hallo, Chile	319
	Games and Sports	293
	Ecology	293
	Caught in the Net	252
	Square and I	236
	SOS	184
	We grow happilly	176
0	Kid Pix	136
1	Claris Works	89
2	Dinamicas	83
3	Necso	70

4. EXPERTS TRAINING, RESULTS EVALUATION, MONITORING

1. EXPERTS TRAINING

In 1993 Experts in schools connected recieved the following training: three introductory lessons (one week period) for groups of 12-15 teachers from the same school (totalling 195) were giving the skills necessary to work with "La Plaza".

The Learning Strategy for teachers in 1994 seriously differed from the mentioned one because schools were given most autonomous rights for that matter. The number of skills to obtain grew also: Teacher were able to study both Enlaces basic program and Claris Works consisting of the editor, data base, drawing program, etc. To optimize its use teachers learned the use of archieves and the way a hard disk works.

As the number of the involved schools grew so does the necessity to let them solve training issues themselves since the geography of the schools widened and was distancing from the Project Centre at La Frontera University. The experts were expecting that growth... there became three times as much schools involved... and they developed a multimedia program with various topics and training workshops. One has access to that program "The Learning Square" from the Square section "Museum".

Together with the already published textbooks and manuals this program was a trial basis for a telelearning method which is expected to be as efficient as usual learning methods. We should mention that teachers could us it as they believe it necessary, at every school.

The next step to bring new members to the net was its administrative decentralisation. It is expected that as the number of members will grow, assistance to most far situated and worst equipped schools is getting more and more complicated. To escape this supposed problem and to test the more reliable and more flexible system of the net widening it was agreed that: The Chilean Pope Catholic University in Viliarica would take control over Subcomponent 1 of the net (where they serve 6 schools); La Frontera University in Malieco would take Subcomponent 2 (5 schools in Angol and 1 in Collipulli. The same agreement was signed with the Concepcion University in Los Anjeles to work with 4 schools.

There is the following work plan for the teachers of the schools in the said subnets which joined the project in the third semester (village schools near Temuco: Lautaro, Freire and others). The 1st stage consisted of:

Learning how La Plaza works, including basic elements of equipment functions. At this stage teachers were to study in groups of 3-5 persons (from 4 to 6 weeks) at least once a week until they would be able to deal with the "Learning Square" tasks properly. The subnet coordinators evaluate the results of learning for each teacher individually. He (she) is tested according to the 30-point "La Plaza" user list.

The 2d stage consisted of Learning how to use an operational system, archieves and a hard disk. Again at this stage of 4 to 6 weeks teachers were to work in groups with an interactive self learning system and textbooks to match. Effiency evaluation was practice-based and was carried out when a teacher felt himself (herself) ready.

The 3d and the last stage consisted of Learning how to use Claris Works and Kid Pix programs. The learning program was "Claris Works Help" with a textbook included. In some cases "Additional Manual on Claris Works" was used. The efficiency evaluation was carried by practice-based methods when the teachers felt themselves experienced enough.

Total number of the teachers involved
(see Table)

Sub-Net	Stage 1	Stage 2	Stage 3	Total number
• Santiago	86	43	33	162
• Angol	138	67	55	260
• Viliarica	103	54	50	207
• Temuco and communities	115	18	10	143
• Los Anjeles	57	7	7	71
Totaling	499	189	155	843

Deminishing number of participants by the end of the stages can be explained by the fact that the First Stage was not completed in time. The learning period in many schools took twice as much time as was supposed either because of the lack of lateral control or because of the difficulties at the spot. Having learnt the use of La Plaza most teacher didn't believe it necessary to master the knowledge about other operational programs. There was yet another stopper: the working plan was not covering all teachers who needed computer in everyday use.

Workshops

This year mastered one more learning field: workshops for detailed study of instruments and specific technologies. Example number one: "Use and management of Claris Works and Kid Pix programs". This program was proposed by Viliarica subnet coordinators during winter holiday. 37 teachers studied it.

13 seminars course made serious impact into learning. Those seminars were presented For the First National Congress on Informatics and Educational Nets ENRED 95 which took place on 6, 7, 8 of October. The total number of participants in the seminars were 437 teachers. Seminars were followed by lectures by foreign and Chilean experts. All the delegates from the schools in the net had possibilities to meet each other and share experience. There were 550 delegates.

Many Informatics Programs' Coordinators saw the success of the seminars and offered their own developments for schools. That raised the Congress' efficiency very much. We noted the learning developments popularity so we set to produce Educational Workshops in 1995 aimed at: a) answering schools' demand and developing supply; b) founding experimental secondary colleges with coordinated teaching beginning March 1995.

In addition it was decided to organise school journalistic societies for school teachers at Temuco and to organise seminars from one to two days depending upon the needs of teachers from the schools in the net.

2. EVALUATION

The job done in these two years let us evaluate the project efficiency in the field of school education.

For this matter an evaluation system was developed which cover wide range of marks. Though we didn't hope that it could be efficient in every field we began wide-aspect evaluation. We draw a primary picture of these aspects in the schools in the net and then we tested each school thouroughly comparing them to the primary picture.

We included in the evaluation such factors like territory, population, school level. Here are aspects we have evaluated up now.

1993 Primary pictures in 12 schools in Temuco and 6 schools in Santiago

1. Testing 1800 children in these schools participating in the project according to the following characteristics:

Creative activity (speed, flexibility and originality in product making). Development of learning levels. Level of comprehension when reading. Group interactivity (towards the task and with other pupils). Self evaluation according to learning tasks. Controls were set on intellectual levels and serious learning deviations.

2. Testing 207 teachers according to the following characteristics:

Mentor's role appreciation by teachers Learning objectives appreciation, appreciation of Learning process and school climate.

Levels of success, autonomy, fixed behavior, selfevaluation and efficiency.

Teaching styles types: professional, initiative, paternalistic and selfmaking.

3. Testing 1200 parents and guardians of the children involved in the project according to the following characteristics: diligence, satisfaction with school, evaluation and activeness.

1994 Comparison to the Primary picture 1 and number growth.

Primary picture 1 was drawn in 6 schools in Viliarica, 5 school of Angol, 3 of Los Anjeles (8^{th} District), 7 of Santiago (one specialized school and one school for children with Dawn Syndrome) and in one school in Temuco (rural one). The testing positions were the same. The respondents included:

- 3000 students
- 450 teachers
- 2000 parents

To compare it with the Primary Picture we tested the same people we had tested in 1993. The information is being processed. We already have primary results for characteristics, like reading comprehension where we can expect changes in the direction of thought. But we are looking for the results from the schools that joined the project later to make sure changes take place because of Enlaces.

3. REVIEWS

Polls were being held regularly in schools to have quick and exact answers to questions about the use of technology.

In 1994 teachers from schools in the net in Temuco were polled. Here are its results. The left diagram shows the use of computers and software in learning process: 1% bad, 48 % good, 51 % very good. The right diagram shows improvement in contact with students: 19 % more or less, 76 % significantly, 5 % not much.

Page 14. In the upper left corner:

The use of communication instruments in the educational process: 14 % more or less, 3 % not much, 83 % much.

In the upper right corner:

How much can it damage learning process if the net will be switched off:

12 % not very much, 3 % not much, 71 % very much.

In the middle to the left: computer

The monitoring gave the full picture of how often Museum, Square, Culture Centre, Newsstand are visited.

Here is the graphic showing the traffic monitoring. Decisions over the net software, time to visit schools due to the schedule, etc., are taken on its basis.

Weekly schedule of a secondary school in Temuco.

5. PLANS

1. NET DEVELOPMENT BY THE SCHOOLS WITH OWN EQUIPMENT

We regularly develop choice strategy, development, motivation, implementation of software that can be copied for schools, especially for those involved in the Enlaces project. At the same time new achievements in telecommunication technologies and new programs developments are used to widen the net bandwidth.

One most important moment in the net growth is to integrate schools or establishments with their own equipment. The simplified version of La Plaza is designed (colorless, soundless and no video) for that, but one can join the net and exchange ideas, news, experience (as text files).

2. Switching of other establishments to the net.

Establishments (schools, universities, Technical Training Centres, private persons, etc.) who wish to join the net (with money, equipment, place, lines) should remember the following:

a) Software and hardware

In 1995 Enlaces have "La Plaza" program with communication capabilities and multimedia learning materials. One should possess an Apple Macintosh 8/180 computer with a 14" colour display or PC with Windows since March 1995 to use these programs.

The Enlaces Project has software for DOS Environment. 17 enables net access and let you send text files only. This version services older PCs AC, XT with monochrome displays without hard disk and minimum memory.

We can add that an establishment can use other Internet-compatible software (Eudora, MacWeb, etc.).

2. NET MEMBERS

Possibilities and Obligations

To join the Enlaces net an establishment should:

Send a request for membership. The net reserves are limited so they will consider the request judging by a school's capabilitiy to switch in to the Internet, its readiness to take some obligations and its real abilities to support Enlaces. At the talks the Enlaces management and the school principle/owner should sign agrement describing the project contents, which a school would like to realise due to Enlaces, the ways it would be carried out, human and material resources for it.

Switch-in. It would be better for school to be located in the Enlaces contact zone: that is since 1995 all the phone-connected places in the 9th District, some Capital District communities, Los Anjeles, Concepcion, Osorno. Place out the contact zone can join Enlaces though the closest Internet node (one should turn for help to the University close to his place). In 1995 we expect to widen the Enlaces' cover zone after the support centres are on.

The equipment that the establishment own (modem, computer, software) should be compatible with the one of the Enlaces net (Internet standard switch software, own programs or "La Plaza").

An establishment should be able to pay expences and costs including those of Internet.

We advise all potential members to get in touch with our coordinators before purchasing equipment. You can keep connection with us in Internet, our address: enlaces - ufro@ enlaces. ufro.cl

MINISTRY OF EDUCATION

LA FRONTERA UNIVERSITY

NATIONAL REPORT OF CHINA

EDUCATION TECHNOLOGIES IN CHINA

INTRODUCTION

China has a territory of 9.6 million km, a population of 1.1 billion and 30 provinces/autonomous regions and 517 cities. In recent years she has achieved great growth in her national economy. The Chinese government has all along paid attention to the promotion of cultural and educational undertakings and raised the slogan of bringing prosperity to the nation through science and technology. "The National Program of Educational Reform and Development" was published in 1993, designing a blueprint for a system of education with Chinese socialist characteristics. In this document the development and utilization of educational technology are stressed.

From the perspective of social progress throughout history, it is evident that education is the mainstay of a nation, and that education is the very foundation of economic growth. The relatively low level of education in China has seriously hampered the advance of China's modernization. How to make the best use of the limited resources of education and the latest educational technology to train highly qualified personnel as soonest and as numerically the largest as we can — this is the major problem confronting education in China.

THE EXISTING EDUCATIONAL SYSTEM IN CHINA
is indicated in Tables 1 - 4, as follows:

Table 1.

Basic Education

	Number of Schools	Number of Students
Elementary Schools	700,000	124,210,000
Ordinary Junior Middle Schools	68,415	40,822,000
Professional Junior Middle Schools	1,582	562,400
Special Schools for disabled children	1,123	168,600

Table 2.

Professional/Technical Education

	Number of Schools	Number of Students
General Technical Middle School	3,964	2,820,300
Professional High School	8,403	3,063,500
Technical Middle School	4,447	1,716,700

Table 3.

General Higher Education

	Number of Schools	Number of Students
Ordinary Higher Education	1,065	2,535,500 BS/BA 88,800 MS/MA 17,600 Ph.D

Table 4.

Adult Education

	Number of Schools	Number of Students
Adult Higher Education	1,183	1,862,900
Adult Training Middle School	4,783	2,067,600

This educational structure is basically adapted to the demand for personnel at different levels to secure social advance in China. However, in respect of the quality of personnel, there still exists a considerable gap between our education and the first-rate education in the world. Numerically speaking, the personnel we can train, as shown in the above Tables, fall far short of the amount needed for our social advance.

The development of science and technology, especially that of information technology, has created the possibility of improving the conditions of education in China. The present paper will introduce, mainly in two aspects, the current situation of educational information technology in China and its prospective developments.

THE STRUCTURE OF EDUCATIONAL TECHNOLOGY IN CHINA

(including its subdivisions) is as follows:

(1) The audio-visual education centers in higher education institutions and professions/industries, which help spread educational technology among the respective institutions or professions.

(2) The local audio-visual centers (AVCs), headed by the National Audio-Visual Center of China (NAVCC) which help spread educational technology among the primary and secondary schools throughout the country.

(3) The local radio-television universities, headed by the Central Radio-Television University, which undertake, chiefly through the nationwide TV networks, formal-schooling education and education without academic credentials of various kinds throughout the country.

(4) The agricultural radio-television schools set up by the Ministry of Agriculture, which undertake education in rural areas in agricultural techniques in the form of technical secondary schools with academic credentials.

(5) The network of educational TV stations, headed by the China Education Television (CETV), which render television-broadcast service for the above-mentioned various forms of education.

(6) The China Education and Research Network (CERNET), which provides the means of academic exchange, both domestic and international, in the service of teaching and research at key universities in China.

Education with Audio-Visual Aids

The Chinese government has paid great attention to the utilization of modern means of instruction in primary and secondary schools as well as in regular HEIs. In order to popularize the use of audio-visual aids in primary and secondary schools, the National Audio-Visual Center of China and many local audio-visual centers (AVCs) have been established. According to available data, among the resources processed by these facilities are 2 billion frames of projector slides, 8 million hours of sound recordings, 8 million hours of video materials, in addition to a number of educational films (or film strips), and a collection of compact discs (including VCD and CD-ROM) and a collection of software used for CAI. Through the cooperation between the NAVCC and AVCs at various levels and the audio-visual education centers and AV classrooms of various educational institutions, remarkable progress has been made in applying modem media to classroom education provided in schools of all kinds. Moreover, progress has been achieved through relevant instructional design renewal of educational concepts and reforms for the enhancement of the efficacy of teaching, the optimization of teaching process, and other efforts to realize the goal of modernizing school education.

Education Television

As China is a developing country with a vast territory and a large population, in the education sector, besides doing a good job of running regular educational institutions at various levels with their programs delivered essentially by face-to-face tuition, efforts have been made to develop distance education through the utilization of modem means of instruction so as to effectively expand the scale of educational provision and create opportunities for more people to receive lifelong education.

As early as 1960, when black-and-white television sets just began to enter the homes of China's common people, radio and television universities (RTVUs) were established in such metropolitan cities as Beijing and Shanghai. With the advent of a new era of reform and opening up in China and concomitant with the formation of microwave television networks established in various regions of China, the Central Radio and Television University (CRTVU) was established in China in early 1979. In 1980, the Agricultural Radio and Television Institute (ARTVI) oriented to audiences and viewers in the countryside was established. With the commission of a satellite-transmitted educational TV channel, China Television Teachers College (CTVTC) was established in 1986 conducting service training of primary and secondary school teachers. China Liaoyuan Radio and Television School (CLRTVS) was established in 1990 providing programs of rural practical techniques oriented to the needs of rural developments. Thus, a multi-dimensional and highly diversified new framework of distance education has gradually taken shape in China over the years.

At present, the complex system of China's RTVU's is composed of the CRTVU (comprising also CTVTC and CLRTVS), 44 provincial-level RTVUs, 696 local branches of RTVUs, and over 1,600 county (or urban district-level working stations of RTVUs.

On the other hand, the Chinese government has invested in developing a network of satellite-transmitted educational TV programs. This network comprises China Education Television (CETV), which has at its disposal three satellite TV channels and a decimeter TV channel serving the needs of the Beijing area, 10 provincial-level educational TV stations and covering 1,000 relay stations, and over 10,000 satellite ground receivers. Besides, the cable television services in more than 200 cities have taken part in replaying the programs of CETV. Through the integration of these two networks, a wide-ranging network of distance education covering both urban and rural areas has taken shape in China.

By 1994 a cumulative total of 1,778,000 students had graduated from 359 subdegree (short-cycle higher education) level programs (specialties) offered by the RTVUs throughout the country in diverse fields of science, engineering, agriculture and medicine; the humanities, economics, political science and law; and fine arts, physical education, and teacher education, accounting for 14.74% of the total output of graduates of all regular and adult HEIs of the nation in the same period. Besides, 3000,000 have successfully completed specialized secondary school programs provided by the RTVUs.

1,006,000 have graduated from the programs offered by ARTVI. The development of distance education in China has contributed a great deal to the formation of a new educational framework in China, to the renewal of educational concepts, to the improvement of teaching methods, to the expansion of educational provision, and to the improvement of educational structure, and to the modernization of education.

Computer Networks

China's economy has been growing very fast in recent years and China is becoming more and more open to the outside world. At the same time, the construction of the global information infrastructure has become a world trend. The Chinese government is promoting the construction of the China Information Infrastructure (CII), with the Internet connection forming one of the major concerns.

In December 1993, the China Education and Research Network (CERNET) project started to be planned. It is the first nation-wide education and research computer network in China. The CERNET project is funded by the Chinese government and directly managed by the Chinese State Education Commission. CERNET will connect all the universities and institutes in China in the near future and will connect high schools, middle schools, primary schools and other education and research entities by the end of this century. CERNET will link to the global Internet and will become a major part of the Chinese Internet community.

The main objective of the CERNET project is to establish a nation-wide education and research network infrastructure to support education and research in and among universities, institutes and schools in China using the up-to-date telecommunication and computer techniques. Its specific aims are as follows:

(1) Establish a nationwide backbone which connects eight regional networks and connect them to the global Internet.

(2) Set up a national network center.

(3) Set up ten regional network nodes.

(4) Adopt TCP/IP as the network protocol and establish network management systems.

(5) Provide Internet applications and develop China's information resources and applications.

CERNET has a three-layer hierarchy (the nation-wide backbone, regional networks and campus networks). The CERNET national backbone uses Digital Data Network (leased line) offered by China's Ministry of Post and Telecommunication (MPT). It forms a multiple ring topology and it has an international link connected to the Internet in the United States. Links to Hong Kong and Germany will be installed in the near future.

CERNET finished its first phase of implementation in December 1995. Currently, there are more than 100 universities connected to CERNET from all provinces and regions except Tibet. The regional distribution of these universities and the corresponding IP blocks (CIDR) are shown in Table 5. It is clear that the Internet development in coast areas is much faster than remote areas in China, the former having

enjoyed much faster economic growth. This indicates the correlation between Internet development and economical development.

Table 5.

CERNET Current Connectivity

Region	# of Univ.	# of conn.	IP Block
• Beijing	191	10	202.112/15, 101.204/14, 162.105/16, 166.111/16
Shanghai	153	10	202.120/15
Nanjing	156	23	202.119/16, 202.194/15, 202.38.64/19
Xi'an	100	12	202.117/16, 202.200/15
Guangzhou	74	17	202.116/16, 202.192/15, 202.38.192/18
Wuhan	156	16	202.114/16, 202.196/15
Chengdu	113	9	202.115/16, 202.202/15
Shenyang	147	11	202.118/16, 202.198/15

CERNET is a nation-wide education and research network in China. CERNET has very rich information resources about China both in English and in Chinese. The starting point of CERNET information is www.edu.cn.

The CERNET information resources fall into 6 categories.

(1) University information. In general, it contains university history, departments, courses and related information.

(2) Information concerning technical/specialized topics. For example, China's stamp collection, ancient Chinese poems, China's water resources, mines and treasure, Chinese law database, universities equipment database. Such information is provided by experts in the specific fields concerned.

(3) Information concerning international sport events. For example, the 43th World Ping-Pong Championship, the 95 Asia College Student Championship, 3rd City Championship and so on.

(4) Hot topics for the general public. For example. Silk Road tourist, Cantonese food recipe and Chinese folk arts.

(5) Libraries with html interface. For example Tsinghua University Library and Peking University Library.

(6) Electronic magazines. China's Scholars Abroad. Mirror sites.

(7) Mirror sites.

Although CERNET has so far only finished its first phase of construction, it is the most important constituent of the information infrastructure in the top universities in China. CERNET makes it possible for our professors, graduate students and undergraduate students keep track of the research developments all over the world and communicate with cooperators/friends at home and abroad. CERNET also enables the outside world to know the education system and the education reforms in China. In addition, the digital library and remote education projects are being carried out based on CERNET, which is playing a more and more important role in China's education and research.

CONCLUSION

At present, China is one of the countries, which undergo the world's fastest development of their national economy. Economic development makes very high demands on education, and at the same time affords the necessary conditions for the improvement of educational technology. With the advance in the construction of the global information infrastructure, we are confronted with a tremendous opportunity and challenge to move towards new educational models in an information-oriented society through making full use of the existing facilities for audio-visual education, such as the educational TV stations, the China Education and Research Network etc. The policy we are ready to adopt is to bring into play the role of the educational TV stations throughout the country and that of the China Education and Research Network and actively to carry on research and development in integrating these two means in order to satisfy the demands of education at different levels.

NATIONAL REPORT OF CONGO

NEW INFORMATION TECHNOLOGIES IN EDUCATION SYSTEM

1. PREFACE

A National report, written in the form that was prescribed to the developing countries, can't illustrate sufficiently enough the required points as the scope of application of new technologies in the country and especially in the education system is quite narrow.

But the number of computers, used in government offices and education facilities of Congo, amounts to 5000 units. This makes us think that the fulfillment of the minimal program of informatization, which implies building up of the National Information Computer System, will lead us to the acquaintance with new technologies. The International Program of Communication Development constantly points to the drawbacks of this sphere. Actually, the only factor that slows down the development of this preferable sector is the lack of investments, estimated as 1% of Gross Domestic Product. Supporting the necessity of the rapid development of this sphere , the developing countries should look for other ways of settling the problem, then those offered for the developed states.

It is necessary to make special steps in this direction by counting on regional and international cooperation. Unfortunately , the execution of the bilateral cooperation programs are still accompanied by shortcomings, that form disproportion among the African countries, especially to the south of the Sahara. As to Congo, the following problems deserve particular attention:

- the present state of telecommunication networks (the development of networks with high carrying capacity and usage of optical cables);
- system and parametric studying of teleinformation networks;
- the terms of creatinig teleinformation networks for linking to the Internet system (working out of protocols, interfaces, etc);
- setting up an Internet server;
- training of a sufficient number of qualified personnel;
- popularization of new information technologies (participation in distant education programs);
- setting up a commission exercising an overall control of the situation .

2. THE STATE OF THE PROBLEM

Information science has shaken the world during last decade. Its rapid and constant development has reached up the level of applied programs in all spheres of life. The integration of informatics and telecommunication in the 70-s was called teleinformatics and moved the information sector toward new area of communication. Telematics, born by teleinformatics, is the discipline that will be used in equipping telephone stations that have to manage high density information flows, transmittrd in digital signals.

At the National Administration of Post and Communication and other information organizations (radio and television of Congo) theoretical introduction of telematics and new communications started rather late, in the 80-s. The year of 1990 was the beginning of their practical use in communication and information services: the Center of Temporal Communication (Centre de communication temporelle) was put into operation at the National Administration of Post and Communication in Brazzaville. The point is that the problem of popularization of informatics in Africa, and in Congo , in particular, was raised in 1980. That is why there are no quantitative assessments of the informatics and new information technologies spreading in education system.

Preliminary arrangements in the frameworks of the Investigation of the process of setting up and utilization of teleinformatics and new information technologies in Africa were made unsystematically. They revealed considerable disproportion between countries in the discussed sphere , characteristic for the whole Southern region of Africa, especially for the countries to the south of the Sahara.

With the Program «The Decade of Transport and Communication in Africa» having been unrealized, each country carried out independently its minimum programs of the telematics and new information products spreading.

Congo participates in the ATF/CEFTI program. We have applied our first experience to the «Transit» project, financed by the Business Forum of French-speaking Countries. As a result, a special Internet server was assembled in the Forum's head-office in Paris. The system is furnished with the following minimum of equipment:

- 1 micro-computer IBM 486 DX2
- 1 modem (9000 Kbps)
- 1 printer HP 550.

Thus, there was set a «SITATEX BZV 8X.STX/28» station, providing a possibility of dialog with the whole group of correspondents. Its linking will be temporarily carried out through the network of the International Society of Space Communications. The established station can serve the teaching personnel of the M.Nguabi University as a mean of setting up relationship with their colleagues. It will also promote the application of new information technologies in higher education system.

3. THE PRESENT STATE OF THE BACKBONE NETWORK

Congo possesses a standard ground IVA station, situated in Brazzaville surroundings and directed to the Atlantic Ocean. There is also a more updated ground digital station, assembled in 40 km from the city Point-Noir. These two units provide an access to international networks. Still functioning on the base of the analogue technology, the Universal Service Network is unable to provide rapid information transmission. At present, the project of setting up a digital information transmission network has been presented and is likely to be soon placed in operation. Today, only private networks are able to handle massive flows of information. The International Society of Space Communications' network, being the base for the E-mail project «Transit», is one of them.

Other private information networks can be utilized (e.g. the Radiotelephone Network (CYRTEL).

Congo shows the average dynamics of telephone and private information networks development: from 1990 the increase makes up 60 % for Congo and 100% - for Africa. In order to catch up with the pace of the «communication and information revolution», radical measures should be taken. In particular, it is important to install an information network, based on the telephone and television channels of the National Administration of Post and Communication.

Functioning of about 100 computers and other equipment in the Commutation Centers provides assurance that the development will grow at a rapid pace after setting up the national teleinformation network. This work can be originated from the project «Technical space» that is being fulfilled by the group of experts, concluding communication engineers, teachers and scientists. This project is realized after placing the «SYTATEX» station into operation in Brazzaville.

In fact, the «Technical space» project, initiated by the National Center of Documentation, Scientific and Technical Information, presupposes pooling together all the existing local networks through the dial-up telecommunication network. First of all, it involves networks of research centers (M. Nguabi University) and International organizations (World Health Organization, UN Development program, AGRI-Congo, AGIP and others).

Our country has made use of the resources of the General Informatics Program, offered by UNESCO. Though our representatives took part in several international conferences, the country didn't receive computer equipment for its education system as we hadn't work out a proper project. That is why Congo submitted the «Technical space» project to the French-Speaking Countries' Experts Committee on the Problems of Telecommunications and Information Technologies. Thus, we are entering the «Transit» project, financed by the Business Forum of French-Speaking Countries, which has given the «SYTATEX» E-mail station into our disposal.

Besides this station , there is a server of the International French-Speaking Countries' Data Bank. Its technical facilities include: a micro-computer «DELL», a laser printer «Jet SL», software of «CDS/ISIS» type. The capacity of the system is 2000 information positions, that equals to the capacity of all the national libraries. By the way, our country acts as a distributor of the «CDS/ISIS» software, belonging to the Documentation Center of the Regional African Office of the World Health Organization.

The largest private companies of the country operate tabout twenty telecommunication systems of «L.A.N.» and «W.A.N.» types.

The installation of the «SYFED» server, integrating the Electronic French-Speaking Network for research and education systems seems to be feasible. The possibilities of these projects and networks will expand with the introduction of a new network, elaborated by the American Firm «ATT» and called «Africa OME: Optical African Network». As a result , the applied technology will provide African countries with a free access to the services and information of international data banks. Their technical facilities amount to about 5 mln computers, linked to Internet. The «Young Africa» magazine (# 1801, July 1995) graded this event as a «technological breakthrough».

Informatisation of school management, carried out with the help of UNESCO, and the planned informatization of the University will lay the base for the composing of a local network of the education system in Congo.

4. RECOMMENDATIONS

The main objectives of this Congress can be formulated as follows:

- establishment of the Permanent Observing Committee for the Program of elaboration and carrying out of educational policies and application of new information technologies - NIT. (Congo suggests a non-governmental status for this organization);
- popularization of NIT as the preferable instrument of progress and supporting NIT development;
- studying the problems of effective introduction of NIT in the developing countries;
- determining ratios of NIT development;
- supporting the working out of national plans of the NIT development in the education system;
- harmonization of services and equipment tariffs;
- providing professional training and human resources development;
- using of statistics;
- carrying out research and information exchange;
- participation in different International organizations, related to NIT.

5. CONCLUSION

It is impossible to talk about the progress of NIT in the developing countries without analyzing the situation in some of them. The survey is likely to be oriented to the desire of finding both the most successful and the most undeveloped fields. And this process should be accompanied by passing of technologies .

During the next stage, the analysis could consider all aspects of the problem (development level, real needs from the point of view of newly creatd services, control over NIT development, etc.). Such approach will make it possible to elaborate measures, conserving and perfecting the achieved results, to propose new rational solutions within a short period of time. And all these steps prove the above mentioned thesis that the developing countries have to look for an alternative way , than the developed states.

Thus, the Congress should be more pragmatic and should offer new forms of cooperation.

APPENDIX

The Research Program of the process of telematics and new information products introduction and application in Africa.

1. Telematics definition and its contents

2. New information products - toys or necessities: an automobile radiophone, teleconferences (including audio - and teleconferences), telecopying, teletext, videotext, teleanswers, automated dialing systems, storage devices, etc.

3. It is a necessity to apply telematics and new information products to the African countries with their development level and needs?

4. Who can be today's and tomorrow's users of telematics and new information products (government bodies, companies, rural communities,

education, medicine, agriculture, etc.)?

5. What product , based on telematics can be suggested?

6. Political, economic, social and cultural consequences of the presence or absence of telematics in Africa.

7. If the large projects carried out under the Program «The Decade of Transport and Telecommunications in Africa» can be continued without the fulfillment of minimum program of telematics and new information products development?

- If «yes», what will be the consequences?
- If «no», what will be probable and desirable advantages

8. What kind of information popularization policy should be carried out in Africa for promoting the development of telematics and new information products, adopted to Africa.

9. Conclusion.

PRESENTED BY

THE GENERAL DIRECTORATE OF TECHNICAL EDUCATION
AND OCCUPATIONAL TRAINING
BRAZZAVILLE

THE NATIONAL REPORT OF CROATIA

INFORMATION TECHNOLOGY IN EDUCATION

ABSTRACT

Croats are an old nation who had their state centuries ago and then have lost it. Recently they regained it and realised their future depends, among other things, on their ability to adopt and implement latest information technologies in all aspects of their lives.

In less than five years one of the best academic and research information infrastructures has been deployed covering the whole community and culminating in the brand new 155 Mbps ATM core backbone.

Croatian future plans concentrate on spreading the infrastructure and technology into elementary and secondary education as well as other aspects of alternative, additional and continuous education.

Introduction of country's leading individuals as well as decision-makers to IT, its applications and its consequences is considered to be one of the priorities. Educational process and system is considered to be the crucial importance in achieving those goals and to have the decisive role in creating the nation's capability to take an active role in the future world.

In achieving those goals a number of problems is expected: financial, social and psychological.

This paper suggests that our ability to transform education and use it to transform the society will determine our ability to survive at all.

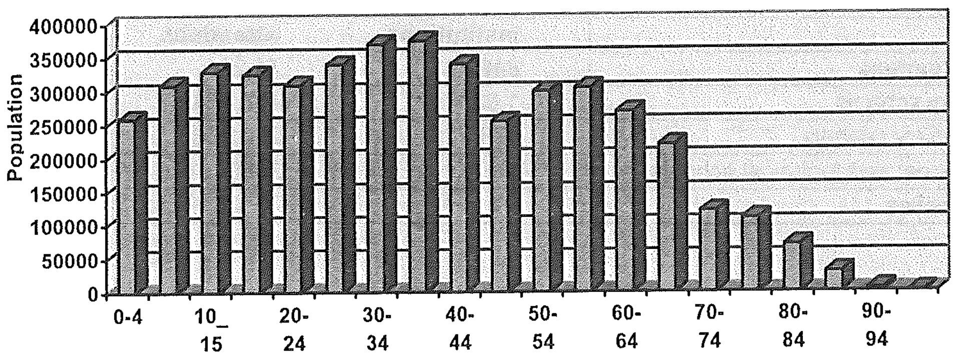
1. CROATIA IN GENERAL

Croatia is a Mediterranean state in central Europe. It covers 57,000 square km of land, framed with 2,000 km of land borders and 6,000 km of coastline along the Adriatic sea. A special geographical beauty present 1,185 islands.

Croats inhabited Dalmatia the southmost part of contemporary Croatia along the Adriatic sea, about 630 A.C. The first Croatian state was established in 892 A.D. and its independence lasted for three centuries. Afterwards, Croats have been a constituent nation in various states until 1990 when Croatia declared its independence. United Nations recognised Croatia as a sovereign state in 1992.

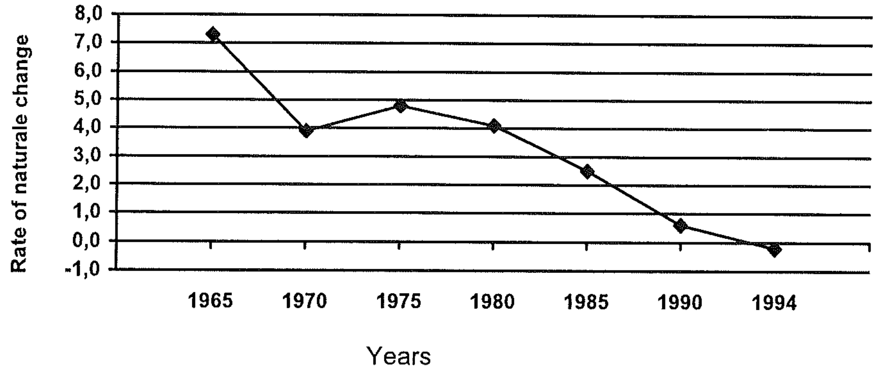
Today's population of Croatia counts 4.8 million, 67.5% of which are in active age, between 15 and 64 years.

Population according to five-years age groups



The war in ex-Yugoslavia from 1991 till Dayton agreement in 1995, inflicted significant social changes reflecting in decrease of GNP from 24.4 billion USD in 1990 to 11.86 billion USD in 1993. Population growth was continuously decreasing since 1975 and reached its minimum at -0.2% in 1994.

Rate of natural change in population



2. EDUCATIONAL SYSTEM IN CROATIA

The oldest written document in Croatian language is a monument "Bascanska ploca" from 1100, in glagolic script. First university was founded in 1669. According to census in 1991 illiteracy in Croatia is at 3%.

Croatian educational system is compatible with those in most European states which enables easy transfer of students at every level. This is often exploited during secondary or higher education. Degrees from most Croatian faculties are recognised in the world.

The educational system has four levels:

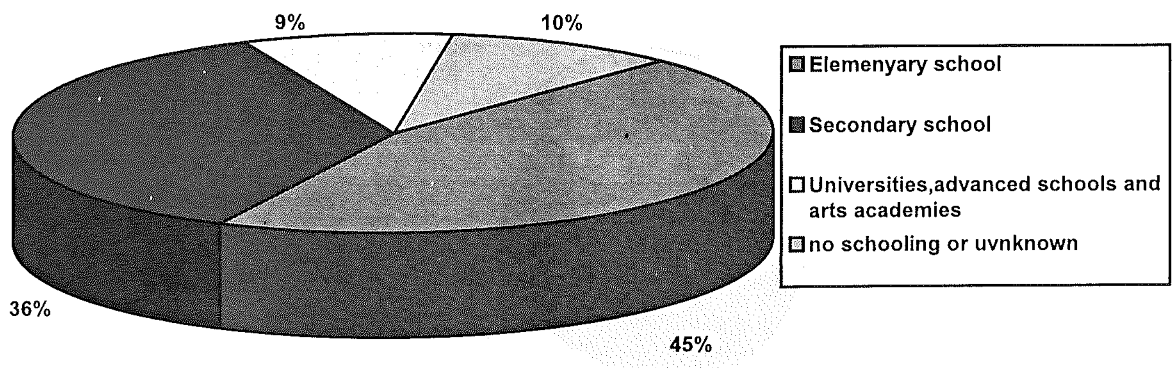
- kindergarten for ages one to seven
- primary education in duration of eight years
- secondary education in duration three to four years
- higher education in duration of three to six years

Number of education institutes, attendees and teachers in school year 1994/95

	Institutions	Attendees	Teachers
Kindergartens	846	74,274	5,081
Primary schools	1,936	438,461	24,091
Secondary schools	478	200,358	15,449
Vocational and technical schools	3	2660	79
Universities	61	77525	5814

The new law on education allows privately owned educational institutions at all levels. However, the majority is still owned by the government and the education is free to all citizens of Croatia. Students do pay for textbooks, food and lodging although a part of those expenses is subsided from the state budget.

Population aged 15 and more years by second degree



2.1. PRIMARY AND SECONDARY EDUCATION

The primary and secondary education in Croatia are free to all citizens of Croatia. Primary education is mandatory for all kids over seven years old.

In addition to regular forms of primary and secondary education there are: education of children with learning disabilities, education of adults and primary musical and dance education.

Special education for children with learning and other disabilities is conducted in elementary and secondary schools for 80,000 students using individual instruction and special techniques.

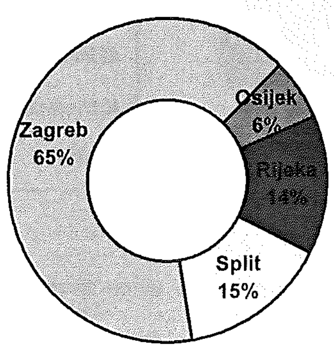
Elementary and secondary education for adults is conducted according to special curriculum and program of instruction, and can be pursued by attending classes or passing examinations. The costs of such education are borne by students themselves or their employers or the Department of Employment.

Ethnical and national unions and minorities have special elementary and secondary schools or classes.

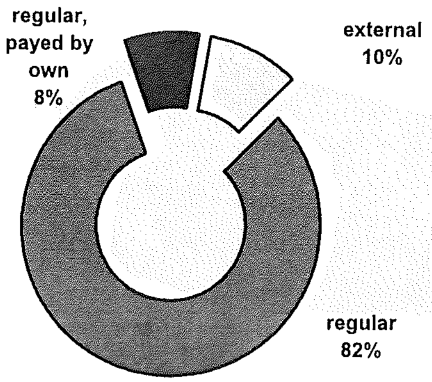
2.2. HIGHER EDUCATION

The Croatian academic community consists of four universities: Rijeka, Osijek, Split and Zagreb. 6,000 teachers educate 80, 000 students..

Number of students by universities

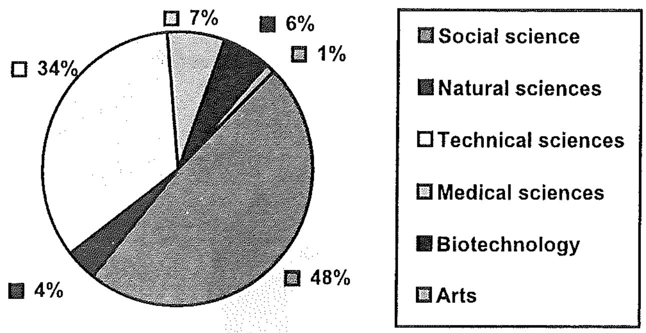


Number of students by type of schooling



Number of vocational and technical schools and universities and students by science fields

	Institutions	Students
Natural sciences	2	3,240
Technical sciences	26	27,620
Medical sciences	4	5,760
Biotechnology	5	5,046
Social science	25	37,759
Arts	3	760



2.3. CONTINUOUS EDUCATION

Currently there is very low demand for continuous education. Statistics show that 48% of participants in a survey in 1975 with about five years of working experience attended some kind of additional education. In 1987 this number has fallen to only 11%. This negative trend is due to labour laws and regulations imposed from ex-Yugoslav regime in the seventies which obstructed and discouraged workers to stream for better education. Today, this number has only slightly grow to 13.7%, mainly due to the war situation present in the country since its declaration of independence.

This situation is unacceptable since trends in employment and market of working force as well as trends in economy in general expect workers to keep up to date with changes in their profession and enable themselves to work in interdisciplinary areas.

Additional problem is the question of literature. Croatian market is rather small so publications are relatively expensive. The same is true for imported international literature due to high transportation costs and relatively low average incomes of citizens.

3. THE ROLE OF MINISTRY OF SCIENCE AND TECHNOLOGY

Ministry of Science and Technology is organised in five departments. One of them is Department for Information Technology. It's duties are:

- co-ordination of development and application of IT in all areas of public activities
- development of information system for academic and research community
- development and maintenance of IS for the Ministry

Definition and enforcement of Law on Information Activities and other regulatory documents the Ministry should facilitate and co-ordinate deployment and usage of IT in all areas of public interest or whenever equipment, SW or services are being purchased with money from state budget. Application of standards is necessary in order to ensure compatibility of people, data and equipment.

The primary method for stimulation of deployment of IT are pilot projects which target real-life problems in real environment and give case studies for similar problems. This helps non-IT people to get the feeling of the benefits, but also requirements of the application of IT. Pilot projects are usually performed by academic and public research institutes though other candidates are not excluded.

National information systems in various areas of human activity are increasingly gaining in importance for everyday's life. Their compatibility, connectibility and data interchargeability are therefore of great importance. In addition, a small country like Croatia has to take care on the usage of its professionals in key areas. This all means that not only hardware, software, applications and data but also people need to be compatible and exchangeable between different national information systems.

Thus, Ministry has adopted the policy which requires all new systems to be built on open operating systems platforms originating from UNIX, mandatory use of TCP/IP protocols and international EDI standards.

Enforcement of this policy should prevent unnecessary development of propietary systems requiring specialists of limited use and resulting in closed worlds.

The main goal of the whole effort is to improve the quality of life of every citizen.

The introduction of IT in academic and research community is undergoing. Activities are focused on providing necessary tools and infrastructure which are of common importance. This includes, but is not limited to: PC's, network nodes (UNIX workstations), modems, office software, programming languages, database systems, scientific databases and referential information. In order to facilitate the usage of advanced ITs, a variety of pilot projects are being initiated. Their role is twofold: to demonstrate the usage of IT in some activity or process and to introduce an academic group to team work and project management.

"Scientific Information System" also belongs to the domain of Ministry. Its aim is to provide an information infrastructure for preservation and dissemination of all types of information acquired or produced in scientific research in Croatia. The development and deployment of system is being centred around six thematic centres covering specialised scientific areas and fields. It is intended not only for better co-operation among scientists but to facilitate co-operation of science and business, as well.

4. CURRENT STATUS OF INFORMATION TECHNOLOGY

4.1. The Internet in Croatia

The main information infrastructure of the modern society is computer-communication network. Today, it is quite clear that it should be some kind of "information super-highway" based on TCP/IP technology.

Only five years ago it was not so obvious but it was then when Ministry of Science and Technology of Republic of Croatia decided that one of key elements of Croatia's strength in future (both social and economical) will be it's ability to use and develop modern computer-communication infrastructure.

Therefore, in the middle of war, in autumn 1991 the idea of Croatian Academic and Research Network was conceived and in less than a year a national infrastructure based on Internet technology covering all four universities has been created and put in operation.

Today, less than five years after, CARNet reached each and every faculty and institute and upgraded it's core backbone to the latest 155 Mbps ATM technology.

A special care has been taken not to profile the network from information consumers point of view, but rather to stimulate users to provide information from the very beginning. It has been achieved by equipping each institution with at least one network node based on UNIX workstation and running networked information services on it.

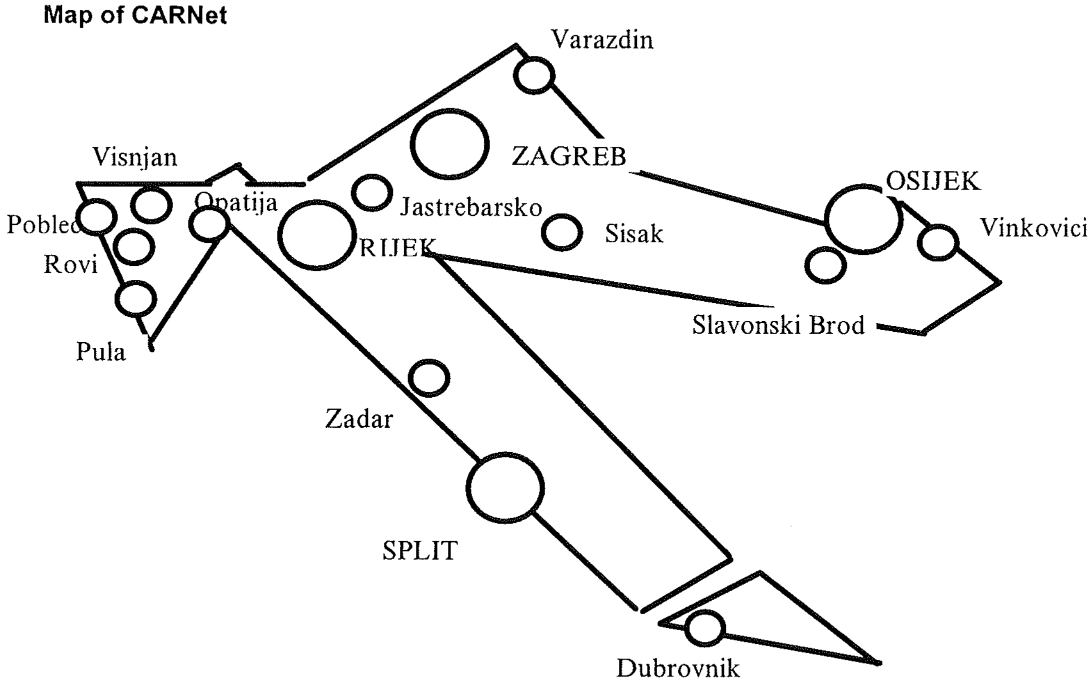
Thus users were able from the beginning to supply their own information or digests to the network.

This infrastructure was available to all segments of Croatian society enabling contact with latest information technology to institutions, companies, groups and individuals.

The project did not confine itself to acquisition of equipment and software only. Education of users and developers, pilot and user support projects are equally important.

Numerous pilot projects help to demonstrate usage and importance of IT in various fields of human activities. The most important projects are: the office of the President, government, Croatian Radio and Television, travel agencies and various medical pilots aimed at laymen, students and professionals.

Map of CARNet



Services provided and examples given helped rise broader attention and thus initiate creation of IT market. It enabled Croatian Post and Telecommunications to start it's own Internet service and thus open doors to commercial activities.

Although CARNet allows access to technology and services to all citizens free of charge, it's aim is not to substitute or compete with commercial or not-for-profit organisations. Still, CARNet provides services to more than 6,000 users on it's public host and negotiates deployment of Internet access point in public libraries in attempt to accelerate the spread of IT usage among "ordinary" citizens.

International project "GLOBE" is being used as a launching vehicle for penetration of IT into elementary and secondary schools.

4.2. COMPUTERS IN CLASSROOM AND WORKPLACE

The global trend in development of IT is towards personalisation and closest possible approach to individual user. As a consequence it means that users are no longer prepared to travel to IT access point. They expect it on their desktop.

It means that every student and teacher should have a personal computer on their desktop with appropriate connection to global Internet. However, it is impossible to achieve for a country like Croatia, not only because of the huge number of units which should be deployed. The second problem is ever shorter living cycle of IT equipment. Five years old PC is practically unusable.

Therefore, the number of educational workplaces equipped with IT is too low. In average, about 1,000 PCs enter classrooms of elementary and secondary schools every year. The same is true for universities and research institutes. The required number would be about three times higher.

However, much better situation is in global connectivity. Academic community is completely "connected", and process for elementary and secondary schools is about to start.

5. PROBLEMS ENCOUNTERED SO FAR

Although great efforts have been made to supply sufficient number of PCs and other required IT equipment to classrooms and workplaces in the academic, research and educational community the absolute number is still too low. Additional problem is in the fact that the equipment is not homogenised in the sense of age and technological level which complicates maintenance and uniformity of applications.

However, this is not the greatest problem. Existing equipment should be used to it's maximum, which is not the case. The major problem is the lack of educational contents (products) utilising new IT. In addition there are very few contents to be used out of regular educational process.

To achieve this is two primary factors: a number of producers and a critical mass of skilled and motivated teachers. And this is where the major problem lies.

The chronical lack of money in state-funded education prevents creation of educational software market and competing producers. This situation is worsened with the fact that interest for additional and continuous education is decreasing for the past twenty years. State policy of ex-Yugoslav regime only discouraged individuals motivated for auto-education.

The lack of domestic educational material has been substituted with the quality products from the world market. Small Croatian market makes translations expensive and lack of state policy makes imports equally expensive.

All mentioned is accompanied by the general fear of new technologies in middle and old generations of citizens, professional and educators, as well as in huge administrative structures.

Children and users are much faster and are on the forefront adopting and using new Its and they leave far behind their teachers and administrations.

The result is the chronical lack of acceptable use policies and rules of behaviour in virtual world.

Fast penetration of IT in everyday's life brings common social problems into this new world of electrons and photons. However, the means and organisations that should prevent or fight them do not follow that speed.

Therefore, aggressiveness, selfishness, ruthlessness and misuse are sometime more visible and annoying in electronical than in material world. Instead of repressive and law enforcement methods, education would be much more fruitful in making Cyberspace a better place for living.

6. FUTURE IMPLEMENTATION OF IT IN EDUCATION

The long term strategy in the field of nation-wide introduction and implementation of IT should take care to provide sufficient information, presentation, reading materials and hands-on experience to political and economical leaders and decision-makers in general.

Specialised presentations and courses will be organised for the members of the government, parlament, political parties and state-owned companies.

Case studies and real life examples of those who faced similar problems world-wide are most convincing methods for getting attention and trust in IT.

This activity has to be organised on a wide front, simultaneously attacking all fields of human and social activities: public administration, public health, education, tourism, commerce, army and others. Likewise, this process has to include individuals in the highest positions in hierarchy but this mustn't be the only focus, IS and IM executives and professionals need to be included as well.

For future generations it is crucial to ensure that today's generations of new teachers leave their schools with knowledge, confidence and enthusiasm about IT. However, it is important to avoid situation in which teachers community would be divided in two camps: those who can and those who can't. Therefore, courses, training and textbooks need to be prepared for older generation of teachers. In the whole activity, a special care should be taken for the needs of non-technical teachers.

Literature and best international educational software need to be translated and localised for use in national educational process. This is the easiest way to quickly start the process. It should be immediately followed with government initiatives in production of domestic educational material.

This century has seen hundreds of thousands Croats leaving the homeland and starting new life elsewhere in the world. They have been driven by economical and political forces and majority remain outside of Croatia. Today, it is believed that as many as 3 million people world-wide consider themselves to be of Croatian origin. This is a great tragedy of Croatian people, but it is also a great treasure for the small nation.

Cultural and economical ties between diaspora and homeland need to be intensified. IT can help in a great deal by providing textbooks in Croatian language, display of Croatian national and cultural heritage, establishing databases of economical interest. It can help diaspora influence events within the homeland, but also get a homeland a better picture of needs and potential of diaspora.

Croats have been successful in selling their potentials world-wide. IT might help them to do the same, but this time, without selling their physical being, i.e. emigrating.

7. PROBLEMS EXPECTED

The problems we discuss here are problems of educational process. The main subject in it is the teacher. It is the basic element from which success or failure will result. Therefore, the main problems to be expected in Croatia are in establishment of positive selection of new teachers, motivation and enthusiasm. Social status and material conditions are key elements in achieving those goals.

Croatian educational system is relatively large and thus introduction of IT infrastructure poses a financial and organisational problem. It is expected that financial sources will be weak for several more years and that several generations of equipment deployed need to be accepted as normal operational environment. Awareness should be kept in mind of the consequences of this state to the applications and educational programs.

A multitude of laws and other legal documents need to be defined and enforced in order to create a stable environment for development, application and use of IT in all types of activities.

Educational system has huge role in educating users not only in the use of IT but also in proper use and behaviour as well as rising the awareness of new relations such as copyright and license issues.

It is equally important to stress information acquisition as information providing in educational process. A great deal can be achieved by taking information from premiere sources. However, true results are achieved only through active co-operation which assumes intensive sharing of own information, i.e. information providing.

Great dynamics in IT market and economy in general requires that technical aspects of IT be separated from the content, legally, financially and administratively. The trend should be toward decentralisation, demonopolisation and deregulation.

Without government intervention it is hard to expect faster creation of educational software market and producers. A kind of "New DEAL" is required in order to start things rolling.

Privacy and security issues are in the centre of interest of Cyberspace citizens and those who consider to apply for citizenship. In order to compensate these problems and seek viable solution it is necessary to separate technical and social aspects of the problem and thoroughly re-examine and redefine the fundamental values of our society.

Education has the major role in this process.

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MINISTRY OF SCIENCE AND TECHNOLOGY

NATIONAL REPORT OF CUBA

REPORT ON THE MODERN STATE OF NEW INFORMATION TECHNOLOGIES IN THE EDUCATIONAL SYSTEM OF CUBA

The state educational system in Cuba consists of the following subsystems:

- *Pre-school education*
- *General polytechnical and labor education*
- *Special education*
- *Technical and professional education*
- *Adult education*
- *Higher education*

In the academic year 1986/87 a wide-range introduction of the State Program of Educational informatics into the national educational system began. Since then, this program has become the priority direction in education.

Introducing informatics into education is done on three levels:

1. State educational system.

2. System of industry-branch and territorial institutions for raising qualification, which comprises refresher courses for persons employed in industry or service.

3. System of Popular Distribution, which includes computer and electronic youth clubs, pioneer palaces, and mass media. Various educational and entertaining actions with unlimited access are organized within this system.

The initial objectives of the Ministry of Education were:

1. To familiarize pupils with computer equipment and to cause their interest in studying the computer.

2. To develop pupils' skills of interactive work with the computer and peripheral devices.

3. To teach pupils basic concepts and methods of work with information, so as they could solve simple problems (especially in other subjects) and apply their knowledge in various situations.

The program was introduced on the following levels:

- in all higher education centers, where informatics was taught as separate subject in all departments and was included in the graduates' diploma;

- in higher pedagogical colleges (there are 14 of them) and in the centers preparing teachers. Informatics was included in the teaching plan (the contents of the course differs depending on the specialization). A new specialization called "Informatics teacher" was introduced;

- in baccalaureate schools, where the course of informatics is taught 3 years and includes 200 hours of lectures;

- in high school, where pupils could choose informatics as optional subject according to the program "Sphere of interests". Informatics was taught two hours per week. Various methods were used in schools in order to familiarize pupils with computer equipment and show them the role of computers in the society;

- in 157 primary schools by way of an experiment intended to study possible methods and forms of introduction computers on this level to develop rudiments of computer using culture (in the LOGO language) in the framework of courses of mathematics and native language;

- in 45 specialized schools for children with psychological deviations;

- in the centers of technical and professional education a one-year course of informatics was introduced for all professions (the contents of the course depends on the profession).

To perform all that, it was necessary to fulfill the program of investment and teachers training.

22,000 computers, both 8 and 16-bit, were purchased.

In the institutions included in the program, laboratories with 11 working places on the average were organized. The number of laboratories depends on the number of pupils, so as to have one computer for 2-4 pupils during the lesson.

At the first stage, 3,500 practicing teachers and graduates of pedagogical colleges, as well as scientists with diploma, were promptly reshaped into teachers of informatics. At the second stage, training teachers of informatics in pedagogical colleges began.

A teaching plan for training teachers of informatics was developed, didactic concepts for each type of education were worked out, textbooks and activity books for each level of education were published.

Measures for development and evaluation of educational software were taken; this is necessary for the further development of the program of educational informatics.

Moreover, finances and computer equipment for education management were allocated. This measures were applied to the central educational agencies, provincial educational committees, and pedagogical colleges, with the purpose of processing information about the level of pupils' knowledge and about the pedagogical staff, planning incomes, processing statistical information, information on the number of children attending school, etc.

We can draw the following conclusions from the ten year experience of fulfilling this program:

1. Of all the components of the Program of Educational informatics, preparation of the personnel is the most important for success.

2. Concerning general objectives, contents, and didactic concepts, one could point out that:

- preparing pupils to problem solving with the aid of computer should be the principal part of the program;
- while teaching basic informatics, one should include it in the contents of the school program in order to form culture and skills of using computer;
- taking into account what we said above, one should make teaching via problem solution, which is the main didactic method in teaching informatics.

Introduction of information technologies into education implies paying special attention to the following problems:

- demand for information technologies;
- study of skills and needs of users of iinformation technologies;
- social, psychological, and cultural problems that influence upon usage of information technologies;
- psychology, sociology, and ethics of users and groups of users;
- methods and techniques of transmitting information technologies from the manufacturer to the user;
- qualification of teachers that use information technologies;
- orientation at information service in education;
- the necessity of working with non-standard methods and service;
- harmonious inclusion of information technologies into teaching plans and programs.

PROSPECTS AT EACH OF THE STAGES OF EDUCATION

In the primary school, the number of computer-training centers will be increased. The main purpose is the same: to familiarize a child with the computer world and to use informatics as an aid in studying various subjects.

In the special education, work with children with psychic anomalies will be continued; informatics will be introduced into programs of other courses in order to support the treatment the children receive.

In the basic high school, informatics will be introduced as a separate subject. The objective of developing basic computer education with the use of computer programs or software packages remains the principal one. These programs are intended to develop basic skills of interactive work on personal computers, of using computers for solving problems in other subjects and for other needs.

On the baccalaureate level, informatics remains a separate subject still. The main objective is to supplement basic knowledge of informatics with specialized software packages and elements of programming. The result of this should be development of skills of computer-aided problem solving.

In the technical and professional education the main objective is teaching applied informatics, dependent on the specialty, and the development of skills for solving problems that arise in industry or service. All this should be accomplished by teaching programming languages and skills of using software systems.

In the preparation of informatics teachers, the main stress will be made upon their technical and didactic training, which will allow to raise the level of teaching.

In other pedagogical professions, the teaching of informatics will depend on the character of the profession and the subject.

In colleges, systematic training of practicing teachers will be organized basing on postgraduate student courses.

It is also planned to create a network for the

National Educational System; this network will be used for distant education, accessing databases, processing information pertaining to management of education, exchange of software, technical, and scientific documentation.

Concerning the obstacles to introduction of the new technologies, we came to the following conclusion:

The main obstacle is of economic character. The present financial restrictions did not allow to systematically invest into new technologies for education and specialized technical documentation.

The Cuban program of educational informatics is not supported by any international program.

DEVELOPMENT OF INFORMATICS IN CUBAN UNIVERSITIES UNDER THE AUSPICES OF THE MINISTRY OF HIGHER EDUCATION

INTRODUCTION

The computerization program for higher education was approved by the Cuban Government in 1984, with the purpose of developing and applying the strategy of introduction computer equipment on this level of education.

At the first stage the program was financed centrally by the state. A major step was made then in the direction of outlining development prospects of national culture in informatics, and needs of various educational services in computerization were determined.

The ministries and organizations having the greatest need in computerization of the educational process were included in the program.

Due to the economical crisis in the country, in the first months of 1991 a decision was made to decentralize the program; it was suggested that the universities change over to self-financing. In particular, it was decided by the Ministry of Higher Education that under these circumstances each university should take the responsibility for fulfilling this program as far as its currency income permits.

The aim of this document is to give an account of the most important points in the history of the computerization program for the Cuban university system, of its present state and prospects, and of the priorities outlined by the Ministry of Higher Education.

1. EVALUATING THE RESULTS OF INTRODUCING THE COMPUTERIZATION PROGRAM

During the ten years that have passed since the moment the computerization program was outlined, significant progress was made. Further on we name the branches in which the success is apparent.

A. Professional education

The computerization program allowed one to include computer literacy in plans and programs of all disciplines, both computer oriented and those where informatics is needed as teaching means and/or tool.

Speaking of preparation of experts in informatics or modern information technologies, one should say that, as a result of intensive work, 13,000 specialists were prepared, including 2,111 experts in electronic equipment and microchips, 3,142 experts in automated control systems, 3,920 experts in telecommunication, 1,500 experts in programming and 1,400 experts in engineering informatics (numerical methods).

For each specialization, a plan of using computers was developed that provided for optimization of the educational process by creating real situations to be analyzed during the classes or increasing quality and exactness of solving various problems. This plan was called General plan for computerization of professional education and became the main document according to which introduction of computer literacy into teaching programs was done.

Each program determined exactly the needs of future specialists in computerization and teaching plans in informatics. .We have serious achievements in introduction of computers into the process of training veterinarians, chemical and mechanical engineers.

Introduction of computers allowed to add new methods to those used by professionals in their work, thus allowing to solve the problems that are very hard to solve using old methods.

It should be noted also that one of the achievements of this program is changes in the public opinion about the necessity of introduction the computer as essential tool for solution of many problems. Although these changes in mentality cannot be called universal, they should contribute to a breakthrough which will allow the specialists to use their professional potential more efficiently.

The computerization program contains the concept of final user, according to which the classical schemes of mastering one programming language for each separate occasion were discarded.

The flexibility of the computerization program allowed one to adjust software and equipment to needs of each particular branch of knowledge and guaranteed the steady development of technologies.

The obvious success of the program in developing methods of application of computers to professional training allowed us to conclude five years ago that we were in the avantguard of the third world and able to compete with some of the developed countries.

The present crisis and the stringent economical blockade imposed on us by the United States are the reasons for the ceasing of funding the computerization program, which had negative effect on the performance of the equipment and made it 83% obsolete. All this told very negatively on the quality of training specialists. For example, the operating environment Windows, which became standard as early as five years ago, can be installed only on 27% of our computers.

B. Training professors, scientists, and post-graduate students

Training professors and researchers is one of the principal factors in attaining the prospects of the computerization program. To that end, for each discipline, the scope of knowledge and skills in informatics required for a professor of it was established. It is clear that efficiency of introduction elements of programming and modern technologies in general depends on to what extent the professor himself has mastered the computer and uses it in his work. This is why the shortage of equipment has a very negative effect upon the level of training of our professors.

Concerning post-graduate training of professors, considerable success was made in this field, because we managed to satisfy the needs in various branches of education, consulting, and service of computer equipment.

We managed to have about 130 refresher classes in informatics for users and personnel, even though shortage of the necessary equipment had its negative effect on this kind of activity, too. A great number of students participated in these classes; the equipment installed in non-university organizations was used as well. In the framework of this activity, 5 teacher-training programs were accomplished (for training teachers of informatics in general, teachers of informatics for engineers and architects, teachers of educational informatics, teachers of programming and of applied programming) and one program for training specialists in computer-aided design and typesetting. 50 persons attended these classes.

There are also a few professions which, not being of a purely computer character, require some knowledge of software and computer architecture. On the other hand, of 169 professions existing in the country, 125 (74%) include computer literacy as one of the disciplines in their syllabi.

An important role in training teachers, scientists, and graduate students was played by the Regional Center of Computer Training for Teachers of Architecture and Engineering (CREPIAI), which is a branch of the Jose Antonio Echeveria Polytechical Institute and by the Center of Informatics for Managers, which is a branch of the Habana University. Both of these centers were created under the auspices of UNESCO.

C. Research

An extensive use of computers is observed in this field; it is thanks to the computers that most of the success in the sphere of higher education was achieved. This statement may be supported by the fact that at the contest of projects submitted to the Ministry of Education for financing, most of the projects submitted imply the use of computer as indispensable ingredient. Of course, levels of the projects vary since the command of computer is not the same in all the groups.

Some scientific teams regard informatics as subject of their research, others are related directly to development of software. Among the teams working with applied programming, those working upon applications of informatics to education stand out. In 8 of 15 universities belonging to the Ministry of Higher Education there are research teams that actively work in the field of educational informatics, that investigate and develop software, programming languages, multimedia, etc. It is a proof of their fruitful work that 50% of works submitted to the Congress "Informatics in Education", which took place in Habana in March 1996 in the framework of the Convention "Informatics in Education", were from our universities.

One of the methods of stimulating interest in informatics among scientists and students is the Students' Computer Contests for the students of the last five years. The number of participants of this competition is steadily growing.

D. Management and using scientific and technical information with the aid of computers

The network of the Center of Scientific and Technical Information of the Ministry of Higher Education was created in 1972; since then and until 1984 the organization of this network had been improved. The finances assigned to this network were used for the purchase of equipment and information and for automating management of university libraries. Since 1984 to 1989 the final phase of creation of the network began, that is 19 centers of information (or main libraries of 15 universities of the Ministry of Higher Education) were founded.

During this second stage, the main investments were made into the purchase of information, computers, copiers, laser printers, CD ROMs, scanners, modems, and other materials required for strengthening the network. After 1989, one continued investing in the network, for information was purchased and the performance of the network was enhanced.

At present, about 3 million copies of books, periodicals, and other documents are stored in the universities. This is why such services as photocopying, computer-aided bibliographical and context search were organized, and databases were created. At the moment we have 300 databases that store more than a million records. Only in 1994/95, the support service allowed to add 77 thousand original articles to these databases (9 articles per one professor or researcher on the average). The network exchange among 3,000 organizations, in which 39 university scientific journals are published, has achieved a great scope. Several thousands of copies of the journals, to the total cost of more than 100 US dollars, take part in this exchange.

As an important event in the history of the network, one should point out the creation of the "National Server of Scientific and Technical Information" with the REDUNIV node. This server is situated in the Center of Scientific and Technical Information of the Ministry of Higher Education (the ICT/MES center), from where the program of development of the network is directed and coordinated. REDUNIV provides e-mail, spreadsheets, referative, bibliographic, mixed and control databases that were purchased or developed in the network. All services are supported by the database control system CDS/ISIS, which is known as MICROSIS and has been distributed by UNESCO.

On the other hand, the ICT/MES center distributes the MICROSIS system in all the country, to which end 90 courses and seminars have been organized starting with 1995; about 1500 persons from 22 organizations attended these courses.

One should point out that REDUNIV node gives our universities the access to the Cuban Academy of Sciences network via X.25 protocol, which gives access to other national services and to the international email via UUCP.

In spite of all these achievements, the access to scientific and technical information with the aid of modern technologies is extremely difficult due to problems with equipment and to the poor quality of national telephone lines.

E. Management of the universities

Speaking of computerization of administrative functions in the universities, a new tendency should be pointed out: the automated systems are coming closer to the final user, thus breaking the older schemes of functioning of computer centers. The systems developed by the Ministry of Higher Education and by the universities themselves allowed to improve the working discipline and to secure more efficient administration of the universities.

The grave situation with equipment had its negative effect both on this field of activity and on the capabilities of the personnel specialized in installation and service of the network in the universities. During the last 5 years, we managed to maintain the level of automation of management in our university centers; in those with the greater potential, their own programs were developed or the base programs were improved.

2. THE FUTURE OF THE PROGRAM OF COMPUTERIZATION OF THE HIGHER EDUCATION IN CUBA

In November 1995, the National Commission in Computerization of the Ministry of Higher Education in Cuba was founded. Experts from all the universities are members of this commission. They decide the directions in which one should develop the computerization program and what parts of the program, which had been created 10 years ago, should be updated.

The measures taken indicate that the Cuban revolutionary Government sees the strategic importance of the computerization program for the future development of our country and gives it a financial support even in the present grave economical situation.

It is certain that one should prepare such a computerization program that will allow our universities to make a breakthrough, that will be realistic enough not to be so dependent on the financial difficulties caused by the present severe crisis. If the program is to perform badly, this will certainly have its effect on the quality of training of the future specialists, and the drawbacks of the programs, with which we will have to fight, will become clear.

One of the fundamental priorities of the computerization program is creating the culture of work in the computer nets and of using the sources of scientific, engineering, administrative, and economical information. This orientation guarantees that our specialists will be ready to work in the national networks and, in the nearest future, in the Internet. This strategy will allow us not to be overwhelmed by the avalanche of new technologies, whose development causes extensive exchange of information between the developed and developing countries. We will be also sure that our students, professors, and scientists are ready to use these resources adequately, by creating the true image of our country and the Revolution in the Internet. To achieve this end it is necessary to create computer networks that join the maximal number of universities and to teach the professors and computer experts so as they could include the new knowledge and concepts into the syllabi of all the disciplines.

The distribution of resources in the higher education will be based upon dividing the existing professions into three groups; for each of these groups, it will be indicated to what extent usage of computers and new information technologies is a priority for each of the disciplines in these groups. It is obvious that the first group will consist of the professions for which informatics is one of the main disciplines, as well as those dependent on the modern computer equipment.

The computerization program should make a special stress upon training specialists and professors, as well as graduate students. It is the graduate students who are responsible for the revision of all computerization programs from the standpoint of the new technologies and for the introduction of the revised programs. Using computers in research will become the second priority, taking into account the extent to which it influences quality and efficiency of research.

The administration of the Ministry of Higher Education knows very well to what extent computer technologies, telecommunications, scientific information, and modern information technologies are intertwined in the modern world. Creating a technological and methodological base for the development of knowledge and skills pertaining to the usage of this technology, introducing its elements into the basic syllabi of each profession, and attaining the new level of information culture in our country are both the main objective of the new Computerization Program for Higher Education and our most ardent wish.

HABANA,

THE REPUBLIC OF CUBA

MINISTRY OF EDUCATION
MINISTRY OF HIGH EDUCATION

NATIONAL REPORT OF FINLAND

EDUCATION AND INFORMATICS IN FINLAND

THE EDUCATION SYSTEM OF FINLAND

The most essential goal of the Finnish educational policy is to provide the entire population with a high level of education. The education system is built to offer people opportunities to proceed in different types and channels of education according to their own abilities and needs, regardless of their place of residence, economic situation, sex or mother tongue. Instruction is mainly given in Finnish or Swedish. In Lapland it is also possible to study in Sami language.

PRESCHOOL EDUCATION

Preschool education, which is not compulsory in Finland, is arranged for 6-year-old children in a day care centre or in a preschool group attached to a comprehensive school. Annually, more than half of the age group participates in preschool education, some 2 % of whom is given preschool education in comprehensive schools.

COMPULSORY EDUCATION-COMPREHENSIVE SCHOOL

In Finland the compulsory school age begins at seven and continues for ten years unless the person has completed the syllabus of the comprehensive school earlier. In general, it takes nine years to complete the comprehensive school. It is the duty of the local authorities to provide comprehensive school education or other corresponding studies for children of compulsory school age resident in their areas. The majority of children attend to comprehensive school studies arranged by municipalities. However, it is possible to study also elsewhere, for example, in private schools, in hospital schools or at home. Some 62000 children start their comprehensive school education annually.

SENIOR SECONDARY SCHOOL

Senior secondary schools provide general education and continue the basic general education provided by comprehensive schools. Nearly 60 % of the comprehensive school-leavers opt for upper secondary school. The upper secondary school terminates in a national school leaving examination, the matriculation examination, which in 1994 was taken by some 30 000 students. The completion of upper secondary education and matriculation examination give general eligibility for university studies and vocational education intended for matriculated students. Under certain conditions universities may also admit students who have not passed the matriculation examination.

VOCATIONAL EDUCATION

Basic vocational training (2-3 years) is given in multi disciplinary or specialized vocational schools. Higher vocational education (3-5 years) is usually given at specialized colleges which can be entered either after comprehensive school or (usually) after completed secondary level studies, Apprenticeship is provided as an alternative route to these qualifications. Polytechnics is in Finland a new Fachhochschule-type institution of higher vocational education whose 3-4 year programmes lead to an academic degree.

UNIVERSITIES

The basic university degree (candidate, master's degree) consists of three stages and takes 5-6 years to complete.

The Finnish universities consists of 20 institutions, of which 10 are multi-faculty universities, 6 specialised universities, and 4 art academies. The universities are located in 11 cities. The number of university students is 135,000. The total number of staff is 23,500, of which 7,500 are teachers.

ADULT EDUCATION

Finnish adult education can be grouped into basic general education, basic vocational education and liberal education. Adults are also offered the same kind basic education - vocational, general and higher education- as is provided for the young.

THE STARTING POINT IN FINLAND IN USING NIT IN EDUCATION

Finland has a good base for development as an information society, which benefits from modem information technology. The network of educational establishments is dense and there is an extensive supply of training opportunities after comprehensive school. About 60 percent of each age group go on to upper secondary school. Over 90 percent of each age group, after completing comprehensive school or upper secondary school, go on to attend a vocational training institution, polytechnic or university. The supply of adult education has increased rapidly since the 1980s.

Information is readily available to people throughout Finland. The nationwide public library system has been designed according to a networked model based on cooperation and division of responsibilities. Every Finnish municipality maintains a public library. In total, these public libraries have over 2,000 service units providing services, which are available to all citizens. About 80 percent of public libraries have computerized library systems, and this percentage continues to increase. Currently, libraries use over ten different computer systems.

There are some 800 scientific libraries in Finland and university libraries represent a central part of this network. Unlike the situation in many other countries, scientific libraries in Finland are public services and open to everyone. The joint data network of university libraries is the backbone of the computer systems in scientific libraries. The uniform structure of this system makes it unique in the world.

In some sectors, the information technology and telecommunications industry in Finland is a world leader, and the development targets set by the EU have already been reached. The quality of Finnish information technology has been recognized in OECD reports, among others. The level of information technology employed in society and business life is relatively high, this is also true in some sectors of education and training.

Major improvements in information technology and telecommunications have also taken place in the science and research sectors, especially during the last five years.

Scientific computing and symbolic data processing have both solid traditions and established positions in Finland. Internationally, computational science and research are at the leading edge, and the results obtained *are* transferred to companies for use in their product development. Finnish research leads the world in some sectors of the data processing field.

Progress in very exacting areas such as supercomputer projects and information network development has been made possible by effective national cooperation and division of responsibilities between the universities.

The number of Internet connections per capita in Finland Us one of the highest in the world.

INFORMATION TECHNOLOGY STRATEGY FOR EDUCATION

Education and research are crucial factors for the development of Finland as an information society. For the citizens of such a society to prosper, they must possess a good general education, a wide variety of capabilities to act and solve problems, and the professional competences and skills required by the continuous changes inherent in a working life based on networks.

The Finnish Ministry of Education has published in 1995 a document on the strategies for developing education and research in accordance with the demands of the Information Society. The strategies and attendant measures cover the ground up till the year 2000. The implementation of certain steps was begun in the current year. The main areas of development are the following:

FROM ONE-OFF TRAINING TO LIFELONG LEARNING

Networking methods and the changing requirements for professional competence demand that the education system is both flexible and adaptable. Educational authorities and organizations must promote networking of the education system and create open learning environments to support the development from "once-and-for-all" training towards lifelong learning. Individual study opportunities must be improved at all levels of education, and study methods, teaching material, as well as the required information services need to be developed.

To ensure that the adoption of new teaching methods and the use of information technology is effective, their development and application must become a part of the everyday activity of universities and educational establishments.

The use of open and flexible learning methods and teaching materials should be increased in adult education establishments, civic and workers' institutes, as well as in open university education. Students should be shown how to benefit from the use of information technology as a learning tool.

The ability of libraries and information services to serve the public in acquiring information should be improved. The libraries should be developed as nodes in the open information network, and their role in providing user support for information networks and electronic information products should be strengthened.

BASIC INFORMATION SOCIETY SKILLS FOR ALL

The task of comprehensive school is to give every girl and boy the multi-faceted basic skills and competences required to find and manage information and to communicate. These are basic requirements in the information society and are essential for further education. All levels of the education system should support the continuous updating of these skills.

The comprehensive school must ensure that every pupil learns how to acquire information independently from different sources, how to manage and process information and how to use information in an analytical and critical manner.

The task of the comprehensive school is to provide every pupil with basic skills in using information technology. Girls in particular need to be encouraged to use information technology.

The use of information technology as a learning tool in initial general and vocational education should be increased as specified in the new national criteria for curricula. Information technology should not be taught as a separate subject, it should be a factor that is integrated into the teaching of other subjects.

The municipalities need to ensure that the schools have the equipment and network facilities necessary for teaching the basic information technology skills. Continuing education should be increased to guarantee that teachers and necessary support staff possess an adequate level of competence.

Adults must have the opportunity to learn the basic skills of obtaining and managing information, communicating and understanding information technology. They must have the opportunity to improve these skills continuously.

VOCATIONAL SKILLS IN THE INFORMATION SOCIETY

Vocational education should provide such skills for living in the information society that correspond to the requirements of a networked working life, one which is continuously changing and becoming increasingly international.

Educational authorities and organizations should together ensure that the initial and continuing education that supports the information industry is sufficient, at the right level, and of the required quality. A national goal should be that professional competence in the different sectors of the information industry in Finland is counted among the best in the world.

The know-how of professionals in the information industries need to be extended to meet the diverse needs of changing job requirements. The introduction of information technology causes particular needs for change throughout initial and continuing education in the fields of library and information services.

FOCUS ON THE TEACHERS

In implementing the principle of lifelong learning, teachers' professional skills are absolutely essential. Teachers need not only to know how to manage and communicate information in their own field, they must also be able to teach methods of obtaining and using information to enable learners to work independently. Teachers should have the ability to use the media necessary for open and flexible learning and be able to modify and develop material in ways which make it suitable for them to use. The prerequisites and content of basic and supplementary teacher training must be developed to respond to these requirements.

DEVELOPMENT OF INFORMATION PRODUCTS AND SERVICES

The availability and competitiveness of high-quality Finnish information products serving education and research must be guaranteed.

Using the new methods which technology makes available, information resources need to be made available for both national and international use. To ensure that Finnish information services function smoothly as a part of a global electronic library, the technological capacity and know-how required to achieve this need to be developed.

The production, distribution and utilization of information products published in digital form must be increased in a variety of sectors, especially in education and training, research and public administration, and in the libraries, information services and archives which serve these sectors. Support is needed for Finland's emerging multimedia production facilities and related businesses through commissioned work and subcontract work.

RESEARCH IN THE INFORMATION SOCIETY

Developments in information technology impact all fields of research, from basic to applied. Nowadays, in almost all cases, information technology is an essential part of the research process. The prerequisites of scientific computing, such as adequate high-performance computing capacity, workstation facilities and high-speed network connections are crucial factors in competitive research.

Finnish universities and scientific research aim to be at the international forefront in applying information technology. Participation in the information technology programmes of the European Union should be active. Finnish education and research should be among the first to attain the goals set by the RTJ for applying information technology and telecommunications.

Developments toward the information society, the application of information technology and increased networking have far-reaching economic, social and cultural impact that requires further research. The focus of pedagogical research should be on the fields of media and learning, and on the interaction between humans and machines.

EDUCATION AND RESEARCH NETWORKS

The national information infrastructure, the Finnish Information Highway, should be assembled as a multi-layer, seamless system. The information network for education, training and research will be a part of a global open network.

The Internet and emerging standards for broadband networks and services should provide the foundation for the education and research information network in Finland.

Schools and educational establishments must be integrated with their local environment. Links between schools and educational establishments at different levels and operating in different fields must be increased, and links with community and business life improved. The information networks should be structured so that they support these developments. The most effective technical way of achieving this is based on regional networking and cooperation.

Information network services are to be made available to all schools and libraries. An adequate level of service should be guaranteed to all educational establishments. Both scientific and public libraries must be guaranteed not only adequate facilities, but also the telecommunications links and expertise required to utilize these effectively. Special attention should be paid to the development of public library information network services and to the development of libraries as nodes in the open information network.

LIMITING FACTORS

In the 1980s, substantial hardware investments were made in schools providing general education and in vocational institutes. At the same time, continuing education for teachers was organized on a large scale. In recent years, as a whole, the school system has not kept pace with the rest of society in terms of information technology, even though a number of advanced regional communication network projects are in progress and several development projects in open and distance teaching and multimedia materials are under way.

The use of information technology in education and training has also been held back by a lack of applications. Finland is a small market *and* language area, and hence production of electronic information products has got off to a slow start. This is clearly seen in the production of educational software. The weak economic situation has also reduced demand for such software.

Currently, the level of information technology equipment available differs from school to school, and some of it i.s obsolete. The situation is worst in primary education. Even where adequate equipment exists, it is often not fully utilized. Teachers have differing abilities in using information technology. The level of utilization of telecommunication services and information networks is still low in Finnish schools, mainly due to the slow development in equipment resources. Cooperation between educational institutions in using teaching resources has been rare. All these factors have slowed down the development of an organizational culture that utilizes information technology.

DEVELOPMENT PROJECTS

Based on the above-mentioned strategy of the Ministry of Education a development programme was launched at the beginning of 1996 with an aim to improve the schools' computer hardware and permanently link individual educational institutions up with Internet. The programme will be concluded by the year 2000.

The name of the programme is Suomi tietoyhteiskunnaksi - koulutus tiedon valtatielle (Help make Finland an information society - help put the school on the road to better knowledge). The programme includes projects for developing classroom practices turning to the best account the new information technology and developing new Finnish multimedia programmes and study materials for use on the net. Over the next three years the government intends to support the local school owners and mandators with roughly FIM 100 million in order that the latter will be able to purchase PCs to the schools and enlarge their information networks. The programme has been enthusiastically and universally applauded. About 80 percent of the schools and their owners have expressed a wish to be part of the programme already in its first year.

INFORMATION TECNOLOGY IN NATIONAL CURRICULA

Curricula at all levels of education in Finland, from preprimary education to university postgraduate programmes, have just been renewed.

Decision-making concerning the organization and content of general and vocational education has been transferred to those who maintain the schools: the municipalities and federations of municipalities. At national level, general criteria for curricula provide the framework for steering education.

New national criteria for curricula for comprehensive schools and upper secondary schools were approved in January 1994. The national criteria for curricula for upper secondary vocational education were approved at the beginning of 1995. The criteria for curricula for higher level and institute level were approved in February 1996. At present, national criteria are under preparation for the vocational diploma and special vocational diploma in adult education, as provided for in the law concerning vocational diplomas.

Requirements of technical basic education, including information technology skills, are incorporated in the curriculum criteria for basic general education. The principles for how these skills should be taught vary from one curriculum to another.

COMPREHENSIVE SCHOOLS AND UPPER SECONDARY SCHOOLS

In the national criteria for curricula for comprehensive schools, pupils are expected to learn how to utilize information technology applications. The study goal is that the pupil, irrespective of previous experience, learns how to use computers and the most common software applications and is also able to make a realistic assessment of the possibilities of utilizing information technology in different subjects.

In the criteria for curricula for comprehensive schools, information technology has not been allocated a separate number of lessons; it is regarded as an integrated theme. Study goals for information technology have been set, but since it is an integrated theme, teaching takes place either in conjunction with other subjects or, in the upper levels of comprehensive schools, as an optional subject, depending on the local curriculum.

In the curriculum for upper secondary schools, information technology is not specified as a subject, course, or separate integrated theme, and no specific goals are set for the skills to be acquired. However, upper secondary school studies include optional, applied courses which can be taken either at the student's own school or at another educational establishment. These optional courses may include studies in information technology. In both comprehensive school and upper secondary school, information technology is used as a tool when studying other subjects.

VOCATIONAL EDUCATION

According to the curriculum criteria for vocational education, information technology must be taken into account from a variety of points of view in all studies, both as a subject in its own right and as a tool for learning other subjects. In general studies, from which a student may choose courses worth between one and four credits (study weeks), information technology is an optional subject available to all students. Information technology is also an optional subject in adult vocational education.

General studies are intended only for those students who enter vocational education from comprehensive school. No general studies are separately defined for students entering from upper secondary schools. The goals of the general studies are included in the national criteria for curricula in every field and degree. This means that the emphasis on the teaching of information technology varies according to the field and the degree. The general goal is to teach the students to use the hardware, software and information resources available in their own field and for them to gain an understanding of the basic functions of computers.

At institute and higher vocational level, students may choose from one to five credits in information technology studies. The aim is that the students become knowledgeable in how to use information technology to retrieve, produce and process knowledge in their future occupations. They should learn to access and use domestic and foreign networks and be aware of the versatility of IT and the new multimedia and how to make the most of them. They should further be able to act naturally and responsibly as users and producers of information technology.

The national core curricula provide a good basis for making use of the new information technology. How IT is taught and made use of, however, is ultimately in the hands of the individual school. It has been found that the curricula especially of small lower stage comprehensive schools show very little IT. Also at the upper stage of comprehensive school and in upper secondary school the use of information and communication technology has been scarce except for the optional courses in IT. The development programme introduced by the Ministry of Education has, however, helped change general attitudes and many schools are currently revising their curricula in regard to their information and communication technology content. The use of Internet in teaching is an interest common to most schools.

UNIVERSITIES

The universities in Finland are autonomous and they are responsible for developing their own curricula. Recently initiated evaluations of university activities have clearly encouraged the universities to pursue this work. The evaluations have been the basis for the development of degrees and degree programmes. A new two-level basic degree system has already been adopted in six academic fields. During 1995, the intention is to have new degree statutes in force in six or seven additional disciplines. Once this has been achieved, 90 percent of new students will be studying in accordance with the new two-level system. The reform of diplomas concerns both structure and content. The goals are to make study more effective and to improve the quality of research work.

In the performance agreements made between the universities and the Ministry of Education, it has already been decided that universities carry out regular evaluations of their teaching and that students take part in these evaluations.

NEW WAYS OF LEARNING AND TEACHING USING NIT

Modern concepts of learning emphasize the students' responsibility for their own learning and their active role in seeking and using information. The role of the teacher changes from being a distributor of book learning into being a tutor guiding the students. The school environment becomes a centre for learning and activity. In libraries and information services, telecommunication and digital information products are increasingly found alongside traditional services as information sources of equal value.

The development of information technology has facilitated new types of teaching arrangements and a more flexible division of responsibilities between universities and educational establishments. Education units can agree on joint distance teaching, which is able to reach students throughout the country.

This makes possible an increase in educational opportunities while reducing costs resulting from the duplication of teaching. Locally, the focus can be on tutoring support for students and on reinforcement of the learning process. For working people, the possibility of studying without time and place constraints is important.

The furthest on the way in Finland is the development of open and flexible study practices in adult vocational education and training. In this sector work for the turning into the best account of new equipment has been steadily done already for years. Development work has been effected in project networks, each comprising thirty educational institutions. Areas of stress have been the development of action models for open learning milieus and the development of study materials for distance teaching. The work goes on. Next in line is the development of distance operated upper secondary schools for adults and the opportunities of mature students to pass examinations using data nets. These projects will be launched in 1996. In addition to the data networks, the use of radio and television in adult education will increase.

Information technology is widely used in Finnish university education. Different kinds of computers are available to both teachers and students, and special computer rooms with terminals, microcomputers or workstations are provided for educational use. However, more information technology is needed, but the lack of financial resources for additional investments and for employing new personnel in maintenance and support is the most important obstacle in trying to meet this demand.

Within the framework of the national strategy for education, training and research in the information society, special projects have been agreed in annual negotiations between the universities and the Ministry of Education. These projects include training courses in information technology, as well as developing hardware and software and campus networks of the universities.

PARTICIPATION IN INTERNATIONAL PROGRAMMES

In Finland, several small-scale experiments on networked training arrangements have already been carried out or are currently under way. Several of these projects have been executed within the framework of the EU telematics programme. The large-scale introduction of new learning methods demands that the development and application of these method's and the technology required to support them become part of the day-to-day activity of universities and educational establishments.

Finland's membership in the European Union has enhanced the interest of the schools to participate in international projects. So for instance the LEONARDO programme has approved five Finnish coordinated projects developing the use of multimedia and IT in education.

COMPUTERS AND SOFTWARE

SCHOOL AND INSTITUTES

Hardware

Exact figures on the number of PCs in Finnish schools are lacking. The number has been estimated by the authorities to be on average the following:

	PCs /school	PCs/number of students
Lower stage comprehens. schools	4	28
Upper stage comprehens. schools	22	14
Upper secondary schools	21	11
Vocational institutions (Including Polytechnics)	60	3-10

Software

All schools with computer hardware also carry the necessary central software. Further, some computer assisted teaching programmes are in use, but not to the extent as could be wished for. There are very few programmes to be had in Finnish and the few there are have not yet reached all the schools.

The most use of computer aided software has been made at vocational institutions who also have the best hardware. The education authorities have supported the production of domestic software for use in schools for more than ten years now, but only recently, with the advent of multimedia software and CD-ROM, have these programs spread also to the non-vocational general education institutions. At the moment there are 10 CD-ROM disks available in Finnish, some further ten being prepared with the support of the education authorities. Due to a very small market, the publishers are not very keen on producing teaching materials in the new media.

Schools are only learning to produce WWW material for the Web.

UNIVERSITIES

Hardware

Information technology at the universities includes different kinds of computers: from individual microcomputers to supercomputers, peripheral devices, and local area networks. Many students also use their own personal computers for their studies. Multi-user servers can be used either via classroom terminals, microcomputers or workstations, or from home by using a modem and telecommunication connections. Microcomputers and workstations can also be used separately, with software either installed in the hard disk or loaded from network servers. The total number of microcomputers and workstations available to students at the universities is about 4,500. This means one device for every 30 students, on an average, but the ratio varies from 1/100 to 1/15. Efforts are taken to reach one device for every ten students by the end of this decade. Teaching staff as well as research and administration staff have normally microcomputers or workstations in personal use. Portable computers are also widely used.

Software

The most common operating system in multi-user servers and workstations is Unix. Microcomputers run mainly MS-DOS and Windows, but also Macintoshes exist with their own operating system. Computers which are used in instruction are provided with the necessary software. Teas or even hundreds of different programs are being used at universities for various purposes. Microcomputers are also equipped with necessary telecommunication accessories and programs for using other computers and network services.

Networking

At the universities, practically all computers are connected to the local area network of the university (Ethernet), which are linked via Finnish University and Research Network (FUNET) to international Internet. Internet connection offers a wide range of services to its users: electronic mail, news groups, remote login, file transfer, World Wide Web, and so on.

The FUNET network was upgraded to ATM (asynchronous transfer mode) technology in 1995. Current connections between universities are nowadays 10 - 34 Mbit/s. International connections from FUNET to Nordic network NORDUnet has also been upgraded to 34 Mbit/s recently. Since need for network services is constantly increasing, the FUNHT network needs to be developed further so that the transmission speed would increase. Also international links to Nordic countries, to other Europe and to the United States, must also be upgraded in coming years. Universities will also upgrade their local area networks and take the ATM technology more efficiently in use.

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NATIONAL REPORT OF FRANCE

EDUCATIONAL MULTIMEDIA IN FRANCE

INTRODUCTION

At the beginning of 70s different forms of information technologies were introduced in the educational system of France. During the period of the last 25 years all lyceum and colleges were equipped with computers as the result of some programmes implementation in the field of national education ("1000 micros", "100000 micros", "Informatics for everyone"). Near 5% of teachers took informatics pedagogics courses, which lasted for at least 3 months. Short-term courses of informatics basis training have been overall offered. After the adoption of the regulations, related to the information technologies application in education, software became a didactic means.

In is interesting to remark, that the objectives of informatics application in education, defined at the beginning of the 70s, has considerably changed since that time. The resume of the changes is the following:

- to provide the opportunity of information technologies application in different disciplines;
- mastering the concepts, used as the professional means of education;
- studying informatics methods.

The application of interactive multimedia for educational purposes is always very sensitive to every shift in the system of vocational training. In doesn't even matter, it is an agricultural, vocational or higher education. In any case the development of educational software involves the following perspectives:

- the modernisation of pedagogical practice (education individualisation; education differentiation depending on one's interests and abilities), which allows to increase the efficiency of education;
- the diversification of educational forms as the result of the diversification of the demands for education; it is considered in the national policy of territories accomplishment (the diversification of the modes of access to education; the development of different educational centres in the rural and urban regions for the partial solution of the problems of the isolation of those, who are willing to study, and of the deficiency of the students in some educational institutions);
- re-qualification of active employees and those, demanding a job, in every field of economy.

Depending on users' demands, the general purposes of informatics utilisation are divided into the following groups:

- the realisation of the citizens as soon as possible the necessity to appropriate to the modern technical culture, in particular to master information technologies;
- the admission of computer and multimedia advantages as didactic tools for youth and adults teaching;
- information technologies recognition by public institutions, in particular by the Ministry of the National Education and by the establishments of the system of agricultural education, less by the institutions of vocational education, which don't have defined specialisation in this field, and for the regional departments, which recently became responsible for some fields of education;
- information technologies application in everyday practice of vocational training and education, which is still occasional, though the responsible bodies are formed and there is a certain experience in the field of vocational, agricultural and higher education;
- the low level of families equipment, though many of them are very much interested in information technologies. There are two groups of interested consumers: parents, anxious about the progress of their children - pupils, who consider, that computer is the aid to improve their results at school; adults experience the demand for the means of self-learning in every field of knowledge and in particular in the field of living languages.

1. THE INDUSTRY OF EDUCATIONAL MULTIMEDIA

There are three large sectors in the consumers' market of pedagogical products:

- the market of articles of general consumption;
- the market of professional products, that is the market of intermediary products;
- informal market of exchange the pedagogical documents of establishments and organisations.

These markets are closely interlaced with each other in the field of finances and industry. However the structures, developing educational software, represent a highly heterogeneous group, that consists of the following:

A. ISOLATED AUTHORS

They don't have any commercial structure, helping them to sell their production. Usually, they are teachers, since recently this group was supplemented with freelancers workers, who work on contract base with an educational institution or a publishing house.

B. BOOK PUBLISHING HOUSES

Publishing houses form departments and affiliates, dealing with software. Usually these are big publishing houses, specialising in the field of school literature, such as *Hatier* and *Nathan.* The public establishment the National Centre of Pedagogical Documentation (NCPD), one of the aims of which is to publish pedagogical materials, has a department of software *development (Unité des logiciels Educatifs).* The system of agricultural education has a specialised establishment - the National Centre of Research and Resources in the field of Advanced Technologies (NCRRAT). The Centre has developed more than 10 CD-ROM programmes.

C. INFORMATICS COMPANIES

This group consists of the publishing houses, specialised in professional software with the departments of educational software development. Among them there are Microsoft (Microsoft Home affiliate) and Claris and servicing and information engineering companies, such as SYSECA and CISI. Most of their clients are the establishments, that are in need of special professional training of their personnel, or they are non-specialised producers, such as book publishing houses without any specialised department for software development.

D. AUDIO-VIDEO PRODUCERS

The TV channels *La Cinquième, TF1, France Télévision* and *Canal+* are intending to start the production of multimedia.

E. SPECIALISED PUBLISHING HOUSES

They have appeared quite recently and their experience in publishing is rather poor. These publishing houses are specialised in new information products (Informatique, Vidéodisque, Télématique, etc.). They are rather small, but able to produce industrial production for a wide range of consumers, as well as services for individual clients. Among them there are *Génésie, Jériko, Chrysis.*

F. SPECIALISED EQUIPMENT COMPANIES

It concerns producers of the equipment, used in the field of education, which applies information and communication technologies. These companies often have to produce "pedagogical production" as a supplement for the main equipment they manufacture. For example, the *Jeulin* and *Micrelec* companies, specialised in laboratory school equipment had to develop a series of data collecting software, compatible with the equipment, produced by them.

G. TRAINING CENTRES

It's quite often, that the centres, offering educational services in a form of courses (lectures) and tours of duty, need to apply new educational technologies for the widening of the range of their students and for the diversification of teaching means. They try to sell their developments through the agency of publishing houses. It is worth to mention, that some centres are specialised in distance education (the National Centre of Distance Education (NCDE), *le Centre National des Arts et Metiers (CNAM),* the Association of Adults' Vocational Education (AAVE). Owing to this fact they become the leaders in the field of educational software development.

There also a lot of ideas, concerning information technologies implementation in the field of higher education. Some of higher educational institutions have already established quasi-professional structures, able to concretise them (or promote their commercialisation). However, among the serious obstacles in the implementation of innovations are the individualisation of directorship, the absence of financial support, non-regulated stakes in the benefits of the authors or establishments, developing "pedagogical production".

The list of the before mentioned producers of educational software should be supplemented with the departments of big private and state companies (insurance company *l'Union des assurances de Paris (UAP),* the companies *Vendôme Formation, Electricité de France (EDF), Société Nationale des Chemin de Fer (SNCF), France Télécom,* etc.), developing software for their own needs.

H. CENTRES OF MUTUAL EDUCATION FINANCING, FUNDS AND ASSOCIATIONS

These are non-lucrative organisations, which main aim is the resources' parcelling among the demanding establishments. Some of these organisations are mainly busy with finances gathering and their distribution among the members of the Councils of education development. Others are working with projects in the field of software development, involving the members of these organisations aimed at the reduction of the corresponding costs. The example of these organisations is the Rhone-Alpes Region Association of the Educational Multimedia Development.

Sometimes other associations are developing software for concrete targets, mentioned in their constitutive documents. The *Association Française pour la Lecture* (for reading promoting) has developed a number of products ELMO; the association *Enseignement public et informatique* has developed the product HYPERTEXTE; the fund *Avenir-Jeunesse-Entreprise* - CHOIX, etc.

I. RESEARCH LABORATORIES

Their production is the result of investigations in the field of educational multimedia. Among these laboratories there are *Laboratoire de Structure Discrete et de didactique* in Grenoble, the *Centre de recherche en Infîrmatique* in Nancy, the laboratory *Représentation et Traitement de l'information Chimique* in Nice, etc. Their products are subsequently diffused though publishing houses. It happened so with the product Le géometre, developed by LSD and diffused by the publishing house Nathan/Edusoft.

J. MUSEUMS

Under the promotion of the National Union of Museums, many museums of France (*Le LouvreCité des sciences et de l'industrie (La Villette), le musee d'Orsay , le Centre Georges Pompidou, etc*) follow their own policy of the development multimedia, working in on-line and off-line regimes.

Lastly, we should note, that the sector of educational software producers is now in the process of radical transformation: intensive merging (*France Télécom* has purchased some small enterprises, *Chrysis de Logedic*; it has attached *Jeriko* and *Infogrammes*); concentration among industrial groups (*Liris* with the *Cité* group; *Havas Edition Electrique* joint *ODA* and *Arborescence*, *Hachette Multimedia, etc*); capital inflow, some activities stoppage, etc.

2. THE INFRASTRUCTURE OF NETS AND SERVICES

Regarding net's services, it's worth to mention, that, though the situation is rapidly changing, at present:

- the services of the interactive regime in the field of education are still not structured in France;

- the communication nets introduction in the system of educational services offering brings about radical changes in pedagogical means (from book and video cassette to interactive multimedia).

There are two basic types of nets: information nets and audio-video nets.

INFORMATION NETS

- The TELETEL net is widely applied in the field of various services and very little - in the field of education. This net is well adapted to interactive queries processing (information on transport time-tables; reserving spaces in airplanes, rooms in hotels, etc.) and much worse adapted for education purposes (there is no opportunity of documents transference, poor graphic interface, slow transmission). Mostly, in the system of education it is used for control.

- RNIS generalisation throughout the territory of the country still didn't change the situation, because the *Kiosque Micro*, which is really able to solve many problems, has opened quite recently. Though now, we are witnessing, how quick visual lectures became popular on the second stage of education, in higher school and vocational education on enterprises.

- The realisation of the RENATER net (French affiliate of Internet) gave higher school a potential opportunity to use such a fantastic means of education, as multimedia.

Some private nets on the base of Internet (Infonie, France on line, MHM), advertised the services in the field of education, emphasising pupils' training at home.

AUDIO-VIDEO NETS

There fore ways of their application:

- application in TV programmes of general channels, in particular of France 3;

- the global application in the framework of recently organised educational channel La Cinquiéme, broadcasted in the Fifth National Radio wave Net, before French - German programme ARTE;

- thematic application in some satellite or cable channels, for example the Planete channel, specialised in documentary information, or the Histoire channel, which is expected to be organised in the near future by *Institut national de l'Audiovisuel* and *SEPT/ARTE*;

- application for the special audience in particular cable nets, which have educational channel or a bank of query programmes, such as EDUCABLE, offered by CNDR, or the channel of the France 3 net, intended for Lorraine schools.

In the future these forms of application will be more often supplemented with information products editions.

3. USING EDUCATIONAL MULTIMEDIA

3.1. USING AT HOME

Only 7% (24 million) of all French families have compatible PC computers at home and only 2-3% of them have the other equipment (approx. 1 700 000 pieces in all these families).

However, the volume of CD-ROMs sale increases day after day: since September, 1993 till September, 1994 there were sold about 700 000 of products; according to some calculations in 1995 the volume of sale will come to 1,6 million. The part of educational products is evaluated in 13%. According to the data of *Electre Multimédia* the main of them are the products for schoolchildren and encyclopaedias.

3.2. USING IN THE SYSTEM OF INITIAL EDUCATION

3.2.1. Primary education

The number of available multimedia equipment is still limited. The educational system has at its disposal 450 working places for the total number of 1100 pupils.

Usually computers are situated in classrooms and pupils are able to accomplish individual tasks. However such tasks are rather rare nowadays. Only the first steps are made in studding the programme LOGO, computer-aided training (EAO), including learning foreign languages.

Some publishers are already offering schools EAO multimedia, but we still don't know it is right.

There are no multimedia products as articles of general consumption for personal computers, financially available for schools. The appearance on the market of some products free for schools, such as "The magic theatre" *(d'Edusoft)* or *Gazelle* software, will partially solve the problem of schools' equipment with multimedia products. Apple production (Kid Pix, Apple Média Tools, Kid Works, etc.) offers wide opportunity for adaptation and creation, easily used by the children of the very early age and by their teachers.

We believe, that the successful Internet using, in particular in the school net on Vercor's Plateau, will get development.

3.2.2. Secondary education

The laws, regarding the decentralisation of the national control system, have considerably changed the allocation of responsibilities, concerning financing of equipment purchasing, between central and regional administration. Regional administration became in charge of some responsibilities, formerly concerning central administration, regarding equipment purchasing for secondary educational institutions. At the same time, the parallel trends of credits' decentralisation and strengthening the position of educational institutions led to the necessity to differ lyceums and colleges, which is closely connected with financial resources and the offering type of education. Rapid and sensible changes took place in this field: schools began to purchase computer equipment without any intermediaries. It has accelerated the realisation of the projects of cables' laying on and lyceums and colleges connection with general net.

At present 350 thousand of microcomputers were installed in 12 thousand of French public and private secondary schools of the system of general, technical and vocational education. Besides computers they were equipped with peripherals (printers, scanners, CD-ROMs, physical interfaces, etc.). The number of CD-ROMs, installed in lyceums and colleges comes to 12 thousand.

Most likely, that the new information space, which will be created in the near future, will be characterised by the three main tendencies:

- existing computer resources integration into a net and their connecting to big communication nets or data transmission nets. About 400 schools have already began to connect their computer resources to the net and during the next months this process should be developed. There is an experience of these nets connection to Internet through RENATER;
- the acquisition of multimedia devices, leading to television and informatics integration;
- the appearance of portable machines (in particular, in preparing classes of higher school), may radically change our attitude towards computer pedagogics, turning microcomputer into super-calculator.

Software for secondary education consists of two types of products:

- professional software, specially developed for the application on enterprises: operational systems and programming languages, general tools of bureautics, specialised tools.
- pedagogical software, specially developed for educational institutions. Most of them are developed by private publishing houses and information companies.

Our state has financed from the budget (80 million francs) purchasing software for secondary educational institutions. The Ministry of education introduced an original system of procedures, related to the acquisition of a right to use a software (mixed licences). These procedures make possible to reduce expenditures for the products, which were evaluated by expert commissions as the products of pedagogical interest (annually schools purchase something about 60 thousand of such products).

Computer education may be acquired not only in specially equipped halls, but in school computer classrooms also. Moreover, more and more computers are installed nowadays in artistic classrooms, lecture halls, laboratories, lounges for teachers and students.

3.2.3. Higher education

There are quite different places for computers in the establishments of higher education. But usually they are placed:

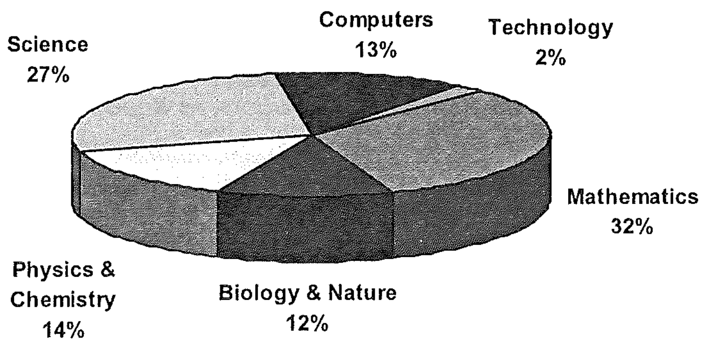
- in the special halls for informatics training or for the technical support of different disciplines teaching (calculations, statistics, econometrics, etc.); these halls are first of all used for compulsory education (practical training, working under teacher's direction). When there are no lessons, the halls are at the disposal of the students, who can study individually with the help of text programmes;
- specially equipped halls for self-learning of particular disciplines; they are usual for technical and medical universities; the students, who reserved working places, get at their disposal different educational products, permitting to acquire the necessary technical skills, to test yourself, to train and to evaluate your own knowledge of basic disciplines;
- specially equipped halls for learning modern languages; these halls either similar to the previous ones (microcomputers, connected to the net or autonomous), or they function like "language laboratories", in case they have the necessary equipment.

consisting of 21,000 hours. In addition, a training center for science and technology teachers was opened in Shiomi, which held courses for 4,000 teachers, with each teacher receiving one week of instruction.

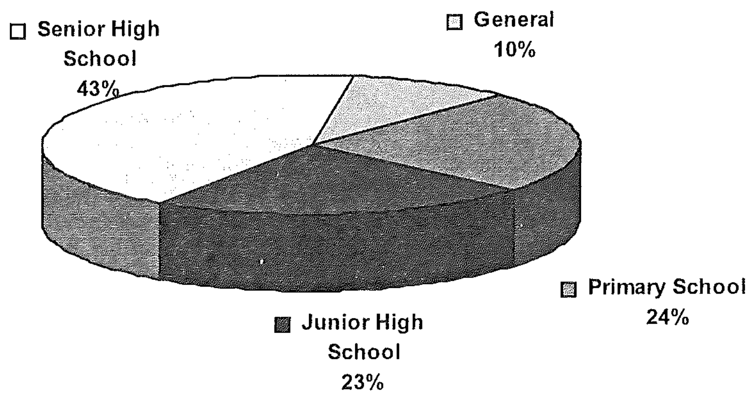
The schedule for 1995-96 includes around 260 courses for approximately 6,500 teachers. There will also be approximately 220 courses for about 4,000 pre-school teachers.

TRAINING COURSES - 1995 – 1996

Training Courses per Subject



Training Courses per Age Group



TEACHER TRAINING AND TEACHER TRAINING COLLEGES

Strong emphasis has been placed on the computerization and introduction of computerized communications to teachers training colleges. The Specialist Primary School Mathematics Teacher course is held at 7 academic colleges, and 10 college projects on mathematics, science and the integration of computers in teaching are due to commence in January 1996. A committee is currently examining the study curricula of teachers training courses at colleges for junior high school mathematics, primary school science and technology, and high school science and technology.

SOFTWARE EVALUATION

Educational software is an integral part of modern learning materials. The educational software market is full of products manufactured by commercial enterprises, with a minority of software designed by research bodies (e.g.. the study curricula department, universities, etc.). Developing educational/learning software is a costly business and the Ministry does not have sufficient funds to do this itself. It was, therefore, decided to use commercially developed products.

These consumers pay for educational software out of their own budgets, and decisions regarding the purchase of educational software are made by the consumers themselves (educational institutions). The Ministry of Education and Culture helps in an advisory capacity only. Unfortunately, educators don't have the resources to keep up-to-date with developments in the market and often buy products with which they are familiar, rather than the most suitable products.

In response to this state of affairs, the Education Ministry has established a software evaluation unit at the Technological Education Center in Holon. The Ministry wants to speed up the evaluation process in order to force the educational system to use software issued with an evaluation label. The and graphic packages, offering 28-56 hours of training in a computerized communications environment, according to the teachers' work program.

3. Integration of Computers in Teaching - Beginners

Another type of training course involves the integration of computers in the instruction of specific study subjects. The course can be given to relatively small groups of teachers from a number of schools. Teachers undergoing the courses will familiarise themselves with various computerized materials which relate to their study subjects, and will learn to utilise computer-integrated study curricula in those areas.

4. The integration of computers in Teaching - Advanced

This course level is designed for teachers and co-ordinators with different areas of expertise, who have completed training courses for beginners and are interested in attending more advanced courses. These courses will include workshops covering the preparation of auxiliary materials suitable for the school study program.

5. Training Courses for School Staff

The computerized training course program also offers a range of courses for school staff conducted on a regional basis. School administrative staff, supervisors and co-ordinators will be offered courses by regional supervisors or training center managers. These courses are conducted by the training centers, and not part of the hours allocated to each school.

THE ROLE OF THE "COMPUTER INSTRUCTOR - ADVISOR"

In order to enable the introduction and proper implementation of computers in the school system, the Ministry of Education decided to allocate a number of training days for instructor-advisors, as part of the computerization program.

Computer instructor-advisors provide one day of training per week at most junior high schools. The instructor-advisor's role is to assist the school principal in the co-ordination of school computers, to help the subject co-ordinators and other members of the teaching staff with the proper integration of computers in the school's general education system, and to provide support for the different kinds of teaching-learning processes.

Together with the principal, the instructor-advisor formulates the annual work program for the field, as well as its implementation with regard to hardware and its uses, software, and the training courses in which the teachers participate during the year. It is also the instructor-advisor's responsibility, together with the principal and school staff, to lead and be actively involved in entire program while supporting and monitoring the initial stages of implementation. It is not his/her job to give the actual computer training courses at the school; however, he or she should be involved in their organisation, in determining their content and their operational framework, and in monitoring their implementation. The instructor-advisor is also responsible, in conjunction with subject co-ordinators, for helping teaching staff team how to integrate computers in their disciplines.

An extensive training system is provided for two types of instructors:

1. School instructor-advisors - for all age groups and types of education. The school instructors will act as tutors and instructors, supporting the process of computerization at the school.

2. Subject instructor-advisors - to work in conjunction and co-operation with the subject supervisors in the training of study subject instructors, as of the 1994-95 school year.

Implementation

1. 180 secondary school (junior and senior high school) instructors attended training courses.

2. 60 primary school instructors were also trained.

The training budget for the 1994-95 school year totalled around NIS 1.2 million.

The plan for the 1995-96 school year (some courses began instruction between July-August 1995) involved the following activities:

1. The training of an additional 150 primary school instructors.

2. The training of approximately 50 additional secondary school instructors.

3. The training of 30 special education school instructors.

4. The training of 300 instructors for the following subjects: Mathematics (30); English (90), Arabic (30), Geography (30), Bible (30), and Language and Expression (90).

The plan allows for the training of about 530 additional instructors.

The training budget for the 1995-96 school year totals approximately NIS 2.5 million.

IN-SERVICE TRAINING

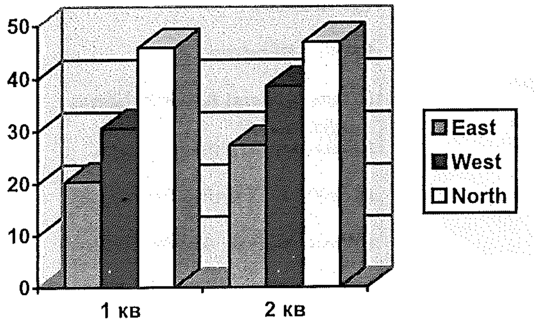
In-service training for teachers is conducted on a regional basis, in teachers training colleges, universities, the Technion, the Weizmann Institute and at the Technological Education Center (the responsibility for implementation lies with the training center in co-operation with supervisors).

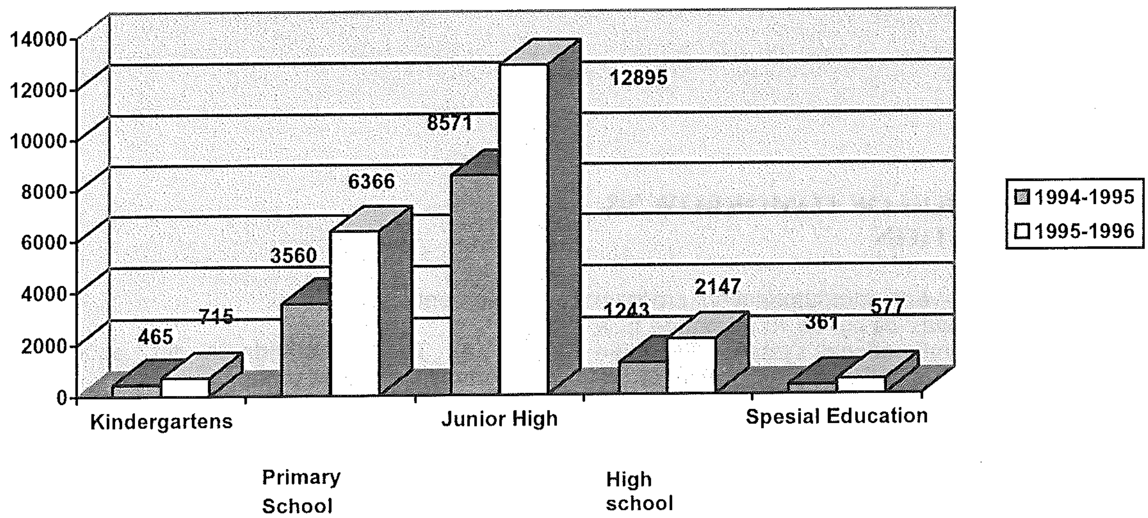
Training courses are held for teachers of all age groups: pre-school, primary school, junior high school, high school, and for instructor-advisors in the following areas: mathematics, biology and natural sciences, physics, chemistry, computers and technology. Most courses involve the use of computer applications.

The object of the training courses is to consolidate the teacher's professional expertise, to familiarise teachers with different study curricula, to equip teachers with the necessary skills to integrate computers in their teaching subjects, as well as training teachers in educational leadership at various levels - subject centers, teachers' trainers and instructors, etc. The composition of the courses will be adapted to the development of new study curricula in different fields and to the wide-ranging activity involved in the computerization of the system and the equipping of laboratories.

In the 1993-94 school year, 232 training courses were conducted for 4,600 teachers,

Allocation of Computer Stations
(Cumulative)





TEACHER TRAINING

COMPUTER TRAINING COURSES IN THE SCHOOLS

The fundamental premise of the computerization program is that the training of teachers, in preparation for school computerization, is an indispensable step in the application and implementation of the computerization of schools and educational institutions. The planning of school training courses is formulated with the full co-operation of the school principal and school computerization advisory team.

Training courses will help to implement the school computerization program, and will provide solutions for the following:

1. Implementing of training course instructions and guidelines.
2. Providing a solution for the achievement of the computerization program's objectives and school priorities.
3. Ensuring that teacher training programs include individual familiarisation and practical experience based on teaching methods which enable optimum utilisation of the integration of computers in the learning process.

School training courses are designed to achieve different objectives. The planning and consolidation of training courses will be implemented on a number of levels in order to achieve the following objectives:

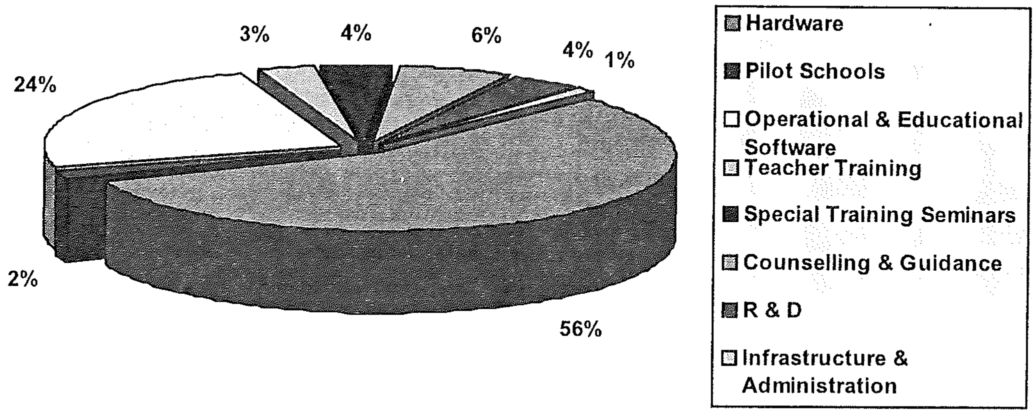
1. Preparatory

This level applies to those teachers with no experience in computerized communications. Teacher trainees will receive 28 hours of instruction on the subject of teaching in a computerized communications environment.

The training course covers the following topics: computers and society, computers and education, computerized work environments in the school, an introduction to communications and data bases, an introduction to multimedia and Windows, and the operation of computerized presentational materials and equipment.

2. Computerized Equipment

The second level of courses, following implementation of the preparatory training courses, is based on working with spreadsheets, data bases, *By Areas of Activities*



IMPLEMENTATION OF TOMORROW '98: COMPUTERIZATION

In 1994, a five-year computerization program was initiated, which was designed to introduce new technologies to the educational system. The main focus of the program is the computerization of the educational system, particularly the junior high schools and teachers' colleges.

GOALS OF THE PROGRAM

1. To bring schools into the "information era" by creating a supportive environment capable of integrating information technologies in a range of activities within the school.
2. To reduce the gap between school culture prevailing culture outside the school environment.
3. To improve teaching and learning by training independent and creative learners, and to develop higher cognitive skills.
4. To enhance the status of teachers by promoting their professional level.

MAIN DIRECTIONS FOR IMPLEMENTATION OF THE PROGRAM

1. To train teachers to integrate computers in teaching, both future teachers in teacher training institutions, and teachers throughout the system, through various in-service training frameworks.

2. To expand the educational support and training system for teachers, schools and local authorities.

3. To equip schools with hardware and software, and replace outdated, unsuitable equipment.

4. To set standards for equipment and programs for all age groups.

5. To encourage the development of special programs and integrate these programs into the curricula.

6. To encourage special experiments, and to assess and distribute their results throughout the system.

7. To develop an infrastructure of information and computerized communications systems which will improve the education system by integrating information systems in teaching and learning.

EQUIPPING THE SCHOOL SYSTEM

Computerization of the schools and educational institutions commenced in 1994, with implementation of a "computerized package," which included hardware, operational and educational software, and teacher training and guidance.

The schools were equipped in a combined effort undertaken by the Israel's National Lottery and the local municipalities. The equipment was supplied by seven contractors, who also provided software and computer training services. As part of the ongoing process of computerization in the Tomorrow '98 program, 450 secondary schools were equipped with computers during the 1994-1995 school year, realising the goal of one computer per ten students.

- NIS 24.0 million - National Lottery budget
- NIS 24.8 million - Local municipalities' budgets

In addition to the above sources, the following points should be considered:

1. This budgetary framework is in draft form only. A detailed and up-to-date annual budget will be presented separately.
2. This program does not contain enough resources to computerise the entire educational system in the five-year period. As a result, an order of priority has been determined by means of which the upper school network will be computerized to a greater extent than the primary school network.
3. The five-year program should be planned while keeping in mind the project's continued operation beyond the five-year period.
4. Consideration should be given to supplementing the budgetary program with additional hours allocated from the Ministry's total programmed hours.
5. The cost of one computer station is estimated at about NIS 4,000. The final cost is subject to the outcome of the Education Ministry tenders.

Budget Set-up and Operational Procedures

The following are the principles and operational procedures of the budget:

1. The National Lottery, together with the local municipalities, will purchase hardware, including peripheral equipment, operational systems, local communications networks, with financing as follows:

a. All educational institutions: kindergartens, special education schools, and schools of all age groups 60% of the rate of financing the acquisition of hardware will be provided by the National Lottery, and 40% by the local municipalities.

b. Teachers' Seminars: full financing by the Ministry of Education.

2. The local municipalities will finance the acquisition of hardware together with the National Lottery, and acquisition of operational and educational software together with the Ministry of Education.
3. The Ministry of Education will allocate funds from its budget towards acquiring hardware, and operational and educational software for schools, teachers' seminars, training programs, guidance and counselling, communications infrastructure, research, experimentation, evaluation and development.
4. Efforts will be made to raise additional sources of financing from other government ministries in order to integrate new immigrants into the network.
5. General principles of financing:

a. The National Lottery will finance 60% of the cost of hardware operating systems, and operational software.

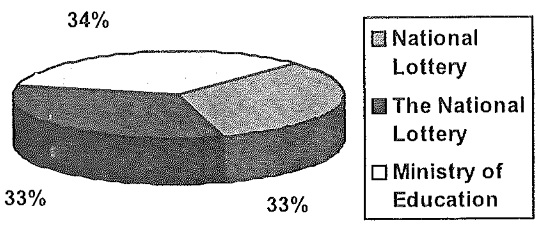
b. Local municipalities will finance 40% of the cost of hardware and operational software, and 50% of the cost of software and educational software.

c. The Ministry of Education will finance 50% of the cost of software and educational software, the entire cost of training programs, and the entire cost of ongoing guidance.

6. The budget of teacher-training institutions will be fully covered by the Ministry of Education and will operate under a separate program.
7. For every age group, an outline of operational and educational software programs will be determined, linked to the hardware and integral to the computerization package. The same applies to the training programs and guidance required by each institution, which will be supported by the program framework.
8. Those schools not equipped in keeping with the program's standards will be given the opportunity to acquire the equipment they lack. Old equipment will be transferred to other institutions and/or be taken out of circulation, as per procedures to be determined together with the National Lottery and implemented in the future.
9. Responsibility for the program's operation: Science & Technology Division/ Computers in Education Department, in co-operation with the National Lottery and the local municipalities.
10. Decisions regarding hardware and software will be made in accordance with the Automation and Data Systems Division.
11. A forum for monitoring and control will be established; its members will include a representative of the Ministry of Education, a representative of the National Lottery, and a representative of the Center for Local Government.

BUDGET BREAKDOWN FOR COMPUTERIZATION PROGRAM

By Sources of Finance



per institution and as per specific requests.

- Kindergarten (compulsory) - one computer station for each kindergarten.

In the event that program implementation is continued for more than five years, the rate of supply in the primary school system will be matched to that of the secondary schools: one computer station for every ten students.

6. Allocation of resources (hardware, operational/educational software) to the schools will be carried out as follows:

- Approximately 75 percent of the resources will be allocated to the junior high schools (grades 7-9).

- High schools, primary schools, kindergartens and special education schools will be supported as the budget allows.

7. An extended training network within the school training framework will receive support as a direct spin-off of new salary agreements and teachers' needs, closely linked to the process of supplying hardware and operational/educational software.

8. Personnel will be trained for positions of responsibility in the field of computer integration in the schools, and training staff (especially new immigrants) as technical assistants at the schools.

9. Innovative projects which make use of new and unconventional teaching methods and technologies will be promoted. Within this framework, ten schools will be chosen from all school districts and sectors, to serve as model schools.

10. Schools in which alternative teaching methods are implemented will be. encouraged, so that computers may be integrated into the classes and help create a new learning environment.

11. The introduction of computers into special education schools will be encouraged at a rate of up to 50 schools per year.

12. The process of supplying computers to kindergartens is to be completed at a rate of up to 250 kindergartens per annum, by 1998.

13. Research which directly contributes towards the goals of the program is to be encouraged.

14. Operational and educational software are to be developed in Hebrew, applicable for optimum curricular coverage, without deviating from the conceptual nature of the program.

15. The program is to be implemented through the services of "implementation contractors" who will provide a computer package which includes hardware, software, training and guidance.

ORGANISATION STRUCTURE AND AREAS OF RESPONSIBILITY

The nature of the organisational structure and areas of responsibility for implementing the computerization program, as determined by the chief executive of the Ministry of Education during meetings of the Committee on Computerization, emphasises that the implementation of the program will be largely conducted by the existing Ministry divisions, each in its own area of jurisdiction.

Responsibility for operation of the program is defined as follows:

1. The Committee on Computerization chaired by the Ministry's Chief Executive formulates policies and follows up on their implementation.

2. A "Think-Tank" Staff - members: Chairman of the Pedagogic Council, the Tomorrow '98 chief administrator. Chief Scientist, Consultant to the Science & Technology Division - all of whom will consider and consolidate educational perceptions, work towards the integration of computers in education, and present their proposals for consideration before the Senior Computer Committee.

3. Operative Staff members: director of the Science & Technology Division, administration of the M.I.S. Division, administration of the Tomorrow '98 project, Director of Computers in Education Department are responsible for initiation, co-ordination and monitoring of the program's framework, as approved by the Senior Computer Committee.

4. Computers in Education Department, part of the Science & Technology Division: the implementary arm of the Senior Computer Committee and of the Operative Staff. Its main responsibility is to prepare the overall budget and monitor its use, as per the decisions of the Senior Computer Committee.

5. All divisions of the Ministry of Education are responsible for the initiation, planning and operation of the program, each in the area under its jurisdiction, following endorsement by the Tomorrow '98 administration.

Working Procedures

Procedures for implementing the computerization program, as laid down by the Chief Executive, chairman of the Senior Computer Committee, in applying computer integration in the educational network in both teaching and learning, will reflect the Ministry's work procedures:

1. Initiation: Under the jurisdiction of each division of the Ministry, and also open to other bodies outside the Ministry.

2. Policy-Making: Overall policy - the Senior Computer Committee, chaired by the Chief Executive. Sectoral policy - under the jurisdiction of each sector, in those areas under its authority, in accordance with general policy.

3. Co-ordination: The "Operative Staff" will co-ordinate the consequential results of the decisions taken by the Senior Computer Committee, which will also serve as the source of authority. Its organisational affiliation - the Science & Technology Division/Computers in Education Department, responsible of computer-related issues in the Ministry.

4. Budgeting: Initiation and general co-ordination of the program for computerization the Science & Technology Division/ Computers in Education Department. Discussion and authorisation: the Senior Computer Committee.

THE BUDGET

Budgetary Sources

The program will be based on an annual budget of NIS 72.8 million for a five-year period. The budgetary sources will be as follows:

- NIS 24.0 million - Ministry of Education's budget school.

b. To create a supportive environment and to aid the school in its process of integrating information technologies, through a wide spectrum of activities.

2. To improve and revitalise the teaching and learning processes by the following:

a. Increasing the effectiveness of learning and teaching.

b. Training an independent and creative student.

c. Encouraging the development of superior thinking skills.

d. Encouraging educated learning.

e. Applying sophisticated information technologies as an impetus towards revitalising and promoting teaching and learning.

3. To enhance the teacher's status.

By promoting his/her professional level, as well as improving his/her self-esteem and social standing.

APPLYING THE GOALS IN THE CURRICULAR STUDY PROGRAMS

Translating these general goals into applied educational curricula can be expressed through the following objectives:

1. To facilitate achievement of the defined objectives in existing curricula that have not been achieved via the traditional teaching methods, by upgrading both the teaching of current curricular content and the normative standards.

2. To enable rapid implementation of the standard curricula by accelerating the rate of learning or by changing the order of teaching.

3. To add new content to the standard study frameworks which, so far, have not been included in the current curricula.

4. To introduce new subject content that was not included in precomputer-age curricula, but are computer-related (such as algorithmic thought, familiarity with data processing procedures, data displays and systems approach).

5. To change the attitude towards current curricular programs, for example, by breaking with the conventional limitations of areas of knowledge, and defining multi-disciplinary syllabi into multiple study units, deviating from the normal curricular teaching approach, and enabling independent and open learning, based on a flexible learning program.

6. To change the conventional teaching methods. Such changes can be achieved by adopting alternative teaching methods, and increasing the pedagogic autonomy of school principals and teachers. Furthermore, change can emerge in the organisational/logistic aspects of teaching by use of the computer in the revolutionary reorganisation of teaching and, perhaps, of the school itself.

THE MAJOR EMPHASES AND FOCUSES OF THE TOMORROW '98 PROGRAM

1. The main focus of the program will be applied to the junior high schools and teachers' seminars. Notwithstanding, attention will also be given, as far as the limited budget will allow, to kindergarten (compulsory), primary schools and high schools as well.

The cost of working with the teachers' seminars will be met by the Ministry of Education.

2. The five-year plan emphasises the following activities:

a. Training teachers to incorporate computers in teaching (all teacher trainees in teachers' seminars, and all the teachers within the various teachers training education frameworks).

b. Expanding the support and training networks for teachers, schools, and local municipalities.

c. Equipping schools with hardware and software, and replacing obsolete equipment with modern equipment.

d. Setting standards for hardware and software for all age groups. Encouraging the development of special software packages and their integration into the study programs.

e. Encouraging special experimentation, followed by evaluation and distribution throughout the system.

f. Encouraging special experimentation, followed by evaluation and distribution throughout the system

g. Developing an infrastructure of data banks and computer communications to improve pedagogic management and the integration of data bases into teaching and learning.

THE PRINCIPLES OF APPLICATION AND IMPLEMENTATION

In view of the above, the program reflects the following principles of application and implementation:

1. Computers are to be integrated into teacher's training institutions, enabling teacher trainees to acquire technological skills as an integral part of their training program.

2. The current network of training and counselling in computer applications is to be expanded in order to meet the demands for counselling, advice in purchasing, guidance in developing school programs, teacher training and teacher promotion as a direct result of school training programs.

3. Computerization of the schools and educational institutions will only be implemented by using a "computerized package" which includes hardware software and teacher training guidance. The integration of all these components will ensure the successful implementation of new technologies in the educational system.

4. The program for equipping the school system, from 1994, includes allocation of resources for the purchase of hardware, operational/educational software, training and guidance, the incorporation of which is a prerequisite to the successful introduction of new technologies into the education system.

5. The target number of computers is one computer station for every ten students (as recommended by the Poled Committee report). Based on the proposed budget allowance, the rate of supply will aim to meet the following standards:

- Junior high and high school - one computer station for every 10 students.
- Primary school - one computer station for every 20 students.
- Special education up to 10 computer stations

Areas of Activity in the Schools

ONE-KEY LOGO	LOGOWRITER		PASCAL, PROLOG, etc.
	DATA COLLECTION & PRESENTATION		COLLECTION & RESEARCH
	WORD PROCESSOR, DATABASE, SPREADSHEET		
	SIMULATIONS		
ACCORDING TO SUBJECTS IN CURRICULUM			
GRAPHICS & GAMES			

BASIC PREMISES

The program is based upon the following premises:

PEDAGOGICAL PREMISES

1. In the modern world, the capacity to use computers (computer literacy) is another basic skill in addition to the three familiar basic skills of reading, writing and calculating, and as such, every teacher and student within the educational system must acquire it.

2. Skills in data handling are vital to every modern, educated person, and must, therefore, become an integral part of instruction in all subjects. These skills can be efficiently acquired by integrating data technologies into the teaching of subject matter.

3. The computer's potential for contributing to effective learning and teaching is derived from its basic characteristics: interactivity, quick response, saving and retrieval of data, and rapid transition between different data displays (text, graphics, pictures).

4. A rich teaching environment, full of information technologies, may create learning stimulii and encourage meaningful and effective creativity and learning.

5. The integration of computers in instruction and learning may create two types of processes:

a. Preserving and reinforcing conventional teaching methods;

b. Creating change and innovation in instruction and learning. The process selected depends, to a large degree, upon the individual teacher's pedagogical viewpoint, the type of software used, and the manner in which computers are integrated into the teaching and learning processes. The program will favour trends toward change and encourage innovation in the field of active learning.

6. Any worthwhile study of non-trivial content cannot possibly depend on the model of "teacher-transfers-material" and a passive student who absorbs it; rather, the model must be that of dynamic, active and experiential learning, in which the student is involved in research and experimentation through an interactive medium.

7. The optimal effectiveness of the computer used by students will be achieved only when there is one computer station for every ten students, and when each student receives three hours of computer use a week.

8. The effective integration of computers in teaching is dependent on the teacher's approach to his or her profession, which should suit the type of software being used.

9. The teacher should be assisted in choosing the most suitable software which meets his/her needs of the specific subject material and teaching methods.

Mapping out those aspects of the software and their special features, and identifying the teaching patterns will facilitate distinguishing between software and computer applications which reinforce conventional teaching methods, and those that augment change and innovation in teaching and learning.

ORGANISATIONAL PREMISES

1. Integrating telecommunications in the education system will be the primary goal of educational policy for the next five years. This integration will be implemented by all units of the Ministry of Education.

2. The role of the Ministry of Education and Culture in this program will be to determine the principles of policy, create an infrastructure, allocate resources, set standards, initiate and encourage other groups to initiate a fuller integration of computers into the education network, stimulate R&D, and administer an experimental network and an ongoing control network of the hardware, software and activities.

3. All teachers within the school system, veterans and newcomers alike, must be computer-literate, as well as capable of integrating computers and telecommunication systems into their teaching.

GENERAL GOALS

The five–year program aims to create a technology-based learning environment within the schools, in order to achieve the following, in whole or in part:

1. To bring schools into the information era.

a. To narrow the gap between the school culture and the culture of the world around it, by creating an "information era" culture within the

COMPUTERIZED COMMUNICATIONS INFRASTRUCTURE

The Commission recommends the gradual establishment of the foundation for a nationwide computerized communications network serving the school system and enabling integration with other communications networks in Israel and abroad. Due to the high cost of this system, it is proposed to assemble it gradually, maintaining a reasonable range of implementation at every stage. The final structure of the communications infrastructure will include the following components:

SCHOOL NETWORKING

1. All computers in each school (in laboratories, classrooms and other activity centers) will be linked to a local network, by means of a server of sufficient power (equivalent to 286 or 68080) The number of servers required will be determined by the number of end stations (if the number of end stations exceeds 40, an additional server is required).

2. These networks will also constitute the sole system of school communications, and will enable communications between school computers and a main station in the Ministry of Education, and between teachers' and students' homes and the school's computerization system.

THE ORGANISATIONAL SYSTEM

An organisational infrastructure should be established to assist schools and the Ministry of Education with the operation and maintenance of computerization systems. This infrastructure is based on the following:

a. A professional computer co-ordinator appointed in each school will be responsible for the operation of computers.

b. The co-ordinator's duties will include: advising and guiding teachers, responsibility for maintenance and proper operation of equipment, assistance to the school principal in co-ordinating all activities related to school computers.

c. Scope of work: on average, the equivalent of about half a teacher's shift in an average-sized school.

d. These co-ordinators, most of whom will come from the teaching sector, will be trained in a special Ministry of Education training program.

A municipal computerization co-ordinator will be appointed in every local educational system under the auspices of the municipal Department of Education.

OUTLINE OF OPERATIONAL PROGRAM FOR 1994-1996

PROGRAM FOCUS

The main thrust of the program will be directed at junior high schools and teacher training colleges. At the same time, the needs of senior high schools, primary schools, kindergartens and special education institutions will also be addressed as far as possible within the budget framework.

PROGRAM HIGHLIGHTS

The following directions will be emphasised as part of the three-year plan:

1. Teacher training and in-service courses in the integration of computers in teaching.
2. Expansion of the educational instruction and support system for schools and local authorities.
3. Providing all Israeli teachers and pupils with basic technological skills (word processing, spreadsheet, databases and application generators) and the integration and use of these skills as part of the learning process.
4. Providing basic skills in database handling, computerized communications and additional innovative technologies (e.g. multimedia).
5. Equipping schools with hardware and software; replacement of outmoded equipment.
6. Setting standards for equipment and software for all age levels.
7. Encouraging development of special-purpose software and its integration into the curricula.
8. Encouraging special-purpose experiments, evaluation and dissemination of their results throughout the school system.
9. Development of technology and information-based organisational and communications infrastructure for use in improving educational administration.
10. Improving and modifying the teaching and learning processes, with a view toward promoting educational achievements.

ALLOCATION OF FINANCIAL RESOURCES

The program's financial resources will be directed to the following seven areas:

1. Hardware (equipment and maintenance).
2. Educational software and operational software.
3. In-service courses.
4. Education, consultation and guidance.
5. Infrastructure, communication and administration.
6. Research, development and experimentation.
7. Immigrant absorption - computer co-ordinators.

communications network for the school system, to enable integration with other communications networks In Israel and abroad. The computerized communication network will permit communication with databases and electronic libraries, which will be at the disposal of students and teachers.

ORGANISATIONAL SYSTEM

The Commission recommended the establishment of an organisational infrastructure to assist the schools and the Ministry of Education and Culture in the operation and maintenance of computerization systems. A professional computer co-ordinator appointed in each school will be responsible for computer operations, and a municipal computerization co-ordinator will be appointed in every municipal system under the auspices of the local Department of Education.

FAMILIARISATION WITH COMPUTERS

The commission recommended the establishment of a professional team to prepare a new and detailed curriculum for the teaching of "Computer Familiarisation" or "Computer Literacy" in junior high school classes. This curriculum is intended to provide pupils in the early stages of their studies with the following:

1. Fluency in the skilled use of computerized tools for processing and presentation of information.
2. Fluency in the information which can be processed by these tools.

RECOMMENDATIONS OF THE PELED COMMISSION

In order to ensure the proper integration of computer software in the teaching and learning processes, the Commission recommended the following:

1. To acquire skills in computer use.
2. To raise achievement levels in various subjects.
3. To improve thought processes and problem-solving abilities.
4. To acquire information handling skills.
5. To increase motivation for learning.
6. To create a learning environment rich in educational stimuli.
7. To create a driving force for innovation in teaching and learning.
8. To improve educational administration as a pedagogic tool.

VOCATIONAL TEACHERS IN-SERVICE TRAINING

The Commission recommended the preparation and implementation of a five to ten-year in-service training program to train all teachers in the Israeli school system in the integration of computer applications in teaching.

The curricula of the in-service training program will be based on basic teacher training programs in colleges. The in-service training courses in computer application areas will be given at university schools of education, in teachers' colleges, and at in-service training schools for teaching staff.

A complementary means of implementing in-service teacher training in computer applications is on-the-job training within the schools, whereby teachers will be guided as they work in the classroom.

DEVELOPMENT OF SOFTWARE AND TUTORIALS

The committee recommended initiating activity focused on software and tutorial development. In addition, the committee recommended the operation of a five-year development program, including the adaptation of existing curricula, with the following components:

1. Cataloguing the current inventory of tutorials in Israel (both locally-designed and imported).
2. Determining priorities in software and tutorial development (by subjects, learning stages and software tutorial types).
3. Readaptation of curricula (goals, content and teaching method) and obligatory requirements (e.g. standard examinations, matriculation examinations) to the potential of computerization technologies.
4. Encouraging private companies to develop software and tutorials in accordance with clear, explicit specifications and Ministry of Education models.
5. Allocation of resources for the promotion of research and development centers in universities and teachers' colleges, in order to enable development of innovative tutorials in areas not commercially attractive to private companies.

HARDWARE

1. The equipping process is not a one-time campaign, but a continual process, which will require updating at least every 8-10 years.
2. The key to the proper equipping of any system is a ratio of one computer for every ten students.
3. Deployment of the computerization system in any school may be conducted on the basis of any of three configurations:

a. Computer laboratory - up to 40 computers per laboratory.

b. Regular classrooms - frontal teaching: one computer with suitable projection means; activity classroom: four computers per classroom.

c. Special activity centers, such as science laboratories, art workshops, library, staff room, school secretary's office. Each school will deploy its computers on the basis of its own considerations and educational concepts.

4. Computers will have a minimal equivalency of 286 or 68080 processing levels; peripheral equipment will be commensurate with this standard.
5. The school computer system will be at the disposal of the community, and will serve extracurricular classes for children in the afternoons and during school vacations.

schools, and will involve them in the decision-making processes and their implementation. The project will provide support for the changes which occur at the schools as a result of the implementation of the program, glean ideas from the schools regarding different programs and their method of application, participate in their deliberations, and involve them in the determination of tasks and their methods of implementation. The program will locate and promote initiatives from schools and individual teachers for the advancement of science and technology education.

5. QUALITY CONTROL

One of the main problems involved in the application of Tomorrow '98 is the question of quality control. Quality control is difficult to realise in the field of education, both in terms of the quality of teaching by teachers, and in terms of the quality of learning by students.

The reason for this lies in the fact that the levels of quality are inherent in the subtle aspects of the dynamics of teacher-student interaction that takes place in the classroom – a dynamic process whose quality level can be evaluated subjectively by the expert observer, but cannot be defined by means of a series of objective criteria which determine the desired mode of behaviour in terms of single values. Much effort is currently being invested in the improvement of learning evaluation methods in order to advance teaching quality levels which should, of course, be used as much as possible.

Nevertheless, the way to ensure "product quality" in the application of the Tomorrow '98 project is, first and foremost, through the utilisation of the best resources available in Israel teachers, academics. Ministry of Education officials and additional parties involved in educational activity and their involvement in the development of advanced programs and approaches, and the training of teachers required by their application. Product quality will be determined by the individual and professional standards of those people involved in the various stages of the report's application.

"TOMORROW '98: COMPUTERIZATION OF ISRAEL'S SCHOOLS THE PELED COMMISSION REPORT

The unavoidable process of computerization in education presents the school systems with the challenge of integrating computers as tools to assist teachers and students in all areas of teaching, learning and educational administration. The creation of a "computer culture" in the schools is the way to cope with that challenge. The use of computers as a means for creating innovations has prompted the Science and Technology Division at the Ministry of Education and Culture to make new preparations, over the last two years, for the absorption of computers in Israel's schools. In view of this, the Ministry of Education and Culture appointed a commission of experts to formulate a master plan for the computerization of the school system. The commission, headed by Prof. Elad Poled of Ben-Gurion University, drew up recommendations and a policy framework for the introduction of computers into Israel's schools.

The commission, consisting of experts from Israel's academic institutions, presented its recommendations in the following areas:

1. Integration of computers in teaching and learning.
2. Teacher training and in-service training.
3. Familiarisation with computers.
4. Research and development.
5. Research and evaluation.
6. Infrastructure, hardware and communications.

The commission recommended the promotion of innovative concepts in teaching and learning, principally: the creation of a learning environment rich in educational stimuli; the creation of a driving force for innovation in teaching and learning; and the improvement of educational administration as a pedagogical tool. The commission's recommendations included the following:

MODEL DEVELOPMENT

In order to encourage the use of computers and integrate them into all school subjects, the commission recommended the development of several models.

TEACHER TRAINING

The commission recommended the foundation, expansion, and intensification of teacher training in the integration of computers in instruction and learning. It also recommended that a training program in computer operation be made an integral part of the curriculum in teachers' colleges and of teacher training programs in universities.

IN-SERVICE TRAINING

The commission recommended the preparation and implementation of a 5 to 10-year in-service training program to train all teachers throughout the school system in the use of computer applications in teaching.

DEVELOPMENT OF SOFTWARE AND TUTORIALS

The commission recommended initiating activity focused on software and tutorial development, trials in experimental schools, and evaluation. The development program will include encouraging private companies to develop software and tutorials, and the allocation of resources for the evaluation of tutorial integration into the curricula.

COMPUTERIZED COMMUNICATIONS INFRASTRUCTURE

The Commission recommended the establishment of a nationwide computerized

NATIONAL REPORT OF ISRAEL

PROMOTING SCIENCE TECHNOLOGY AND COMPUTER STUDIES: THE "TOMORROW '98" PROGRAM

INTRODUCTION

The overall objective of the Tomorrow '98 project is to improve the quality of science and technology education offered to children in Israel. The Ministry of Education adopted a five-year plan (1994-98) to implement the project.

Below are some of the key principles in the implementation of the project:

1. THE TEACHER AS THE FOCUS OF IMPLEMENTATION

The most important aim of the Tomorrow '98 project is to significantly improve the quality of science and technology education in Israel. The improvement of the quality of education will, first and foremost, be achieved by means of the daily academic interaction between teachers and students in the classroom. Thus, the implementation of the Tomorrow '98 project will highlight the advancement of teachers' level of professionalism, in terms of both content and teaching methods. The revision of study curricula will be accompanied by extensive activities involving training courses, in-service training and support, aimed at working together with teachers in adopting advanced methods of science teaching which devote special attention to the needs of the student, thereby generating a more meaningful level of study and enhancing the students' position vis-a-vis the school and learning in general.

Implementation of Tomorrow '98 involves emphasising the teacher's professional advancement through extensive training programs:

- Training professional primary school mathematics teachers
- Training co-ordinators for computer laboratories
- Training science and technology teachers for junior high schools
- Improving training for science teachers in senior high schools

2. THE STUDENT AS THE FOCUS OF INSTRUCTION AND LEARNING

The Tomorrow '98 project will devote special attention to the application of study curricula and teaching methods which revolve around improving the students' comprehension, mobility and enjoyment. This is a difficult objective to achieve, but not without precedent in Israel and throughout the world. The key to achieving these objectives is the emphasis placed on the qualitative aspects of the study material alongside the quantitative aspects ("principles in place of formulae"), particularly in mathematics and physics; the introduction of interactive teaching methods (with extensive integration of computer use); changing the perception of the student from a "material absorber" to that of an active partner in the evolution of concepts in his or her mind; and changing the perception of the teacher from a "material conduit" to an instructor in an interactive learning environment.

The primary means to be used in achieving these goals are the development of new programs which integrate science and technology, and the use of student-oriented teaching approaches - increasing the use of computers in teaching and extending individual learning.

3. COMPUTERS FOR THE ENHANCEMENT OF INSTRUCTION AND LEARNING

One of the most important tools, both in the enhancement of teaching and learning, and in the creation of change in teachers' attitudes, is the use of computers in all stages of teaching and learning. Thus, another area of particular importance for the Tomorrow '98 project is the introduction of "enlightened" methods of computer usage, which place the student at the center of the learning process and generate an interactive learning environment. The program entails the introduction of computers for teaching and learning at all levels of education, with the goal of reaching a ratio of one computer station for every ten students in the primary and junior high schools, and one per every twenty students in the high schools.

The program includes the establishment and operation of science laboratories with a view to maintaining a continuous link between academic and practical studies, and integrating scientific and technological aspects in teaching. The anticipated goal is that by the end of the project, every student will participate in 2-3 hours of laboratory activities every week.

4. SCHOOLS AS FULL PARTNERS IN THE IMPLEMENTATION PROCESSES

The school is the center of educational activity. Tomorrow '98 will devote a long-term and methodical effort to understanding the requirements of the *ous subject areas.*

- Produce a core of highly skilled IT specialists to satisfy the needs of the market at home and abroad.

- Formation of 3 support group which may lend assistance in the following areas:

1. Curriculum support for IT
2. Software support and development for IT
3. Technical support
4. Training support

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FACTORS LIMITING PROGRESS IN THE DEVELOPMENT OF NEW TECHNOLOGIES (NITS)

SERVICE UTILITIES

The area of Guyana is 83,000 square miles, and has a population of about 750,000 persons. About 75% of the population are concentrated on the narrow, flat coastland, but many others live in small communities in the riverain, mountainous and other areas of Guyana. Educational Institutions exist throughout the length and breadth of Guyana. However many of these areas, particularly those external to the flat coastland, suffer from the lack of certain essential services, including:

- adequate and ready transportation facility;
- a ready supply of electricity (except where individuals own private generators);
- telephone system that boasts a penetration of 46,219 telephone lines has not yet been extended to many of these locations.

The National Broadcasting System is to date not powerful enough to broadcast all areas of Guyana.

The above mentioned utilities are integral the use of information technologies in all formal institutions of Guyana.

LACK OF TEACHERS WITH IT SKILL

Many of our secondary schools have acquired computers and attempted to start a programme of computer awareness in schools. Like many of their predecessors in other countries, the foresight to acquire skilled persons or offer training to existing staff before placing computers in the schools was sadly lacking. Many of the computers in some schools were and still are underutilized or not used at all, except in cases where VSO's help was sought.

Two of the secondary schools that have VSO's attached to them have done a remarkably good job in training students with few machines, this was evident in the Caribbean Examination Council (CXC) results obtained.. At one of our senior secondary school, about twenty students will be writing the CXC exam In June '96. These students suffer severe constraints, there are only 2 computers on which to prepare their practical pieces, complete assignments and have hands-on practice sessions.

FINANCE

The purchase of a computer still remains a big investment for schools. As a result, most of the secondary schools in Guyana have acquired computer through various donours. Unfortunately, many of these 'gifts' are very old versions of 4th generation computers and seems to be of little use in a school which has as its priority - the enhancement of teaching and learning through the use of CAL packages. For example, one school was given a few BBC computers, two others were given 2-each, 8088 computers Guyana has to be very careful in accepting these gifts, since it may prove very difficult to standardize our systems in the future.

NATIONAL POLICY FOR INFORMATION TECHNOLOGY IN EDUCATION

As the Ministry of Education, at the time of writing does not have a National Policy concerning the use of information technologies in education, the schools which took the initiative had no guidelines to follow in their work. Steps are now being taken to remedy this situation as a committee has been formed to produce a draft national policy in time for the new academic year '96-'97.

OUR VISION FOR THE FUTURE

Guyana which is now in an advantageous position of introducing information technology to schools after reviewing the successes and pitfalls of its predecessors, foresees a vision for the future to include:

- A population that is computer literate.

- Using IT as a planning and developmental tool in education.

- Production of a curriculum that integrates IT in the various subject areas.

- Preparation of students for the world of work and the existing new technologies.

- All teachers are skilled in using IT in vari-

at the main branch of Cyril Potter College of Education (CPCE). An option course in Information Technology was then introduced to primary in-service teachers by the institution. These students were exposed to the use and application of generic, computer assisted learning (CAL) software and an introduction to programming. This was a progressive step by the institution, hut to date only sixteen (16) students have elected to choose Information Technology as an option course. In a country where the '93 - '94 statistics shows that there are 98,003 primary school students and 3,746 primary school teachers, one can immediately perceive the problem of insufficient trained persons to deliver IT, if the current trend of training in such small numbers continue. Little or no training is offered to In-Service Secondary School Teachers.

SECONDARY SCHOOLS

Some secondary schools in three (3) of the ten democratic regions have fulfilled their desire to have the new technology in their schools. Computers were acquired mainly through Old Students' associations. Parent Teachers' Associations, other donors and The Ministry of education. In most of the schools, there existed great anomalies with regards to IT, the most important being that:

- there was no policy regarding how the computers should be used to enhance teaching/learning;
- there was a lack of skilled persons to deliver an IT program to students,
- Computers were stored away because schools lacked the preparedness for their use.

In some of the schools. Voluntary Service Officers (VSOs) played an integral role in delivering a computer awareness programme - as they saw fit, to students and in helping to train local teachers.

PRIMARY SCHOOLS

As at the lime of writing, there are no primary schools that have computers used for the enhancement of leaching and learning. The Ministry of Education is. however, trying to access funds for the introduction of computers into 6 primary schools in Guyana - A Pilot Project for the academic year 1996-1997.

INFORMAL SECTOR

Many private institutions offer computer courses to students for a fee. Most of the courses are mainly introductory, bur they lack the hands-on time to develop confidence and dexterity in using and applying the software. These schools provide the largest component of IT education in Guyana. The standard of tuition is variable as is the content, and each concentrate on basic computer applications such as word-processing, database and spreadsheet management. Some training in programming, computer-aided design, desktop publishing and technician courses is also offered. The courses offered by these institutions have not been accredited or certified by the Ministry of Education.

COMPUTER HARDWARE AND SOFTWARE IN THE EDUCATION SYSTEM

The provision, acquisition and use of software in the educational system, are major issues for educational officials in Guyana. This hinges on the fact that as a poor third world country, Guyana lacks the financial resources necessary for industrialized development. Hardware and software used in the educational system originate from and are bought from developed countries such as England and United States of America (USA). These include the following:

- *Generic packages viz.; word-processing, database and spreadsheet;*
- *Educational games:*
- *CAL packages; and*
- *Programming software.*

The disadvantage of such purchases is that the programmes are not specifically designed to suit our educational needs. In cases where purchase is made from USA, one finds that there is also the US-English spelling problem.

Additionally, the purchase of educational software is a new phenomenon: hence, suppliers do not readily have them available on stock, and they do not have catalogues from winch selection can be made. As most of them are not familiar with the educational curriculum, they can offer little or no advice about the choice of software.

This situation could, however, be remedied with the advent of the proliferation of computers in schools. The Guyanese programmers may be co-opted to sit with educators to design subject specific programmes which are suited to our local needs. Additionally, established suppliers could target this new market and make available catalogues and preview copies of software.

NATIONAL REPORT OF GUYANA

NEW INFORMATION TECHNOLOGIES AND EDUCATION IN GUYANA

ABSTRACT

This report provides an overview of the current state of information technology in Guyana from the primary to the University level; the provision of computer hardware and software in the education system, including educational administration; envisaged policies towards standardisation; and the factors limiting progress in the adoption of new technologies in education.

STATE OF THE ART OF NIT

Information Technology (IT) in education is a relatively new Field for Guyana. In many ways, it is still the embryonic stage; where there is a lot of development work to he done and is some instances, the correction of anomalies which exists. The chart overleaf captures the current state of Information Technology as it exists in the formal sector of our education system. This is further discussed in the course of the paper.

In the information education sector, the situation is somewhat different. That sector has shown increased activities in education in the field of information technology over the past few years. This is evident from the many computer schools and clubs that have mushroomed throughout the country. The focus of this paper, however, deals mainly with the formal education sector.

It should be noted that .the term "information technology" includes the computer as its primary device and other associated communications technology. However, for the purpose of this overview, new information technologies (NITs) will refer specifically to computers.

UNIVERSITY

The Computer Centre, which was established by the University of Guyana in 1993, is used mainly by students and lecturers of the University for time-tabled courses, additional practice sessions and some amount of personal work. This centre houses about 25 personal computers (PC's), which are networked and served by a Novell Netware V3 11 file server. The software offered, include generic applications such as word-processing, computer-aided design packages and programming languages. The university has one computer which is specifically used for sending and receiving electronic mail.

At present a diploma course in computer science is offered to students by the University of Guyana. The degree programme is scheduled to start in September 1996. (As the university has a student population of more than 3,000 students the computer centre is inadequate to fully meet the demands of the student body and staff, - results in a severe shortage of trained persons who graduate from the only university in the country.

TEACHERS TRAINING COLLEGE

At the beginning of the academic year '94-'95, an IDB funded project made it possible for the establishment of a Computer Resource Laboratory

NIT. There is cooperation with other European and overseas universities so that the materials can be used in different countries.

2.8. MULTIMEDIA AS MEANS FOR PRIVATE LEARNING

During the last years several hundred multimedia products were developed and sold for private learning purposes The spectrum of themes is very wide spread: it reaches from helping programs to fill in the tax bills to programs how to do sports, from cooking to traveling, from learning games for children (mathematics, foreign language etc.) to quizzes. The market for those products is vastly expanding and a good proportion of the world's largest book fair in Frankfurt/M is dedicated to those products.

3. CONCLUSION AND OPEN QUESTIONS

The recent developments of technology and educational discussions show that the educational system has to reflect a great variety of open questions. In order to get new experiences there should be a widely accepted framework of educational and pedagogical aims related to the media. The furnishing of the schools with computers and telecommunication machines should follow the pedagogical aims not vice versa.

Therefore efforts made by the European Commission and other official programmes are only helpful insofar they are closely connected with pedagogical ideas.

It is important that new information technologies cannot replace the teacher: Schooling cannot be reduced to the teaching of special knowledge to pupils. Schooling has before all the task to integrate young people in a human society.

It can be assumed that the teachers role will change In the future he will not be the only one who can transmit knowledge to the pupils, NIT can be helpful and can make learning better. But the teacher still has to-enable the pupils to bring the knowledge in a good system, he has to help to evaluate the information - and he has to help the pupils to integrate themselves in a social community.

Even if new technologies can help to learn it has to be stressed that learning will still be a hard work to do. Relying only on the technological possibilities can end in barking at the wrong tree. And it has to be said that it will need time for parents, teachers and the society to accept that new technologies can lead to 'a more human society.

As it is mentioned in the congress document one has to note that there is a strong challenge for the developed countries to help the others to take part in this technological and educational development. The running for the "pole position" in the international competition has to be bound up with the aims of international policies: international cooperation, economic welfare, saving cultural traditions and the struggle for peace and freedom.

THE CHAPTER CORPORATE CONTINUING TRAINING IS PART OF A REPORT WHICH PETER SCHENKEL (FEDERAL INSTITUTE OF VOCATIONAL EDUCATION) PRESENTED AT THE OECD ROUNDTABLE AT PHILADELPHIA, USA, 14 -16 FEB. 1996.

- training staff whose workload has been reduced can concentrate on "difficult cases",
- in-house learning, learning at home and learning in continuing training centres will be possible,
- the students' various preferences and experiences can be taken into account,
- redundancies will be avoided.

The state of research in Germany can be shown by the conclusions of a report on the effectiveness of multimedia and hypermedia learning systems. The authors conclude that "we do not yet know enough to make general statements about the possible effects on learning of multimedia systems". Even if multimedia systems have considerable potential for improving learning performance "the vast majority of the multimedia systems now in service have little or no positive impact on learning performance " Nonetheless, acceptance on the part of trainers and students, the hopes of positive impact on the learning process, and especially the expectations of a marked reduction in costs, are high.

2.3. ADULT EDUCATION

New technology is widely applied to general continuing educatio. Many public and private further education institutions offer lectures for initiation into the handling and use of electronic data processing It includes initiation into the use of computers in general as well as lectures dealing with some specific software (for example Word or Excel). Large enterprises work out their own training material for vocational further training and continuing education, or else they commission smaller enterprises. Computer-aided training material is used by the enterprises during work hours as well as for home-work. Some of these enterprises supply the participants of such programmes with the hardware necessary for home use.

2.4. DISTANCE EDUCATION

Distance Education in Germany can be divided into that part concerned with schooling and vocational training and into that part concerned with university level education and ongoing training. As for the first more than 140 providers prepare and sell studying material and other media to more than 150,000 learners. The part of learning material including computer programs is growing although mostly limited to subjects which are especially related to computer knowledge. Experiments have been made using NITs and telecommunication to improve learning simultaneously at different places via Tele-Conferencing and Tele-Teaching. CD-ROM and multimedia was introduced in training courses which had been led during vocational off the job training after Germanys reunification.

2.5. TEACHER TRAINING

Due to the quick development of the technology many efforts had to be made to train the teachers. Many in-service training courses were offered so that many thousand teachers could get professional experience in using media and NIT for education. But to implement NIT media in lessons others than computer oriented and "computer near" subjects the training efforts have to be continued.

Teacher education at university level in the area of information and communication technology has not yet reached the desired level. Special lectures are given at universities whereby teachers are trained in informatics as a subject for the secondary education; however media-related subjects in the training of teachers as well as new technology in the training of all teachers are still at an experimental stage. The reason is that few young teachers could be appointed in the past few years for budgetary reasons.

2.6. NIT FOR ADMINISTRATION IN SCHOOLS

In the past few years the Laender have made every effort in order to simplify and improve the efficiency of the administration of their schools by introducing computers for administration purposes. This simplifies the transmission of acknowledgments to the different ministries. However, such computers are seldom used for teaching since these devices are mostly used for school organization and administration.

2.7. NIT AT UNIVERSITY LEVEL

2.7.I. NIT and traditional universities

The use of new technology for research has become a rule in most cases. However, university teachers are only beginning to make use of the possibilities offered by the new media for preparing and teaching. There is a significant potential which can and should be used. Some obstacles are the limited availability of software as well as the different relation of the academic contents to new technology.

During the last month a growing position of universities are handing out themes for examination theses that are concerned with a NIT in educational contexts. Media and media competence become more and more an accepted topic in teacher education even producing videos or computer program as part of the exams. Additionally there are specialized universities for media.

2.7.2. NIT and Distance University level education

The German Distance University (Fernuniversitat) has more than 50 000 students, 15% of them are regular students, the others use the Distance University as possibility for ongoing studies and for vocational academic training.

In more than 30 projects NITs were implemented and evaluated, for example "Fernuniversitat by satellite", Video-Conferencing in the Department of informatics, having servers for mailbox purposes, computer conferences. The German Institute for Research on Distance Education (*Deutsches Institut fur Fernstudienforschung an der Universitat Tubingen*) has installed a special department which develops and evaluates new forms of learning using thinking can be reached easier by using multimedia and telecommunication. It is expected to have new answers at the end of 1999.

2.1.4 Supporting systems

As for the audio-visual media there are in nearly all communities lending and delivery systems (media-centers) so that teachers can rent without charge videos, films and other media for the use during lessons. All Laender-together keep running a central institution, where films, videos and software are produced and delivered for educational purposes. Those products are available in more than 800 "media centers".

"Because of the dynamic development in the market of new media, it is nearly impossible for individual teachers to obtain and keep an overview of what is on offer and to find new media which can support their lessons effectively.

Here, great help is provided by the database SODIS (Software Documentation and Information System) which contains information on all new media for education available on the market. This database is a joint product of the German federal states and the Republic of Austria.

By means of this database every teacher can find out with little time and effort which new media are available for his subjects and topics. As there is already quite a wide range on offer, the teacher will usually have-the choice between various new media which might be suitable provides help:' for most new media it offers evaluation reports and, in some cases, practice reports on lessons actually held. Guided by these reports, the teacher is generally in a much better position to judge which of the media are really suited to his/her special purpose. "(W. Weber)

In all of the Laender regional support/media centers give additional and personal advice to judge new products and give hints for implementation in the lessons.

By the project SODIS more than 4 000 programs have been checked after -before all - pedagogical criteria, but only some 80'ies of the programs arc highly appreciated as "Examples of good new media for learning". Because software producers use this label ("Example..") for advertising this testing system has a positive influence on improving educational programs.

2.2 VOCATIONAL TRAINING

2. 2.1. Vocational schools

As mentioned earlier the highly differentiated vocational training system consists of various types of vocational and higher vocational schools, of the dual system during apprenticeship (a combination of organized training work in the firms and enterprises on the job with one or two days vocational schooling per week off the job). For the ongoing training on or off the job there are especially institutions of higher (university) education and training.

Using computers for training is familiar in those jobs and subjects that are related to the use in real working life Using media and NITs as a tool for teaching in other subjects still has to be improved.

2.2.2. Corporate continuing training

For years multimedia learning had been presented at fairs and in the trade press as a cost-effective and efficient form of learning. Although pilot projects for a training technology attracted great interest, the actual use of this technology in continuing training as limited. There was no basis for more extensive use, as the computers were not powerful enough, standards had not been harmonized, the programs were unsatisfactory and experience with programmed learning in the 1970s had been inconclusive. Moreover, there was basically no incentive to reorganize course contents and the way in which they were taught. Firms were for the most part satisfied with the continuing training standards and systems.

This situation has changed only quite recently. Owing to its greater performance range and falling prices, today's standard computer has obviously become a multimedia computer With new storage systems, video sequences several hours in length could be included in programs in 1996. Almost every new purchaser is therefore theoretically able to use learning programs which are becoming increasingly attractive New software platforms should also allow program swaps between operating systems whose compatibility is at present very limited.

Developments in the telecommunications field are another important incentive. As a result of new data networks, the imminent liberalization of the telecommunications market in Germany and the increasing inroads made by ISDN and Internet, telecommunications and multimedia are being associated fort he first time in the minds of the general public. This has also created increasing interest in telematics-based learning.

This turning point coincides with a phase of very great economic change that had been marked by worldwide competition, dynamic product development, new marketing strategies and quality concepts, new organization and production structures and above all by the business world's unprecedented cost consciousness.

Available studies in Germany on multimedia learning do not yet provide any information on this new situation. There are a great many reports on the multimedia market in Germany, but they give only economic and technical information on the market. Secondary sources are mostly used, and ad hoc representative surveys and specific case studies are dispensed with. As there is no body in Germany which collects or routinely collates data on multimedia learning, the statistical position seems unsatisfactory compared with the United States and the United Kingdom.

The Fraunhofer Institute has brought out a comprehensive study on the opportunities and risks for multimedia systems in corporate basic and continuing training. The authors consider that such systems provide a range of possibilities, even if basically they take a conservative view:

- decentralized training can lead to cost cuts,
- large target groups can be reached once programs are set up,
- training times can be cut in some cases,
- the workload of training personnel can be reduced,
- knowledge can be passed on in a way that suits the individual,

the contents and significance of media. The function of computers as an aid is in this context only accessory.

To quote the report on North-Rhine-Westphalia again: "For these... areas in-service training has, in some cases been, been taking place for more than ten years in North-Rhine-Westphalia. Depending on which area the teachers want to qualify for these in-service training courses last for approximately 20 to 40 days; universities also offer additional courses for those teaching computer science as a subject in the upper grades. In some regions and in certain fields demand for this kind of training is already declining because schools no longer require the training ".

2.1.2. Media Competence as an upcoming target

Due to the technological changes and new developments in the field of education new perspectives and new tasks for schooling came up. There was a general shift in educational targets concerning NIT. since the beginning of the 90's the concentration on the computer as a tool for teaching and learning tends to be diminished step by step in favour to establish a "media competence" in the learners mind.

That means, that all different types of media, books as well as videos, magazines as well as audio-tapes, films as well as multimedia computer programs should be seen and taken as a highly differentiated but closely connected system of information and statements that influence the perception of the world. So NIT became a double bound target for schooling: On the one hand NIT is taken as a tool for teaching and learning; on the other hand it is an very important topic in nearly all school subjects to talk and discuss about, to show the chances, implications and problems for the individual and the society as a whole.

2.1.3. Using Media and NIT

Using TV and Radio

For almost 30 years in the Federal Republic of Germany there has been a large network of school television programmes broadcast by public stations. Programmes designed for educational purposes are broadcast daily for between 30 and 60 minutes. These programmes are mostly accompanied by written educational material, published either in special magazines or through editors specially founded for that purpose. School radio programmes have been broadcast daily for over 50 years.

In some German Laender special self-instructional television programmes have been broadcast for over 20 years. Together with the attendance at lectures (every two weeks) and written material, they lead to an officially recognized general examination which entitles the student to higher education the "Telekolleg". Since then more than 50 000 people have been able to acquire a higher educational level in addition to their professional qualification. In-the past few years Telekolleg has been accompanied by computer software. Television programmes and partly the written material are also used in schools of general education and in vocational schools.

Specific further training programmes broadcast on radio have-also been supplied for 30 years to interested teachers and other persons. Within the "Funkkolleg" 60-minute radio programmes, written material and special lectures given at the institutions of farther education form a media compound for the sake of scientific further education; it is recognized by the universities as part of their curricula. The "Funkkollegs" will also be extended through computer software programmes. About 700.000 people have taken part in these "Funkkolleg", gaining thus a better professional and vocational qualification.

Using Multimedia and Telecommunication

Multimedia and telecommunication offer new chances for learning and are at the same time a new topic for education: By using new hypermedia learning environments pupils can learn much more self-determined, self oriented and self-responsible. They choose their proper way of learning, they select their items to learn in their own manner, and they define their learning pace in the way that is appropriate to them. Using self-guided multimedia learning tools it is possible to learn how to learn: the basic requirement for life-long learning and for managing the overwhelming amount of new information offered by media and technology.

It is a common trend in Germany's general education system to avoid more and more simple drill and practice programs or other programs based on behaviouristic principles. Newer discovery learning approaches, applied for multimedia programs, are preferred.

Some German schools could make experiences with the use of telecommunication for educational purpose Well known examples are the participation in world-wide projects such as G.L.O.B.E., an international project for environmental preservation. There is also international cooperation between different schools in other areas.

Several schools exchange E-mails on subjects and teaching projects of common interest. The experience gained is quite positive. Lectures enriched by the experience gained by other pupils in other countries widen the perspective and show international relations as well as common responsibilities (for instance for the protection of environment and preservation of peace).

More efforts are to be made and telecommunications/telematics should be used exhaustively. Some projects have been started this spring and are aimed at a larger use of telecommunication. The motto was "Connecting schools to the net". It means that 10.000 schools throughout Germany will be given the opportunity to make new and creative experience when learning, teaching, preparing lectures as well as in the qualification of the teachers. Some sponsors have promised their assistance, for example Deutsche Telekom AG; Siemens, Hewlett-Packard and IBM.

Although the chances and opportunities of these technologies can be estimated as high, there are still a lot of pedagogical experiences to be made: What are the new topics of education, what are the methods of teaching, what are the forms of organizing schooling and time-tables, what are the new teachable and learnable topics crossing or leaving the older school subjects? By answering these questions new insights in learning-objects, in the methodology of teaching and in learning objects, can be made. We are convinced that the aim of systemic

More than 400 mostly SME's develop and furnish multimedia programs for a rich range of purposes, more than 4 000 software programs for educational use are offered (but only 80 of them are estimated as good examples for new media for schooling).

Germany has one of the closest cable-tv-network in the world, about 1.000 000 ISDN connections exist and the major cities are connected by ATM nets.

As the liberation of the telecommunication market is planned for 1998 the technological development will raise more and more.

2. NIT IN EDUCATION

2.I. NON VOCATIONAL EDUCATION

2.I.I. Aims for basic education in the field of NIT

The different targets of general school instruction when dealing with the new information and communication technology have also to be interpreted in the perspectives of general educational aims. The primarily target is not to instruct young people in skills and abilities appropriate for immediate professional use, but rather to develop and to strengthen their position as responsible citizens, as responsible and self-conscious human beings as well as members of a community Items, such as teaching how to handle new technologies are not of foremost importance, it is rather a matter of getting insights into and understanding how this technology works, the opportunities and chances it offers and the problems occurring for individuals as well as for society as a whole. Manipulation and technical skills are prerequisites for reaching and implementing the overall targets.

In the early seventies informatics, already a science taught at the institutions of higher education, became for the first time a specific school course as part of pilot projects so that it was possible to create specific courses at the second stages of secondary education. In the late seventies informatics became a standard subject, also included in the final examination.

In the early eighties as PC's and especially home computers began to be successful and were therefore increasingly used in the different areas of everyday and professional life, the Federal/Laender Commission for Educational Planning and Research Promotion and, at a later stage, the Standing Conference of the Ministers of Education and Cultural Affairs developed basic planning regulating the introduction of basic training in information and communication technology and involving all pupils of all schools' offering general education. It was agreed that this would not be a new separated school subject; however, a certain number of hours (as a rule approx. 40 to 80 hours) was planned for initiation into the basics, the available opportunities and problems that occur. The primary aim is not to develop programming skills, but rather to experience and test concrete applications of the technology to the specific school educational targets.

The report on the situation in my Land says: In the Land "North-Rhine Westphalia, when we talk about the use of computers in the classroom, we distinguish between 4 areas:

- basic training in information and communication technologies (ages 13 to15);
- computer science as required in compulsory choice/differentiation courses (ages 15 to 16);
- computer science as an elementary or advanced level course for upper grades of grammar school (ages 17 to 19);
- use of new media in individual subjects or for cross-curricular teaching.

Of these four areas the only one compulsory for all pupils of all types of schools is the basic training in information and communication technology. The objective of this training is for pupils to get to know, by means of three examples, how new technologies can typically be used. They are to examine the basic structures and functions of these new technologies by themselves and to reflect upon and judge the effects of their use. The training is carried out for approximately 60 lessons with topics such as 'Newspaper', 'Department Store', 'Ecosystem Forest', 'Carbon Cycles', 'Industrial Robots' or 'CAD/CAM' within the framework of those subjects which offer suitable points of contact with these topics .

In the following years pupils my deepen the knowledge acquired during the basic training by attending computer science lessons. However, as pupils decide by themselves on their individual school career, they may or may-not-decide to take up this subject. What is typical for all three areas outside the basic training is the fact that here the computer itself with its components and especially its software become the object of study. " (W. Weber: Advisory centres for new technologies - an addition to teacher training. To be published.)

In the meanwhile it may be assumed that about half the schoolchildren of the Federal Republic of Germany have already taken part in such basic training courses. However, the "new" German Laender are still lagging behind. In the older German Laender it can be said that the technical equipment and especially computers necessary for implementing any initial training and informatic courses at the second stage of secondary education (Oberstufe) are available in the schools.

The German Laender have drawn up extensive programmes for teacher training in the past few years at very high cost. The target was not only to train teachers of the subjects in the area of natural science and mathematics but also teachers which are able to use computers for educational projects in the area of humanities and fine arts. However, the majority of the teachers detaining qualification in further training programmes are in mathematics and natural science. Owing to the changes occurring in technology, continuous further training programmes are necessary and they should increasingly deal with

NATIONAL REPORT OF GERMANY

ASPECTS OF NEW INFORMATION TECHNOLOGIES IN THE FIELD OF EDUCATION AND TRAINING IN THE FEDERAL REPUBLIC OF GERMANY

INTRODUCTION

Because of the acceleration of technological and economic development and because of the dynamic processes in the society new efforts have been made to develop different parts of the educational system in Germany. One of the former aims of education: to accumulate a lot of knowledge and skills for being prepared for the future life becomes more and more doubtful. Since the knowledge grows so quickly in all subjects and since the 'half-life' of knowledge declines more and more (it is estimated that half of the knowledge is actual for only 3 to 4 years) it seems to be ineffective to learn specific topics with all the actual details.

At the same time one has to state that only few people do still the job they have been educated for when they were young. Changing of profession several times during a working life becomes more and more regular, staying in the profession of former apprenticeship the exception.

So there begins in Germany a discussion on the general aims of education, on the contents of learning and on the means and media to sustain the change.

New Information Technologies are insofar at the same time the reasons for the important change in education and the possible tools to realize the change and development.

I. THE FRAMEWORK OF EDUCATIONAL DEVELOPMENT

I.I. THE CONSTITUTIONAL SITUATION

The structure of the educational system in the Federal Republic of Germany is based on the exclusive responsibility of the Laender for the full range of educational and cultural affairs. It means that the curricula are regulated by the 16 German Laender which reach agreements on guidelines within the Standing Conference of the Minister of Education an Cultural Affairs. They are practically implemented in the different German Laender on an independent basis. In consequence, uniform educational planning only exists as recommendations made to the Governments of the different Germany vender. This includes plans regarding initiation into new information technology.

The Federal Government is responsible for the dual vocational system, i.e. the combination of industrial training and school vocational education In this area too, concerted action with the Laender should be reached.

Universities and institutions of higher education enjoy scientific autonomy. Since they train teachers, curricula require the approval of the supervisory state authority.

The educational targets of the Laender are guided by the Constitutions which aim at turning young people into responsible citizens, education them to human awareness, freedom, respect for the opinions of others, and peace. Self-responsibility and a democratic attitude are essential educational targets.

1.2. THE TECHNOLOGICAL SITUATION

In 1995 there were about 15 Mio. Personal Computers in Germany, for 1996 the number should raise up to 18 Mio. About 28 % of households have a PC for private use (5 Million) of which about 3/4 are MS-DOS or Windows PC's. It is expected that the number of private PC's will rise to 6-9 Mio in 1990.

2.7 Mio. private PC's are equipped with CD-ROM; two third are installed for private use, one third for occupational purposes.

Although actual general data for the equipment of schools are not available one can say that the majority of secondary schools have bought their computers in the middle or at the end of the eighties so that newest computer technologies are not found everywhere. Multimedia machines are still rare. Therefore new efforts are to be made soon.

ABBREVIATIONS

C.I.P. - Centre of Information on Pedagogics
D.F.I. - Directorate of Finance and Real Estate
D.T.V.E.- Directorate of Technical and Vocational Education;
D.G.G.D.F.E. - Director-General of the General Directorate of Finance and Equipment;
D.D.E.C. - Directorate of the Department of Examinations and Competitions;
D.P.S.Q. - Directorate, responsible for Personnel and Social Questions;
E.S.L. - Estuaire State Lyceum;
B.P.P.E.S.G. - Branch Programme of Promoting the Educational System of Gabon;
S.T.S.A. - Science and Technology in the Sector of Attendance;
D.E. 1 - Directorate of Education 1;
D.E. 2 - Directorate of Education 2;
D.E.P.P. - Directorate of Investments Planning and Programming;
H.P.S.T.E. - Higher Pedagogical School of Technical education;
H.P.S. - Higher Pedagogical School;
A.L.H.P.S. - Applied Lyceum of Higher Pedagogical school;
N.P.I. - National Pedagogical Institute;
P.A.E.D.G. - Project "Administration and Education Development in Gabon".

CONCLUSION

The analysis of the existing situation revealed the following drawbacks:

- information technologies implementation is in the embryo condition, the most of control operations are done manually, which leads to the high risk of making mistakes;
- equipment and software are incompatible;
- computer systems are isolated, non connected with each other, developed without any general plan of the Department development;
- equipment is morally obsolete or hardware is scarce(in some subdivisions) for students and teachers education;
- qualified specialists in informatics are few.

Trying to improve the mentioned drawbacks, the Ministry faced the following problems:

- too high expenditures for the new technologies implementation on its services and establishments, for the maintenance of the necessary temperature regime in classrooms. It is especially difficult in province;
- personnel training for equipment maintenance in laboratories and technical schools;
- too high prices for the services of international telecommunicational networks.

For the solution of its problems the Ministry of the National Education followed the policy of costs cuts and information technologies implementation on their own, while promoting software and competence exchange (international and between organisations), as well as the development of international networks and servers.

MINISTRY OF THE NATIONAL EDUCATION,
YOUTH AND SPORTS AND WOMEN AFFAIRS

NATIONAL COMMISSION FOR UNESCO
DIRECTORATE GENERAL OF EDUCATION AND PEDAGOGICS

SCHEME 1

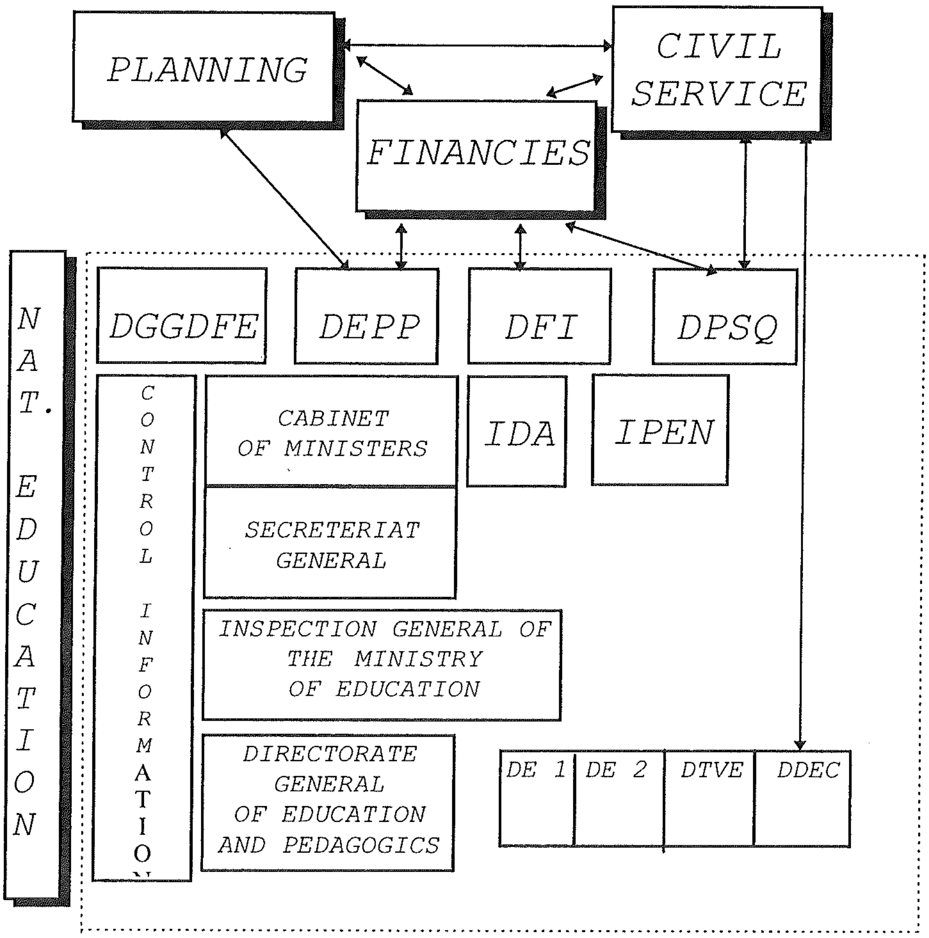

PLANNING
CIVIL SERVICE
FINANCIES
NAT. EDUCATION
DGGDFE
DEPP
DFI
DPSQ
CONTROL INFORMATION
CABINET OF MINISTERS
IDA
IPEN
SECRETERIAT GENERAL
INSPECTION GENERAL OF THE MINISTRY OF EDUCATION
DIRECTORATE GENERAL OF EDUCATION AND PEDAGOGICS
DE 1
DE 2
DTVE
DDEC

Table 3 (continue)

Gabon-Canada 1990 State-Gabon, 1995	3.3.4. D.T.V.E.	(1) IBM PS/1 80386 & (1) printer 4072, (1) IBM 486DX2 & APTIVA (1) printer LEXMARK	WORDPERFECT EXCEL POWER POINT
State-Gabon	3.3.5. D.E.2	(1) IBM PS/1 & (1) printer	WORD, Progiciel GBM
State-Gabon, 1984 France-Gabon, 1995	3.3.6. D.P.S.Q.	(1) BUKK,(2) printers BULL (3)IBM 466 & (1) IBM 486 (1) IBM 14L8 & (2) print.	PRPGICIEL ADS WORD, EXCEL, PROFIL
State-Gabon 1988 State-Gabon 1993	3.3.7. D.E.P.P.	(1) IBM PC & (1) printers (3) UNISYS PC, (2) PS/1 & (3) printers	ACCESS, WORD EXCEL, DBASE IV
State-Gabon 1987	3.3.8. D.F.I.	(1) CII HONEYWELL-BULL	Progiciel DGI

3.2. Activity and results

The activity of the educational institutions (e.g. technical Directorate), which have acquired equipment for managerial purposes, are aimed at the local development of applied systems, adopted for a partial automation of controlling activity, and to form an automated office environment.

Examples:

Estuaire State Lyceum (ESL) and Applied Lyceum of the Higher Pedagogical School (ALHPS): The development of an automated office environment, which is at the disposal of a the Co-operative (ESL and ALHPS), the nomination of a specialist to be in charge of informatics problems (ESL) and administration (ALHPS) for the current controlling operations (students movements in the school system, students lists for each class, accounting teachers working time, etc.). Teachers are able to use the installed equipment for self-education and educational documentation preparing (ALHPS).

Directorate of the Department of Examinations and Competitions: Computer application on each stage of examination control, when students are obtaining the certificate of finishing incomplete secondary school and exams on Service trades (2nd level, brief course).

Directorate of Technical and Vocational Education: Computer application in the current controlling operations of the Directorate.

Directorate of the 2nd level education: Computer application for controlling some documents, in relation with the Directorate's teachers (the change of employment, business trips, promotons, etc.). A special employee is in charge of it - the specialist in office informatics.

Directorate of investments planning and programming: Automated processing school statistic data bases and preparing some documents. The Directorate permanently connects with the Ministry of Finance and the Ministry of Planning, exchanges diskettes with them.

Besides, the centralised documents control system, prompted to the Director-General of the General Administration, Finances and Equipment to take a decision to install in 1987 two terminals attached to two of his technical Directorates and two external administrative services - the Ministry of Finance and the Ministry of Civil Service.

Directorate, responsible for personnel and social questions: Attached to the units of "Saldo" and "Civil Service", the Directorate offers the Ministry of Civil Service decisions on each decree, concerning personnel, which are in the competence of our Department. At present it implements the semi-automatic regime of management. of 10000 employees.

Directorate of Finances and Real Estate: Attached to the unit "Directorate-General of Budget", this subdivision processes information on the Ministry Budget.

4. AUTOMATED CONTROL SYSTEMS DEVELOPMENT IN CENTRAL SERVICES: POLICY OF STANDARDISATION

On February 18, 1992, Minister of the National Education addressed the corresponding subdivisions the Note, which included the following:

1)facts statement: "...the project of information technologies implementation in the Department trends to be concretised with the promotion of the others..."

2)the following directions:

a) "to observe the integrity of the informational system of the Department and to seek for the conception integrity of its control, basing on the integral control scheme...";

b) "to charge one of the senior officers with all the projects of automated data processing..., to assign one of our officers for co-ordination...";

c) " to provide the division of the applied systems into modules on the base of the integrated scheme of control...";

d) "to provide our participation in the quest of finances ..., purchasing software and hardware..."

The Director-General of the General Administration, Finances and Equipment is responsible for the conduction of the negotiation about foreign partners participation.

Besides other articles, financing concerns the automated control over teaching staff and school statistic data base; software for the personnel control system, developed by *ADS Informatique-Gabon*, taking into consideration the existing equipment.

The second goal of the Director-General is to provide the due regard of the Ministry surrounding, represented on the following scheme:

Table 2 (continue)

France 1991 and 1992 State-Gabon, 1995	2.2.3. LEON MBA NATIONAL LYCEUM	**COMPUTER HALL**: (5) KENITEC 386 & (6) 486 & printers EPSON **Department of information** (1) UNISYS 486, (2) KENITEC 486 & (2) printers **Director's Bureau and Secretariat:** (1) MAC & (1) printer UNISYS Supplement: (1) BULL, (1) printer	TURBOPASCAL, DBASE IV Software for students Controlling software
AID 1993, 1995 OWN FUNDS	2.2.4. TECHNICAL LYCEUM OF PORT-GENTIL	(5) IBM XT286, (1) APTNA 386 Printers: (3) EPSON 1500 & (1) EPSON 800, (1) AMSTRAD 1 FAX BROTHER 370	LOGOCRIPT 2 WORKS, FRIGO DEP, EXCELL 4, AUTO SKETCH
France 1989-91 1992 1992 1993-1995	2.2.5. Conventional public schools (France-Gabon)	(8) MO5, integrated into a network; (6) IBM 8530 (5)OLIVETTI:286;(19)486SX; KENITEC:(8)386SX,(4)486SX, Printers: (8) OLIVETTI: (2)386SX;(1) 486SX; Printers: (3); (3) COMPAQ 486SX, (1) IBM PS/2 486SX; (15) OLIVETTI 486DS, (1) Printer	VALISE IPT, LOGI, EDUC, NATHAN-RND, COKTEL VISION EXCEL 4, WORD 2; EXCEL 5, WORD 6, WINS DB3, CORELDRAW 5

2.2. Activity and results

The named educational institutions provide access to equipment only for the teachers (to control performance, etc.)and those students, who study a basic course of informatics, programming, etc. The state schools with special status provide these opportunities for every teacher, student, as well as administration. There is technological assistance and a permanent pedagogic counsellor on informatics at their disposal.

The means of informatics as a subsidiary tool for education (computerised experiments in some subjects, offering poor students scientific information)form some of the abilities (logic thinking, background for the new technologies) and practical skills (text processing, programming, etc.)

As a tool it develops teachers resourcefulness, a creative approach (diversity; "confidentiality" of applied school control systems, developed in educational institutions)

3. MANAGEMENT-ORIENTED EQUIPMENT

Table 3

3.1. The structure of information computer environment

ORIGIN and date	Technical directoRATEs and establishments	Type of equipment and their number	used software and languages
STATE-GABON, OWN FUNDS & SHELL 1992 AID 1992	3.3.1. ESTUAIRE State LYCEUM	(3) IBM PS/1, (1) ZENITH (1) BULL 486 & (3) printers 1 FAX BROTHER	WORD, EXCEL, DBASE III
OWN FUNDS 1992-1995 Canada 1994-1995	3.3.2. Applied Lyceum of the National Higher School	MAC: (1) CLASSIC, (2) LCII (1) LC475,(2)Print., 1 FAX (1) MAC LC 450, (2) IBM 286,(2) Printers EPSON	EXCEL 4, CLARISWORKS 2 & 4
France 1992 &1995	3.3.3. D.D.E.C.	(3) UNISYS & (3) printers ONDULEUR	WORD, PROGICIEL DG1

1. PEDAGOGICS-ORIENTED EQUIPMENT

Table 1

1.1. The structure of information computer environment

ORIGIN and date	Technical directions and establishments	Type of equipment and their number	used software and languages
France 1987: used equipment	1.1.1. I.P.N. (C.I.P) C.I.P already doesn't operate (1990)	(6)MO5, integrated into a network, (1) GOUPIL (3)IBM PCXT (2)AMSTRAD PCW 9512 (2)printers IBM	BASIC, WORKS, WORD
France 1987: used equipment STATE-GABON 1995 and 1996 1995	1.1.2.L.T.N.O.B a)Sector STT: hall closed since 1990 b)industry. sector c)administration	(2) IBM PCXT & PC286 (2) SHARP with cassettes (2) AMSTRAD PCW 9512 (2) IBM PC & (2) printers Telecopier	BASIC, WORKS, WORD No software (by order)
economical operators 1988 STATE-GABON 1994 and 1995	1.1.3. National Commercial School of Port-Gentil	(3) AMSTRAD PCW951, (2)IBM PCXT & 1 printer (broken) IBM APTIVA486: (3) SX25, (2) SX50, (1) SX66; Printer LEXMARK: (1) 2391/PLUS, (1) 4072, (1) 4076 1 FAX Brother 370	BASIC, WORKS, WORD, LOGOCRIPT EXEL2,5, LAP LINK ORDICOPTA, ACCESS POWERPOINT, WORD6

I.2. Activities and results

For the teachers of *Technique and the services technology* (1987-1990): during the period of 15 days after their work they studied intensively methods of modular and structural programming in BASIC and WORKS. Here informatics is considered as the discipline, related to Services.

Exclusively for the seniors of general educational schools and of the National commercial School: informatics was taught as a subject with the following examination.

2. EQUIPMENT FOR TEACHING AND CONTROL IN SCHOOL SYSTEM.

Table 2

2.1. The structure of information computer environment

ORIGIN and date	Technical directions and establishments	Type of equipment and their number	used software and languages
France 1988: used equipment 1992 1993	2.2.1. The Immaculate Conception Institute	(1) BULL.MICRAL40, (1) IBM PS/1, (12) MO5, integrated into a network (worn out) Printer:(1) OKEY, (1) BROTHER M 1918; (2) OLIVETTI 486/5X PC & Printer; (1) COMPACT 486 & Printer EPSON	BASIC, WORD, EXCEL The programme of control after students
OWN FUNDS AND AID (1987-90) OWN FUNDS (1991-95)	2.2.2. RAPONDA walker college	(14) MO5, MO6, integrated into a network; (1) GOUPIL, (1) IBM 88 (1) AMSTRAD, (12) LEO PC386; (2) LEO PC486; (3) printers Hewlett Packard	BASIC, LBO/PCE, PROLOG, WORD DBASE III, Software on physics and chemistry

NATIONAL REPORT OF GABON

APPLICATION OF NEW INFORMATION TECHNOLOGIES: PROBLEMS AND RESULTS

This Report is a branch one, rather then national, from the viewpoint, that the sections related to education were prepared by subdivisions of many organisations, and in particular of the Ministry of the National Education, Youth and Sports and Women Affairs, which is in charge of the of occupational training, etc.

According to the formal features the Report should include the sections, related to the activity of two subdivisions - Women Affairs and Youth and Sports. However, these structures are new in the Ministry, and therefore will be out of our consideration.

Thus, the spheres of the direct (public establishments) and indirect (organisations with the status of social service) influence of our Ministry covers the following types of educational activity:

Pre-school training (26 classes in kindergartens), initial education (1122 establishments), teacher training (2 centres, the first one is state, the second - private, Catholic);

Secondary general education (98 establishments) and secondary technical and vocational education (12 establishments);

Higher pedagogical education under the aegis of two organisations: the Ministry of the National Education is the superior for one of the Centres of teachers training for technical lyceums and colleges; The Ministry of Higher Education is the superior for one of the Centres of teachers training for lyceums and colleges of general education;

The preparing courses under higher educational institutions (2 classes: higher mathematics, special mathematics).

In the educational system, directly of indirectly influenced by the Ministry of the National Education, the process of new information technologies implementation (such as micro-computers, computer application in experiments) is often checked and runs selectively. Still, there are sectors, that haven't been even touched.

Other information technologies (Internet, data banks, computer networks with local servers, developed interactive graphical systems) are too expensive, and today the problem of their purchasing is not of priority.

However, some latest innovations of the office informational technique (telecopier) and in the field of communication (cellular telephones) are quickly developed.

Thus, the given analysis of the situation with the informational environment in the system of education, revealed the following orientations for work:

1. *Pedagogics-oriented equipment.*
2. *Equipment for teaching and control in school system.*
3. *Control-oriented equipment.*
4. *The development of automated control systems in central services; policy of standardisation.*

The three following consistent patterns are revealed in the process of informational technologies implementation in education institutions:

1)The creation of informational computer space (special halls with air-conditioning);

2) Purchasing of new or second hand equipment in case the teaching process is run by groups, consisting of 2-3 persons - the project initiators.

3)Purchasing new and used equipment, regarding systems' compatibility.

The illustrated part of the Report comprises only the data, acquired in the result of our investigation, which has involved:

- 11 exemplary educational institutions of initial and secondary education in Libreville and Port-Gentil. These were the first organisations, which started to implement informational technologies in their activity.

- 7 technical Directorates of our Ministry.

active, are almost passive on multimedia market and don't launch any large attacks, like those, campaigned on the other coast of the Atlantic ocean. The role of the state in this field is still determinant.

Education software development demands considerable investments, which are rather risky, when the Francophone market is relatively restrained. State administration influences this market either through the direct aid in multimedia development, or through the procedures of the further license acquisition with the help of mixed licences.

Le National Cinema Centre put into effect a specific form of aid to multimedia edition. A part of advance is returned to the producing enterprises, providing them with necessary funds for multimedia development. The Ministry of Culture and Industry is responsible for these advances financing.

In order to realise the aforementioned recently adopted programme of promoting the development of information mainlines, there was organised a bidding, in which 138 project took part. In 1995 the total sum of 50 projects support will amount 53 million francs (in 1996 it'll be 100 million francs). Bidding arrangement once more illustrated the demand for qualitative programmes, aimed at multimedia development. The mechanism of lending the aforementioned returning advances is supposed to be supplemented with the fund of interactive products edition promotion (in 1995 its financing amounted 30 million FF).

4.1.2. Higher education

The policy of the Ministry of Education in this field is active, but constantly it faces the aforementioned resistance of teachers. As far as higher school institutions are autonomous, they can be influenced only through stimulation or financial support of existing nets. The contract financing policy and the new policy of the working out the regional development schemes for higher education incited higher educational institutions to use the new teaching methods, based on multimedia.

The resources of the RENATER net, which is under the control of central and regional administration, are available for every university. However, educational institutions are to finance the connection to the net and to provide data exchange in the ambit of their university. The Ministry provides financial support (unfortunately insufficient) of collective activities, such as the development of distance training or self-learning on sites, and to involve in this activities the structures in charge of the popularisation of perspective experience. It also supports financially those multimedia distributors, who sell at a discount. The Ministry makes efforts to create a real market, French and multilingual, of hi-tech products. The Ministry of Foreign Affairs and Co-operation follows the policy of the creation a French-speaking market.

Considerable efforts are made to influence teachers' attitude towards this situation (the distribution of brochures, guides, multimedia, etc). It began to create the information system on existing computer resources on the base of RENATER.

4.1.3. Vocational training

The policy, promoting the elaboration of educational multimedia in the frames of the system of vocational training, is under the control of central and territory administration (mostly regional). Target contracts for several years determine the volume of co-operation on this level.

The Ministry of Labour pursues the promoting policy in the field of multimedia through the three types of measures:

- drawing the inventory of the products, entering the market, from technical and pedagogical points of view;
- the financial support of some products distribution among educational institutions (it's expected, that due to the state support the cost of these products amounts only two thirds of the initial price for 4500 educational institutions);
- the promotion of the pilot projects devoted to the organisation of teaching/learning process with the aid of multimedia.

Approximately 150 centres, possessing computer resources, are responsible for providing educational institutions with information and for the evaluation of educational programmes. These centres are financed by the Ministries of Labour, Education, and Agriculture, by territory administration and, in particular, by regional Councils, as well as by public and private organisations. Though the centres activity is unwarrantablly narrowed (to the problems of reduction the level of illiteracy and qualification improvement), today the range of the problems of their concern widens.

4.1.4. Agricultural education

The ministry of Agriculture, Fishery and Alimentation:

- financially stimulate multimedia resource creation (2 million francs annually, distributed under the control of NCRRAT);
- works out the policy of resource centres development, which includes the promotion of nets' creation, personnel tours of duty (2-3 million FF annually).

4.1.5. Regional policy

Regional administrations, usually having long-term contracts with the central administration, are taking the following measures:

- direct aid to the production of educational software;
- financing the infrastructures of the Information Resource Centres and telecommunication nets for open and distance education;
- technical and financial support of the projects, related to these infrastructures, which objective is pedagogical resources development;
- the programmes of teachers' training, including the section of new technologies;
- promotion of reorganising the regional educational market, using, if necessary, the relevant projects of educational software development;
- the organisation of the Resource Centres for teachers and providing information about educational software.

The policy, conducted by different regions, differs in content and scale. As common for the national programmes, financing in the field of educational software can not be a separate item and usually it included in financing items of other operations.

Usually the realisation of the part of the national programme in the field of vocational training, concerning communication technologies and educational software, fathers by territory administration on agencies - the organisations with autonomous juridical status.

4.2. THE STRATEGIES OF SCIENTIFIC RESEARCH AND DEVELOPMENT

France is an active participant of the European Union scientific - research programme in the field of information technologies implementation in education and vocational training. IT seems, that regarding France role in the European Union, it is able to undertake more obligations, concerning this programme. Its international co-operation is yet correspondingly limited and mostly covers only Francophone countries (Canada, in particular).

4.3. INDUSTRIAL STRATEGY

Almost all French industrial companies, except *France Télécom*, which has recently become very

1000 students annually). Training in these occupations correspond the strategic objective and worth the development of the specialised software. The structures of vocational education in banks (e.g. the *Scalbert-Dupont* bank) and financial sectors use the products, represented on market.

The application of the products, that are represented on the market, for the professional languages training and bureautics studding began quite recently and now it has the tendency to develop. Sometimes, for example, in case of the *BULL* company, when vocational training is offered about 7000 students, it may be generally of almost completely based on software.

The use of educational software for general education rapidly develops and is introduced in many disciplines. There are the examples of software using for training fast reading in the company *Alcatel-CIT*, the bases of communication and general culture in the insurance company *Assurances Générales de France*, elementary mathematics in the *Renault* company, etc.

Software application has got prevalence in the system of education control (e.g. the bank *Crédit agricole* in the Central region of the country).

3.3.3. Professional departments and the organisation of mutual financing vocational training

Almost all these establishments are not involved right in the programmes of educational software production and application. Nowadays the situation changes, in particular it concerns development of information systems on the existing products and the conditions of their use.

3.4. THE INSTITUTIONS OF DISTANCE TRAINING

There are about 550 000 persons, who take the courses of distance training, offered in catalogues by 250 private enterprises and public and para-public structures. These data was collected without regard of the services of distance training, offered by companies for their personnel, because this education is not for all comers. Information and communication technologies application is expressed only telephone communication services and video texts. Other practising computer and communicational services are rare. So, there is an example, illustrating the situation in general: The National Centre of Distance Training of Agricultural Profile, having 5500 students, doesn't use any pedagogical multimedia.

Educational software is also used in case of on-the-job training, but the scale of it differs. Judging by the number of organisations and consumers it's still rather poor. However, some educational institutions largely use it: the regional centres of the *National Institute of Compatible technologies, Centre Université Economie d'Education Permanente* in Lille.

There are two measures, which are necessary to change this situation: families equipment with microcomputers, because now their level is lower, than in the neighbour countries; the development of corresponding educational structures in the system of vocational and agricultural training, as well as in universities.

4. THE POLICY OF PROMOTING EDUCATIONAL MULTIMEDIA

4.1. THE POLICY IN THE FIELD OF EDUCATION AN VOCATIONAL TRAINING

4.1.1. School education

The France Ministry of Education developed some experimental programmes in the field of new technologies implementation in education. These programmes comprise all disciplines. The experiments objectives and content are presented in reports, distributed overall.

The last report concerned information mainlines and services and revelled the following urgent objectives:

- the liquidation of educational institutions isolation from the world, through communication, remote access to computer resources;
- co-operation development (between teachers' groups, students, on a national and world scales);
- sharing the resources and competence inside educational sector, teachers' and students' tele-training (the organisation of data banks of class works; technical and pedagogical support of consumers and educational institution; continuous teachers' training; lyceum training with the aid of video lectures).

In collaboration with higher educational institutions and some other partners, the Ministry of Education launched a global project. Technically, it is based on RENATER infrastructure, locally connected with the most perfect and economic systems, in particular with RNIS and cable video communication nets.

Twelve higher educational institutions and 400 establishments are involved in the project and at present are developing services on the base of *RENATER* and *Numéris.*

At the same time, there is a search for partners in other organisations, in particular in the sphere of culture and science, for the elaboration of the products, adapted for learners' demands. Presently, the list of the involved organisations is supplemented by the National Centres of Space Research in the filed of environment protection and observations of dirt condition, the *Georges Pompidou Centre* in the sphere of culture, with *Institut National de la Sante Et de la recherche Medicale* and the National Institute of Pedagogical Research in Biology.

Moreover, university libraries are also equipped with the devices, permitting to work with multimedia. Mostly, they are necessary for reading encyclopaedias, dictionaries and data bases on CD-ROMs. If a higher educational institution doesn't have a hall for self-learning, library usually purchases a programme package "electronic documents".

Multimedia application for education in higher school has some difficulties. Bit by bit the resistance to innovations abates, as well as the fear of new technologies; the problem of the necessary means of infrastructure (materials and cadres) is partially solved. Nevertheless, the main problem still exists - environment individualism: teachers consider, that their role is in the creation of individualised education, and they long to its unaided formation, without any regard of the pedagogic materials of the other authors.

Supposing, the named difficulties are overcame. It brings about the new problem: the acquisition of multimedia products is too expensive. It is extremely dangerous under the conditions of the absence of any policy, regarding licensing on sites. Dispositions, concerning the promotion of these products production, partly solve the problem, but the vote for these purposes is still insufficient in comparison with the total amount of educational vote. We'd like to notice, that the solution of the problem through the products purchasing by the students on their own faces the absence of the corresponding teachers' directions, the lack of the necessary equipment at home and too expensive costs, though equipment producers and regional administration assume measures, aimed at costs reduction).

Higher educational institutions are longing to link their local nets with the RENATER net, to provide their students with the opportunity to use as much multimedia, data bases and other products as possible. Since recently, some educational institutions adopted the course of the elaboration of the products, interesting for a wide range of consumers or designed for nets.

3.2.4. Agricultural education

Educational institutions of agricultural system of education are fist of all focused on the elaboration and distribution of professional educational software. The application of pedagogical software is new for us and yet we don't have reliable and comprehensive information about the experience in this field and available equipment. However, besides the aforementioned NCRRAT, we have at our disposal:

- 60 local centres of computer resources, which are under the authority of the Ministry of Agriculture, are equipped for individual and distance learning;
- 600 biggest agricultural educational institutions were implemented with basic computer equipment: the minimum computer class equipment is 21 computers, among which 1 is for multimedia.

3.3. USING IN THE SYSTEM OF VOCATIONAL TRAINING

There is no systematised information about educational software using in the system of vocational training of France. However, there is a certain experience in this field and competent structures have already been formed.

3.3.1. Educational institutions (except the institutions of agricultural profile)

The Ministry of Labour launched the initiative, providing for all comers the opportunity to acquire individual training in basic disciplines. In the framework of this initiative the educational network of the departments of individual training is functioning. It comprises 450 departments, which make use in their teaching activity of educational software. According to the available data, in some regions (in particular, the Bourgogne region, 1995) only 80% of the network departments use educational software, but on a different scale (the number of PC differs from 1 to 12, while the number of applied software differs from 1 to 40).

The AAVE Centres (340 locations), the Centres of pupils training (more than 800 centres, where pupils are trained by rotation on enterprises and in the centres) and the establishments of adults' vocational training in educational institutions, guided by the Ministry of Education are supposed to be well equipped with computers. The ways of their application are various: multimedia tools for acquiring professional and technical skills, learning the basic disciplines and the improvement of the general level of culture.

Public and private establishments, offering modern languages teaching, are widely using information technologies (about 20% of the total amount of the educational programmes in use) in the form of multimedia means: students either use them independently, or they are involved in the training process. Monographic studies (ORAVER - 1995, and the new edition, now its preparation is under way) show, that software may be intensively used for education, but yet it's rather difficult to estimate its application quantitatively.

The general plan of educational software application in private educational structures depends on the decisions of the enterprise, financing them, because it entails the necessity to change the organisation of training and pedagogical approaches. It's supplemented by some other factors, related exclusively to the sphere of vocational education: competition (it dictates the conditions of the maximum profit of investments); the status of the private educational institution; the diversity of employment forms (from the full employment by sine contract to temporaries).

3.3.2. Enterprises

Nowadays educational software became on the means, used by enterprises for their employees training (teaching special professional technical skills, languages, bureautics; general professional education)

Such special technical occupations, which are extremely necessary under the conditions of the modern technical progress (railway traffic safety in the company *SNCF*, aviation technologies of Airbus airplanes in the company *Aérospatiale*), annually attract a considerable number of matriculates (about evaluation unit has formulated a range of testing criteria for educational software, taking into consideration technical-pedagogic factors, hardware compatibility, and integration with approved study curricula. Thus, indirectly, the unit has become a source of guidance for educational software developers, thereby enabling the Education Ministry to become more involved in the supervision of educational software used by schools.

REGIONAL COMPUTER SUPPORT CENTERS

In an effort to make training and support services available to as many educators as possible, the activities of existing regional support centers have been expanded, and additional centers have been opened. In order to maximise use of existing infrastructures, the centers have been established in areas where pedagogical centers are operated, making it possible to expand their activities to include training in the use of computers.

In 1994, twenty regional centers were funded at an overall cost of NIS 6 million. An additional NIS 2.5 were budgeted for the purpose of expanding the centers' computer Infrastructure.

Last year, the support centers and training teams focused their efforts on preparing the integration of the vast quantities of computer equipment being supplied as part of the computerization program in the schools. Special attention was directed to providing support to the schools. Each of the schools budgeted in the computerization program was allocated a computer-advisor one day per week.

During the course of the year, the Science & Technology Division appointed six regional supervisors, as well as regional directors, to oversee implementation of the computerization process. The roles of the training staff, the supervisors, and the directors were redefined accordingly.

MODEL SCHOOLS

Model schools were defined for the following purposes:

1. To serve as "flagships" of the national computerization program.
2. To serve as a "laboratory" for the testing of advanced stages of the computerization program.
3. To serve as a source of inspiration and focal point for evaluation.

In 1994, ten schools were chosen to serve as model schools.

Each school is required to select an academic advisor to take on the following responsibilities:

1. To help determine school policies.
2. To guide school operations.
3. To assist the school in creating a definitive evaluation process.
4. To initiate innovate projects in the field of computerization. Two permanent bodies have been set up to administer the project:

1. A team of twenty principals and computer co-ordinators from the schools will meet periodically to discuss ongoing problems and developments.
2. A team of academic advisors (those working with the model schools), who will meet periodically to discuss the academic aspects of the project and its implementation.

SPECIAL PROJECTS

Tomorrow '98 includes projects which are operated in various regions, settlements and educational institutions. The applied initiatives are generated by schools and settlements, and reflect efforts, on various scales, to implement the recommendations of the Upper Committee for Science and Technology Education. The projects applied in schools reflect the desire for change and the emphasis placed on science and technology subjects in a learning environment, including the development of new interdisciplinary approaches.

Today, approximately 40 programs in operation, at various levels of implementation, including the following:

- The Regional Computerized Communications Center in the Northern Galilee;
- The Negev 180 Project;
- The Computerized Communications Teachers Center in Ramat Hasharon Media + ;
- The Computerized Communications Network at Teachers Training Colleges;

REGIONAL COMPUTERIZED COMMUNICATIONS CENTER IN THE NORTHERN GALILEE

As part of the Tomorrow '98 program in the Northern Galilee, a regional computerized communications center was established with which teachers can communicate via modem links. The regional computerized communications center enables teachers to exchange information via electronic mail, communications forums and to establish a computerized electronic newspaper. All the teachers participating in the project are linked to the regional computerized communications center and Communications Support Center.

COMMUNICATIONS SUPPORT CENTER

A center has been established to provide support for schools and workshops, and which trains subject and interdisciplinary school computerization instructors. During the 1994-95 school year, 35 school instructors and 15 regional instructors received computer training at the center.

Equipment

Teachers attending training courses were provided with notebook computers.

Some schools have been equipped with presentation equipment.

The project involves the equipping of computer schools as part of the computerization project.

The project involves the equipping of some primary schools and junior high schools with science laboratory equipment.

NEGEV 180

This regional center for the promotion of excellence and leadership in education was established in conjunction with the U.J.A. (Joint). The center is designed to provide the Negev and Arava regions with a facility for the operation of advanced education programs and the establishment of computerized communications study environments. These environments will be linked to each other and to research and science centers within the region, outside the region and with the rest of the world via a computerized communications system.

The center will initiate the establishment of data bases and activities for science and social studies-oriented youth at regional, national and international levels.

Project Negev 180 offers the following activities: the researcher-historian program, the young ecologist program, and computerized student newspaper programs.

Goals of the Center:

1. The development of knowledge and expertise in fields in which the Negev has unique advantages.
2. The reinforcement of co-operation between the regional communities.
3. The promotion of innovative education initiatives.
4. The development of training and research-oriented knowledge, programs and tools.
5. The promotion of co-operation with other communities in Israel and abroad.

Areas of Activity

1. The establishment of computerized communications study environments in schools.
2. The deployment and operation of a regional computerized communications network.
3. The establishment of a teacher and school principal training infrastructure.
4. The establishment of a support system for high school student diploma work.
5. The reinforcement and extension of activities for advanced students and science and social studies-oriented youth.
6. The operation of regional, national and international youth camps.

TEACHERS TRAINING CENTER – RAMAT HASHARON

A computerized communications teachers' center is being constructed in Ramat Hasharon, at which a model is being formulated for use via the educational communications network.

The center will serve 575 pre-school teachers in the area who teach around 8,300 students at 12 pre-schools and 43 kindergartens.

The goals of the center are:

1. To generate the teachers' creative thinking.
2. To encourage use of the data bases and computer applications.
3. To expose teachers to the educational concept of open tools, and to experience workshop learning.

Workshops for teachers and pre-school teachers will be conducted in the following fields:

- Communications - *Information systems
- Mathematics - * Science
- Learning

The center will help generate an educational environment, in which the teachers and schools are linked via a communications network for the following purposes:

- Electronic mail - * Use of data bases
- Reviewing scientific articles - * Remote study
- Curricula revision - * Use of computerized advice centers

MEDIA+

The aim of the project is to create a new learning environment in which students study independently and design presentations for the subjects they study. Learning progresses in accordance with the ability, areas of interest and individual learning approach of each student. The teacher acts as a guide who helps students and supports each student's learning processes.

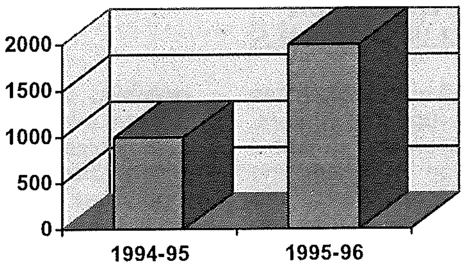
The program concentrates on four subjects: the sciences, history, literature and geography. In the future, the program will be implemented in all junior high school subjects.

The goals of the program are:

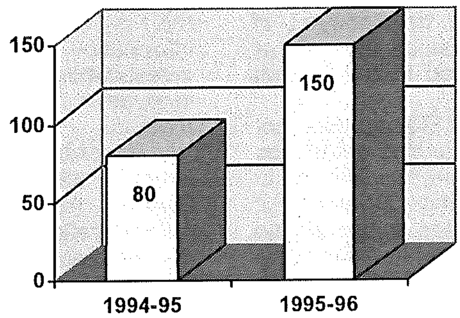
1. The operation of advanced technologies in all schools.
2. The integration of computers in all subjects.
3. The integration of computers by all teachers.

THE DEPLOYMENT OF PROJECT MEDIA+ ACTIVITIES

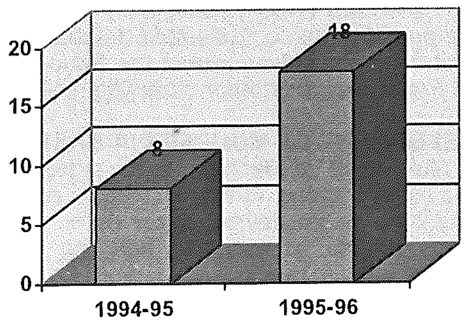
No. of Students

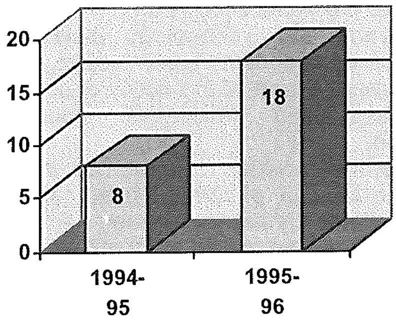


No. of Teachers



No. of Schools





COMPUTERIZED COMMUNICATIONS IN ISRAEL

A COMPUTERIZED COMMUNICATIONS NETWORK AT TEACHERS TRAINING COLLEGES

The process of college computerization is being conducted in three stages and is designed to achieve a ratio of one computer for every ten students. By the end of the 1994-95 school year, 29 colleges had achieved a ratio of one computer for every 13 students.

An inter-collegiate communications network has been established, linking the colleges with the Internet international academic communications network. At first, 14 colleges were linked up. A computerized communications course is being given, involving 27 teachers' instructors in the field of program design integrating computerized communications in teaching. An extensive deployment plan has been drawn up to implement the program.

COMPUTERIZED COMMUNICATIONS IN THE SCHOOLS

The Science and Technology Division is currently planning a national computerized communications project, with the following objectives:

1. The development of a national computerized

communications model which addresses pedagogic, organisational and content aspects. The model is designed to provide support for all educational institutions through out the networks, and to help them operate their communications systems.

2. To provide instruction in the operation of advanced computerized communications technologies, with particular attention given to teachers' in-classroom work requirements, in order to enhance study levels

USE OF DATABASES AND COMPUTER ENVIRONMENTS IN ISRAEL'S SCHOOLS

Students using of educational databases require revised curricula to include updated content. To this end, the Ministry of Education and Culture's Science and Technology Division supports the production of new databases appropriate to the curricula. The Division coordinates and guides the development of these databases on the basis of pedagogical considerations, such as support of curricula, encouragement of students in research learning, problem-solving and independent study. One of the important objectives of the Science and Technology Division today is the development of student potential for independent study; the use of computerized databases is intended to realise that objective.

The Ministry of Education and Culture does not initiate the establishment of computerized databases itself, but encourages local projects and initiatives in schools, pedagogical centers and development centers. The Pedagogical Committee is responsible for the co-ordination of all local initiatives regarding the establishment of databases and for determining standards for database production.

The Ministry of Education and Culture supports the development of some 40 computerized databases in the following fields: technology, biology, history, civics, geography and literature.

EDUCATIONAL CD-ROM PROJECT

The Science and Technology Division has initiated an experimental educational project, the first of its kind in Israel, as part of the policy of promoting open-mindedness and innovative educational experimentation.

The experiment, which commenced in 1993, has led to the installation of computerized databases in some 90 schools throughout Israel. All of the databases have been produced in CD-ROM format. Every CD-ROM installed in the school system includes some 25 educational databases with information on four areas: science and technology, the humanities and social sciences, educational counselling, and pedagogical instructions/guidelines provided by the Ministry of Education and Culture (director-general circulars).

Every CD-ROM includes 350,000 pages of text and a sophisticated information retrieval program.

Information retrieval is simple and user-friendly, operated via a personal computer at the school, without the need to access remote computers and communications lines. The CD-ROM stations in the schools have recently been linked to an educational local area network (LAN), enabling classrooms to access the CD-ROM stations in the school library and to retrieve information.

The educational experiment with the CD-ROM is motivated by the need to adapt the study environment to the accelerated rate of the development of technology. One way of achieving this is through the use of available, updated information which enables learning through investigation and discovery, and helps develop innovative directions in education and learning methods.

In order to promote the use of databases in Israel's schools, the Science and Technology Division has established a nationwide Project Administration responsible for applying the project to the educational reality of the schools, training teachers, and supervising the quality of the databases integrated into the educational CD-ROM.

The project has a team of experienced pedagogical instructors who visit the schools and provide in-service training to teachers and educational counsellors.

Teachers at those schools using the educational CD-ROMs undergo special in -service training in the operation of computerized databases, both in the schools themselves and in the Educational CD-ROM Project Administration's training facilities.

DEVELOPMENT OF MULTIMEDIA BASES

Multimedia is defined as a system will co-ordinatestes various forms of media, operated by means of a single device: a computer. Multimedia systems enable access and handling of a wide variety of media (audio, video, text) by means of previously-unavailable methods. The Science and Technology Division encourages development organisations in Israel to develop multimedia systems in many and varied areas of learning. The Division encourages pedagogical centers, which belong to the country's technological education networks, to take an active role in the development of multimedia systems in education.

NATIONAL REPORT OF KAZAKHSTAN

NEW EDUCATIONAL SYSTEM FORMATION IN THE REPUBLIC OF KAZAKHSTAN AT THE AGE OF INFORMATION TECHNOLOGIES

1. GENERAL PRINCIPLES OF EDUCATION SYSTEM DEVELOPMENT ON THE BASIS OF NEW INFORMATION TECHNOLOGIES

While humankind is entering the epoch of information (post-industrial) civilisation, when the most important products of a social activity are information resources, there is a demand for a new educational system, adapted for the XXI century.

In the conditions of radical changing, taking place nowadays, the first reforms of the Ministry of Education were related to the enlarging of higher educational institutions and to the implementation of test-rating system. These reforms are the first stages of the renewing process of the Kazakhstan educational system. However, these measures are opposed by the conservative teachers. In this connection, we would like to express a trivial idea: today the reforms in the field of education will benefit only if information technologies are more actively and consciously implemented in this system.

At present, the educational world is entering a new phase of its development - gradual introduction of the new teaching/learning technologies, based upon the maximum sinking into the "intellectual medium of knowledge" with the aid of computer and telecommunication technologies. This process is caused not only by the modern tendencies of information technologies development, but also and first of all by the crisis situation, which takes place in the modern system of education. Nowadays we are witnessing an increasing gap between the fast development of various fields of social activity and the system of education, which turned out to be incapable to keep pace with the changing in life conditions. The scientific and technological development of society is so fast, that the traditional educational system cannot change curricula, teaching/learning methods and programs of teachers' in-service training so often according to the up-to-date situation.

It's obvious now, that the further social and economic development of the country needs mutual adaptation between the society and the system education, otherwise the increasing gap between them will turn out to be ruinous for the country on the whole and the system of education in particular.

The realisation of this fact leads to radical changing of the content and organisation of teaching/learning process, to the development of the new educational system on the basis of computer and communicational technologies. In this connection we are talking not only about the methodological and organisational improvement of the existing system, but also about the search for a radically new model of education, corresponding the demands of the coming epoch of information. This system is to provide continuous, distance, open and virtual education, as well as the intellectual improvement of the teaching/learning technology.

Now, it is rather difficult to realise the significance of the coming phase of the educational process. During this phase there should be founded the intellectual background for the further development of the country and estimated the achieved level of civilisation of each society. Consequently, the reforms in the field of education should be conducted with the due regard of tomorrow demands, so that for the further reforming activity not to become a sort of revolution.

In order to provide the evolutionary development of the educational process it is necessary to long for the information unity of politics, economy, education and science as the base for the society's integrity. It's conditioned by the fact that the new phase of the educational process is forming under the influence of scientific and technical progress, economy, administering structures, social and political content of education and teaching theory, which are closely connected and interacting with information technology. Hence, our society should consider education as a prerequisite for economic scientific and technological development, for the lowering of unemployment level, for social equality and political stability.

Under these conditions, one of the most important aspects of society's informatisation is the creation of the elements of information infrastructure, dealing with the educational process, which would provide a new level of personnel training. It is related to the society's entering the third phase of computer revolution, which should provide not only the opportunity of continuous data exchange through global networks, but also the development of network calculations. The conceptions of intellectual global networks are elaborated now for this purpose. These networks are to realise the accumulation of big volumes of information in an electronic form, which may be transmitted to any user through the networks.

The basic principles of the educational process transition to the new phase, formulated with regard of the trends in information and network technologies development, for the next decade:

- territorial independence of a learner's network access to any form of data and calculating resources;
- transparent site and the opportunity of an automatic call of any educational information or data on different disciplines, without reference to their physical situation;
- simple users' interface, providing learners' interaction with teaching systems in the forms, oriented at the mechanisms of human thinking, such as speech, gesture, imagination, etc.;
- on line help to learners for the acceleration of the process of digestion of information on different subjects, as well as mastering tools of computer and network teaching technologies;
- the variety of forms of information interaction between learners and teaching systems, namely teaching systems should be multimedia;
- flexible architecture of intellectual teaching systems, able to increase and modify due to the module principle of their construction on the basis of object-oriented technologies;
- the possibility of control over the complex levels of intellectual teaching systems organisation, which should be able to give the learners-friendly solutions to the increasing number of complex problems.

The main idea of the intellectual improvement of the educational process consists in the module multifunctional and multimedia presentation of educational information and the gradual creation of its structure and its activation. The intellectual improvement means the teaching systems adaptation to the individual character of every learner, to the level of his knowledge, to the methodology and teaching subject.

2. THE MAINSTREAMS IN THE EDUCATIONAL SYSTEM REFORMING

The modern stage of the reforms was initiated in April, 1995 by the President of the Republic of Kazakhstan Mr. N.A. Nazarbaev at the Republican Conference of Teachers. The Action Plan for the educational system reforming was fixed in the Governmental Program, related to the realisation of the conference recommendations, and in the National Policy Concept in the Field of Education, adopted by the National Council of the State Policy under the President of the Republic of Kazakhstan.

The creating Kazakhstan system of education should regard the following world trends:

- educational institutions curricula should meet the needs of labour-market;
- comprehensive training will provide manpower mobility;
- promotion of self-education as the main element of teaching/learning process and the basic factor of learning activity development;
- searching for and implementation of the various forms of education and science integration, unity of teaching and academic research;
- transformation of teacher's role as a source of information into an active organiser of the educational process;
- strengthening of educational institutions autonomy and interaction between them;
- development of the democracy in education administration;
- creation of the conditions, favouring innovations technologies implementation in education;
- international co-operation development in education.

However, there are some points in the home system of education that should be continued:

- education availability to the great masses of population;
- high level of background, in particular in natural sciences;
- possibility to train students in many fields of science, technology and industry;
- sufficient teaching and methodological support of each level of education;
- efficient application of educational resources;
- rational organisation of students' leisure time;

The program principles of forming the new educational system, adopted on the aforementioned base, determine the following priorities:

- development and putting into effect of the national educational standards for each level of the system of continuous education;
- improvement of financing mechanisms of educational institutions functioning, the development of their financial and economic independence, using additional funds, stimulation of their innovation activity;
- levelled regional educational system development, based on the flexible account of the regional and republic needs;
- development of informal forms of education, especially in secondary and high special school;
- organisation of an effective system of education administering on the Republican and Regional level, providing co-ordination interaction with corresponding Bodies of Government;
- introduction of an indicative planning for educational institutions according to the main indexes of cadres training and on the base of the prediction of the demand for them;
- modernisation of the educational institution on the base of increasing the practical importance of acquired skills and knowledge, humanisation of the entire content of education and New Information Technologies implementation;
- development of the rights and responsibility of the heads of educational institutions, promotion of

the practice of their contract employing and reports to their personnel;

- providing entering the world educational environment, raising the level of home education up to the world standards;
- creation of an effective legal base for education.

In general, the aims of the reforms in the field of education are to make it more humane, to address to the spiritual world of a learner, to create an individual-oriented educational system of the Republic of Kazakhstan. Its aim is to provide every citizen of the Republic with the opportunity to realise his ambitions and reveal his talents, to stimulate his searching for the field of activity, that will give him the maximum satisfaction and the maximum benefit for the country. In order to achieve this objective there should be integrated reforming of every level of continuous education.

The fundamental base for the system of continuous education is general secondary school. At present there are 8573 schools of general education, covering 3036500 students.

The three stages in the process of a child's growth - childhood, boyhood, youth - determine the three stages on school education: primary, fundamental and higher.

Today the aim of education is to create the conditions necessary for a child's development and self-realisation on the base of free choice of the educational institution, curricula and text-books, forming their ability to make independent decisions.

Many pedagogical institutions are oriented at the creative search activity. The major part of specialists are convinced of the necessity of school renewing. At present 30% of schoolchildren are studying the programs of gymnasiums, lycees and profile schools.

The Republic Basic Plan and 28 variants of the typical curricula are working in the mass school of general education. Every school has the right to create its own variant of a curriculum or to choose among the suggested ones, regarding its students' interests and abilities.

At present the Ministry of Education together with the Altasyrin Scientific-Research Institute of the Problems of Education n.a. Altynsarin is working out the educational standards and the new Basic curriculum, which are so necessary under the conditions of schools and disciplines variety. It provides for a radically new structure and content of the educational process, oriented at a child's personality, for the transition to a developing teaching, supporting the development of a practical, analytic and creative thinking, and for the education of the ability to make independent solutions in the process of their life activity. The renewing of the content calls for the education of the civic consciousness and for the Kazakhstan patriotism, for the good studying of foreign languages on the base of the principle of three languages (Kazakh, Russian, Foreign).

The ethnic demands of the population determined using seven languages for children's education in Kazakhstan schools. Besides, there are 14 native languages taught in the places of concentrated inhabitation of some nationalities.

In 1991-1995 the number of general secondary schools, where Kazakh is the language of teaching was annually increasing owing to the national policy of the national school development. During this period their number increased to 459 schools, and the number of Kazakh children, who are taught in their native language, - to 287500.

Twenty two universities and pedagogical institutes and 28 pedagogical colleges are training cadres for educational institutions. Recently, the number of trained specialities increased: we began to prepare teachers - psychologists, social pedagogues, specialists in economy and marketing of education.

The new content of education demands for a corresponding didactic, scientific and methodological support. In this connection, our main objective now is to create and publish a new generation of original text-books and didactic materials in Kazakh and Russian.

The reform of general secondary education is conducted under economically difficult conditions. Teachers' low salary debunks prestige of the profession.

The trouble situation concurred in the Republic schools provision with text-books and didactic and methodological materials. Deficient financing caused the double reduction of the volume of their publishing, comparing with 1991. We have almost stopped to publish materials for teachers and educators. Therefore they are insisting on publishing special magazines, such as "Mathematics at School", "Physics at School", "Chemistry and Biology at School", "Foreign Language at School", "School and Production", etc.

The economic and social course, followed by the Republic, demands for some new features of the system of practical and primary vocational training of schoolchildren. However, during the period of the last 4 years the number of interschool training and production combines decreased by 50 ones, the number of training workshops and enterprises, allowing for practical training, - by 340. There is also the reduction of the number of schoolchildren labour units.

In this connection the problem of students' early mass vocational guidance is of current interest. In order to solve it we need to develop a new type of educational institutions - vocational school. Teenagers, who have finished fundamental school, will be able to acquire complete secondary education and a working trade.

In the future, great attention should be paid to the problem of searching for, training and education of talented children. This solution of this problem is supported by the elaborating National program "Ability".

Rural and small schools also face a lot of problems. There are 6564 rural and 3825 small schools (with insufficient number of students). Their material and technical equipment doesn't agree with the present standards of the educational process: the majority of classrooms and production workshops have dated equipment, their computers and technical means of education are physically and morally worn out. There are no plants in the Republic to produce school furniture, equipment, no enterprises to repair and maintain computers and other devices and apparatus.

In order to improve the material and technical school base it is necessary to reconsider the expenditure norms for these purposes and to accommodate them with the new life conditions.

It's supposed to organise enlarged schools on the base of joining close schools and regional territorial school combines, with regard to the regional conditions of settlement and the achieved level of interaction between localities. It will allow to use rationally the material and technical base and school cadres.

One of the most important problems of 1996 is to realise the demands of Article 30 of the Republic of Kazakhstan Constitution about compulsory secondary education. After finishing fundamental school (9 years), children are able to acquire complete secondary education, continuing their training in a gymnasium, a lycee, at avocational school or school of general education with a special practical training in mass working occupations. There will be more opportunities for the working youth to acquire complete secondary education without attending lessons.

The difference between the students of various educational institutions demands the development of a concrete mechanism and special curriculum. Teenagers studying 2-years programs of lycees (with the majority of natural sciences) and gymnasiums (with the majority of humanitarian disciplines) gives the opportunity to improve the level of matriculates background, who are entering corresponding technical and humanitarian higher educational institutions.

Now there are 235 state secondary special educational institutions (SSSEI), which train teachers; 195 of them are in the system of the Ministry of Education.

Secondary special school of the Republic trains students in 203 specialities, herewith special attention is paid to the training of specialists of the general sectors of market economy. The structural reforms, which take place in the country today, the shifts of the priorities in the demands for manpower from production to service branches, entail the structural reform of secondary special education. International experience shows, that the majority of cumulative manpower and the most mobile part of it are the specialists of servicing fields of activity. Therefore now the number of educational institutions are changing their profile and a new specialities Classifier is developing.

Since 1994/95 school year a new generation of text-books was introduced in 192 specialities of SSSEI. The Program of humanitarian education is realised through the complex of humanitarian, general educational and special curricula. The bank of typical curricula and teaching programs was created under the Ministry of Education.

When the Ministry of Education became in charge of branch SSSEI, it began to develop new educational and methodological combines, simultaneously it made the analysis of the curricula in order to find new opportunities to shorten the period of education to 2-2.5 years for those, who have general secondary education.

The planned 30% reduction in 1996 of the number of students, admitting to SSSEI, may affect in the considerable reduction of educational institutions. Today SSSEI is quite an adapted type of an educational institution, which corresponds the demands of our economy. The experience of a number of developed countries (e.g. USA) shows the same tendency. USA 2- or 3-years colleges are similar to our vocational schools. Today they represent flexible multitarget educational institutions. Their further development is considered to be the most reliable strategy, which is conditioned by their maximum orientation at students and industrial demands.

Nowadays, 28 SSSEI are the structural subdivisions of the universities. State farm vocational school are also reorganised now. Some of these schools, that are out of the agricultural market economy structure, are transformed into agricultural colleges. In 1996 74% of SSSEI will be financed from the regional budget. However, it dangerous for the future system of special secondary education, because it doesn't support the continuous system of vocational training. In 1996 and the nearest years we have to:

- continue the process of SSSEI inclusion in higher educational institutions (HEI) complexes and to agree their curricula with the educational programmes of first years of education in HEI;
- finish the development of a new legal base for special secondary education;
- introduce in SSSEI the system of multiprofile education and to organise the generally contract-based courses for the free part of the population, who are looking for a new job;
- reconsider the proportion between the sizes of cadres training for the branches of material production and service;
- renew the content and pedagogical technologies of specialists training; to shorten the period of education;
- provide not one, but a number of funds SSSEI financing; to develop them as multitarget schools.

During the last years the structure and the quality of HEI network has considerably changed. There has greatly increased the number of classical and profile universities and academies. 12 universities and 3 educational academies were organised in 1991-1995 on the basis of educational institutions transformation, many of them are developed as educational complexes, which consist of institutes (higher colleges) and SSSEI (colleges).

The Republic HEIs offer their students training in 225 specialities. Every state HEI has a licence for the right to teach.

Every year new Kazakh groups and departments are organised in HEI. At present 33.3% of students are taught in official language.

In order to increase the opportunities to acquire higher education by the representatives of the national minorities, in 1995 every HEI speciality has got a certain quota for the number of admitting students of the Kazakhstan Nations' Assembly.

The number of Doctors of Science increased in HEIs from 613 in 1991 to 943 in 1995, while the number of Candidates decreased from 8892 to 8314. The number of Degree specialists has also decreased from 41% to 32% of their total number.

On the whole, the Kazakhstan higher school has powerful scientific resources, permitting to provide a high level of graduating specialists.

The content of education is also renewing. Recently, there were adopted the normative document "State Educational Standard of higher education", basic principles and state standards for 122 specialities, which determine the compulsory minimum of the content of education, the maximum students load, the demands to level of graduate background.

The National Council of the State Policy under the President of the Republic of Kazakhstan adopted the Concept of humanitarian education. On the base of the Concept the Ministry of Education has developed and realises the corresponding program and has introduced the HEI general cycle of social and humanitarian disciplines.

Every HEI has included in summer examinations of 1994/1995 school year test forms of students certification, combining them with rating system of knowledge estimation.

According to the Government planned measures, the most important problems of higher education reforming will be solved in 1996. Herewith, we have to regard the following world trends in the field of higher education:

- considerable escalation of its development;
- administering decentralisation and the increasing of the level of HEI autonomy and academician staff independence;
- faculties transformation into departments, with the introduction of an interdisciplinary approach to specialists training;
- the organisation of the regional systems of higher education;
- the development of non-university sector and the organisation of far-out HEI, offering education on the base of New Information Technologies;
- the introduction of new organisational forms of HEI science.

We shall also have to take the following measures:

1. The optimisation of the HEI network: the development of the humanitarian profile; the enlargement of the university and academy sector; the active continuing of process of colleges inclusion in HEI complexes. In general, the course is aimed at the rational reduction of the number of HEI in the Republic.
2. The development of the regional HEI. It seems to be rational to provide the functioning of either one large HEI of the university level, or one multiprofile Western-type university in every region of the country.
3. The organisation of HEIs activity according to their status. It's going to provide integration between humanitarian, natural sciences' and technical education, as well as the improvement of the level of vocational university education.
4. The transition to a double-level structure of higher education: basic higher education (Bachelor, Diplomaed specialists - engineer, physician, agronomist, etc.) and the special higher education (Master).
5. The shortening of the terms of education is differentiated according to HEI types and specialities from 3.5 years (pedagogical) to 6 years (medical).
6. The renewing of the content of education and the modernisation of the educational process. The national standards for 103 more specialities are going to be adopted, the Classifier of higher education specialities will be renewed, the separate students' work will be promoted, the new generations of text-books and didactic materials will be worked out.
7. The integration between higher education and science: it's necessary to provide the continuous transformation of the scientific knowledge into the educational one.
8. The improvement of higher education administering. Some HEI will get the autonomy status; the activity rectors' regional councils will be organised on a qualitatively new level.
9. The creation of a number of financing funds, in order to provide the HEIs economic stability.

The important role of postgraduate education (PGE) in the system of continuous education is conditioned by its responsibility for the renewing and increasing of the intellectual resources of the society.

It is very important to realise social security and rehabilitation of employees not only due to the economical measures, but also through the system of education. The significance of PGE system is considerably increasing under the conditions of economy reforms. It provides an effective opportunity to upgrade the qualification or to acquire a new speciality within a short period of time for a great number of specialists, it helps them to return to the different branches of economy, education, science and culture and to stay in their positions.

The main problem here is to define the demands to the PGE educational institutions (subdivisions), to modernise the structure of their network, to improve the content, forms and methods of education.

Therefore he structure of PGE was changed: those educational subdivisions, which trained cadres in non-perspective specialities, are closed; some faculties of qualification upgrading changed their profile.

The main sources of highly qualified scientific and pedagogical cadres are the former students of postgraduate studies and doctorship.

During the last period, the number of students of postgraduate studies began to reduce. Although, the number of postgraduate studies has increased by 14 schools, comparing with 1992, the number of their students has decreased from 943 to 886. It is conditioned by the absence of any financial stimulus for Degree specialists and by the ruining of traditional scientific connections with CIS countries and industrial establishments.

The following measures are necessary to be taken in order to train cadres of the highest scientific qualification:

- to develop the network of Specialised Councils through the forming of the regional and inter-branch ones;
- to improve a mechanism of granting the best associate professors Professors Degree;
- to use the Mastership as a perspective way of scientific and pedagogical cadres training;
- to define the quality of their training though the mechanisms of HEI certification and accreditation.

The private sector of education is a part of many countries economy. The competitiveness of private educational institutions is determined by their capacity to meet the needs of labour market and to satisfy the demands of separate citizens.

The Kazakhstan transition to the market economy supported the creation of an informal sector of education. The adopted in 1992 law "On Education" became the legal base for it.

The majority of Kazakhstan informal vocational educational institutions don't possess their own educational and laboratory rooms, they don't have staff teachers and their source of financing is fees for education. Training is offered in the specialities, demanding minimum investing.

Nevertheless, the formation and development of the informal sector of the Republic system of education are one of the most important directions of the reforms in education. This process is natural for the market economy and therefore irreversible. Moreover, the role of informal educational institutions will gradually increase, because they can implement flexible and perspective forms of general and vocational training and support the realisation of the right to study. Besides, the reduction of the number of state HEI students is partly compensated by the students of private educational institutions.

Therefore the Republic Government promotes informal sector of education. Private educational institutions should have priority in vacancy leasing. It's necessary to develop the mechanism of inclusion on the competitive base of informal accredited educational institutions, training cadres in deficient specialities, in the scheme of partial national budget financing. In 1996 the normative base for the private educational institutions functioning will be improved.

The new educational system shouldn't emphasis the form of property of an educational institution. There should be common criteria for state and private educational institutions. The main index for their estimation should be the level of knowledge of their graduates.

Kazakhstan integration into the world community is impossible without educational systems integration. Since 1991 international and intergovernmental contacts are constantly developing. There have been signed and successfully realised 40 interdepartmental agreements. Kazakhstan HEIs concluded 70 direct treaties on international co-operation, organised 29 Kazakh - Turkish lycees. More than 1800 Kazakh pupils, students postgraduate students and teachers are trained nowadays abroad in the educational institutions of the developed countries, while 2000 of foreigners are studying in Kazakhstan. Certain measures were taken in order to meet the educational needs of the representatives of Kazakh nation abroad, in order to develop the entire educational environment on the territory of CIS countries. A considerable help in the educational system reforming was offered by some international organisations: Asian Bank of Development allotted $20 million credit; the European Community granted 70 thousand ECU; Soros Foundation allotted grants for educational literature publishing.

Special role in the international co-operation development plays the realisation of the Decree of the President of the Republic of Kazakhstan of November 5, 1993, regarding the establishment of international scholarships of the President of the Republic of Kazakhstan "Bolashak" for cadres training abroad. 171 scholars are studying now in USA, Great Britain, Germany and France. In general, the Kazakhstan students adapted to the foreign systems of education and soon make their contribution to the development of the country.

The following measures will be taken for the further development of international co-operation in the field of education:

1. To develop and annually correct on the governmental level the list of especially deficient specialities for the elite cadres training abroad, regarding the social and home economy needs.

2. To make the Ministry of Education in charge of the co-ordination of the Kazakhstan citizens training abroad. At present different private enterprises, associations and funds are working in this field without any control over their activity. Consequently, students are not provided with medical insurance, the necessary minimum of financing, social security and guarantees.

3. To create the nostrification mechanism for the documents, related to the system of education.

4. To think over the question regarding the organisation of an International university with English as the language of teaching, with foreign teachers and International Diploma, in order to train the intellectual elite of Kazakhstan.

5. To use the resources of the Kazakhstan embassies abroad, of the Kazakhstan Representations in UNO, UNESCO, EC and other International organisations for the international co-operation development and for the creation in Kazakhstan of a data bank on the world system of education

3. THE STATE OF THE ART AND THE PROBLEMS OF INFORMATISATION OF THE SYSTEM OF EDUCATION IN KAZAKHSTAN

The whole world pays great attention to the informatisation of all fields of activity, and especially of education. In the near future the Kazakhstan role in the world process first of all will depend on the determination of its government and citizens to achieve the strategic objective - the Republic transformation into a world intellectual power with the advantageous development of non-material intellectual and scientific branches of industry. But there are some prerequisites for the development of such kind of economy: 40-60% of adults should have higher education, while the part of scientific workers should be about 2-5% of the country. Scientific and technical resources of the country should be not "saved", but promoted. They must work and save the whole country and there is no other way out.

The aforementioned objectives may be achieved through some changing in the investing policy, which provide for economy stability improvement due to the education informatisation.

The complex approach to education informatisation in Kazakhstan permits:

- to provide every citizen the availability of knowledge and information;
- to develop individual intellectual and crea-

tive abilities;

- to promote co-operation, knowledge and data exchange;
- to upgrade the qualification and operatively change the field of activity during a person's active period of life;
- to improve the efficiency of correspondence and individual ("home") training through the system of distance education.

According to the statistics, the institutions of the Kazakhstan system of education are equipped with 58, 875 computers, while the number of modern ones is 3305. School equipment with computers is rather bad, because the majority of the modern ones are at the disposal of HEIs. In fact, the Republic school equipment with computers consists of 1,181 pieces, that is 2.5% of their total number. The majority of vocational schools don't have computers at all, SSSEI possess 160 computers, that is 6.4% of their total number. HEI have 1,694 computers (29.2% of the whole amount).

In order to provide a quality training in the field of informatisation, there is a demand for high quality software, which costs 50-70% of hardware. But there are many good specialists among the staff of general and vocational schools, of HEIs, who develop their own software, including software in Kazakh.

The quality estimation of the software, developed by the educational institutions of the Republic, was periodically carried out on the workshops, conferences, exhibitions (1993, 1994, 1995), held by the Ministry of Education of the Republic of Kazakhstan on the base of the Republican Centre of New Information Technologies (RC NIT). However, there are no funds for the purchasing of any software.

The basic legal and methodological documents are necessary for the implementation of information technologies in the Republic of Kazakhstan, in order to improve the quality of the educational process, scientific research and the educational system administering, to create an informational environment and integrate it in the world system of educational.

The analysis of the aforementioned basic documents showed that the Republic demands for the following normative documents:

1) the concept of informatisation of the Republic of Kazakhstan education;
2) documents, providing citizens with the right for information and informatisation;
3) the concept of the Kazakhstan system of education entering the international information and telecommunication system;
4) the concept of the satellite general information system for the Kazakhstan system of education;
5) documents regulating the development of the telecommunication network for control purposes and interaction, of distance training, of the creation of data banks for education;
6) the programme of informatisation of the Republic of Kazakhstan education.

The course of Informatics was introduces in school curricula because of the developed countries transition from industrial to information society. This transition was conditioned by the appearance and development of a principally new tool - computer.

If we consider the information flows "person-person', "person - computer", "computer - computer", it becomes obvious that the system "person - person", being very versatile and interesting, has been studied by many humanitarian sciences and long ago became a part of fundamental school subjects. The recently appeared system "computer - computer" represents a special technical problem and should not be compulsory studied in general school. The development of modern Information technology made the knowledge of the system "person - computer" a problem of everybody's concern. Consequently, a person should learn to interact with computers at school and therefore the global aim of school informatisation is the increasing of the efficiency of learner's computer application as a tool.

The policy of the Republic of Kazakhstan in the field of general secondary education should provide: the development and introduction of the national standards for primary, fundamental and complete secondary education; the improvement of the system of students' knowledge control; the development of different forms of training; the creation of New Information Technologies and didactic tools.

Many educational institutions are developing up-to-date automated systems, have animation and graphic illustration of some disciplines, elaborate tools for educational automated systems, software on mathematical statistics, math programming, health service, physical culture, etc.

It's worth to mention the development of the first Kazakh fonts for WINDOWS, graphic software, audio and video multimedia systems, medical and biological programs, the application of perspective tools (Borland Pascal 7.0., Modula-2) and hypertext technologies, etc.

There has already appeared software educational and controlling programs in Kazakh. We should also mention, that there are some original programs developed with the aid of the old computers.

The participants of the International Conference - Workshop on Software and Hardware, held in September 1995 in co-operation with Moscow Institute of Teachers' Qualification Upgrading, Moscow Institute of New Technologies in Education, and IST (International Software Trading, Switzerland), made the decision to organise annual conferences - workshops on New Informational Technologies on the eve of the August conference of secondary school teachers.

On December 22, 1995 the Republican Centre of New Technologies in Education held an International Conference - Workshop "Informatisation of the System of School Education". The Conference took place in the Grand Hall of the Ministry of Education of the Republic of Kazakhstan. The participants of the Conference were the school, teachers of Informatics, SSSEIs and HEIs staff from Almaty.

The participants of the Conference decided to elect a group of teachers for the development of a didactic complement, consisted of a text-book on Informatics for the students of 10-11 forms, a didactic material for the teachers and students of pedagogical HEIs, a book of problems on Informatics for secondary schools in Kazakh and in Russian. Now they are preparing variants of this complement.

Today one of the most important problems is the problem of organising the scientific and methodological developments and the licensing of educational software and workstations for organisational and controlling purposes of the system of Kazakhstan education.

The laboratory "The New Information Technologies at School", organised in the RC NIT, is carrying out scientific research project "The control system of the educational process on the basis of New Information Technologies at school, in the Regional Departments of Education and the Ministry of Education of the Republic of Kazakhstan", in the framework of the Republican target scientific and technical program "Informatisation of the National Economy of the Republic of Kazakhstan" (the Decree of the Ministry №400 of April 18,1994), according to the Protocol on the co-operative work, signed by the Ministry of Education and the Ministry of Science and New technologies of the Republic of Kazakhstan.

Since April 1, 1995 this scientific project is financed form the budget through the Ministry of Science and New Technologies of the Republic of Kazakhstan and is devoted to the problems of school education informatisation:

- the development of the control system for the school educational process on the basis of New Information Technologies (NIT);
- the development of the technology of education on the basis of NIT;
- the creation and application of a computer data bank on tests according to the levels of difficulty, adequate to the national standards of education;

In order to solve these problems, there was organised the studying of the technological operations of the educational process and revealed some "bootlenecks" in the system of education. There was suggested a scientifically based theory of the technology and control over the educational process on the basis of New Information Technologies on the different levels of management: school, regional, republican. It demonstrated impossibility of educational institutions control without corresponding standards of education. The complex of standards for general secondary education consists of the following seven positions:

1) the content of education;
2) the estimation of the quality of education;
3) teachers' qualification;
4) educational institutions;
5) educational institution administering;
6) educational process technology;
7) school Olympiads arrangement.

Certain results were obtained in the process of the program realisation. Information technologies development and implementation in the secondary school educational process will be continued in the framework of the program of cadres pre-service and in-service training.

The Memorandum about mutual understanding, signed by the Asian Bank of Development, UNESCO and the Kazakhstan Government for the project of the rehabilitation and improvement of the administration of the educational system, is a prerequisite for the future informatisation development in education in framework of the Program of the development and reforming of the educational system of the Republic of Kazakhstan.

The installation and realisation of a computer information control system for education provides a telecommunication system necessary not only for the solution of the problems of administration informatisation, but also for the New Technologies implementation in distance training.

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NATIONAL REPORT OF LUXEMBOURG

INTRODUCTION

The new information and communication technologies, as well as lhe computing tools used in audio-visual systems, are fundamentally changing our society. These iransformations affect not only the workplace but also social and cultural life and constitute a challenge to education. The children of today have to be prepared for the society of information and communication of tomorrow.

In the recent past, the Luxembourg educational system has taken up the challenge. Computing has become a compulsory subject in secondary and technical schools for pupils aged 15 and over. In vocational training, special courses introduce pupils to the use of the computer in the professional world. Furthermore, considerable efforts have been made lo integrate the computer as a learning tool throughout the curriculum and at all levels.

GENERAL OBJECTIVES

As far as the new information and communication technologies are concerned, the Luxembourg educational system has given priority to two general objectives. The first of these is to offer all pupils basic training in the new information technologies, to initiate them into the most common computing tools and to introduce them to the practical use of the computer as an aid and as a learning tool. The second objective aims at enabling teachers to take advantage of computing tools to improve and diversify their teaching methods.

The first objective has been achieved, at least to a great extent:

- on the one hand, by offering computer-awareness courses, which are to be considered a fundamental element of their general education, to all pupils before they leave school. Thus, a computer awareness course, introduced in 1986, aims at giving the young their First contact with the new information technologies. This course is obligatory for all pupils in their last year of compulsory schooling. The knowledge acquired in these courses will be developed and deepened, cither in the upper level of secondary education, or in vocational training, or directly in professional life.

- on the other hand, by creating two new courses which supplement the computer-awareness courses and during which pupils use the computer in practical project work.

The pupils of the lower level of secondary and technical education (age: 12 to 15) take part in interdisciplinary projects. Since the school year 1990-1991, this course has been compulsory in technical education and optional in secondary education. The aim of the course is lo introduce pupils to general computing tools such as word-processors or databases through practical project work which has a direct link wilh the other subjects on the curriculum.

In secondary education, pupils aged 16 to 17 can choose fiom various "pre-specialisation options" before they make a final decision on which orientation they want to give to their studies. A certain number of these optional courses introduce pupils to the computer as an aid and as a learning tool.

As far as the second objective is concerned, considerable efforts have recently been undertaken to integrate the computer across the curriculum with the aim of diversifying and improving teaching and learning methods. Pilot projects have been initiated, both in primary and in secondary and technical education, to explore the educational potential of the new information technologies and to develop means of integrating them into the curriculum.

It should also be noted that the Luxembourg educational system is currently trying to move away from a more teacher-centered approach, based on the delivery by the teacher, and the assimilation by pupils, of abstract knowledge, to a more student-centered approach, based on practical project-work, group work and autonomous learning. Such an approach was first experimented with in both computer-awareness courses and in interdisciplinary project work where the computer is to be used as a tool. Although this shift is still in a very early phase, it is hoped that teachers' awareness of the computer's potential for student-centered practical activities (learning by doing) will come to act as a catalyst on other subject-matters on the curriculum.

IMPLEMENTATION

To ensure the fulfilment of the objectives concerning the integration of the new information technologies in the Luxembourg school system, efforts have been concentrated on the following points:

- Systematic development of the hardware available in schools. Nevertheless, the recent introduction of new courses which integrate the computer into the learning process, as well as the constantly increasing requirements of the trachers who want to use the computer as a learning tool in their classes, have multiplied the needs both in hardware and in appropriate software.
- Information and teacher training, both initial and in-service. Teacheis should not only be fully aware of the new developments in computing and in its educational potential, they should also become competent in the use of the computer in their classroom.
- Software evaluation with the aim of assisting and orienting teachers in their choice of appropriate

software.
- Development, evaluation and diffusion of pedagogical models which teachers candirectly integrate into their courses.
- Development of adequate infrastructure to allow teachers to obtain information onthe new developments and to pool their experiences and expertise.

For a small country like Luxembourg, international co-operation, and more particularly on the level of the European Communities, has proved to be of the greatest importance. With the rapid developments of the new information technologies and their applications in education, it is essential for contacts with other countries concerning information about new software packages that are available, teacher training, pedagogical models and methods, ... to be made and developed.

1. THE LUXEMBOURG EDUCATIONAL SYSTEM

The Ministry of National education and Vocational Training ("Ministere de 'Education Nationale") is responsible for the whole of the Luxembourg national educational system.

Attendance at a Luxembourg state school is free, i.e. the State budget covers all costs resulting from the running, the equipment and the administration of the schools.

The teachers of primary education have attended, after their secondary education, a teacher-training cycle of three years of higher studies at the Institute for Higher Pedagogical Studies and Research (I.S.E.R.P. - "Institut Superieur d'Etudes et de Recherches Pedagogiques"). Teachers of secondary and technical education must have attended university for at least four years: they then attend- a cycle of three years of initial training, both theoretical (First year) and practical (last two years), co-ordinated by the Department of Pedagogical Training of the University Centre Luxembourg (C.U.L. = "Centre Universitalre de Luxembourg").

During their professional careers, primary school teachers are supervised by the inspectors of the Ministry of Education, secondary and technical school teachers by the director of studies of their school. What is inspected is the teachers' adherence to official methodology and programmes and to the prescribed school books.

The Ministry of National Education and Vocational Training is in charge of the co-ordination of the syllabuses. As far as primary education is concerned, the syllabuses are described in the plan of studies ("plan d'etudes"). A special commission, nominated by the Minister of National Education, defines the general outlines and objectives of the "plan of studies", the details of the curriculum being then worked out by special work groups. As far as secondary and technical education are concerned, the Ministry of Education bases its curriculum decisions on the suggestions and advice of the National Commissions for Timetables and Syllabuses ("Commissions Nationales des Horaires et Programmes") which are made up of practising teachers, each school being represented by one delegate.

The Ministry of National Education and Vocational Training is also responsible for pedagogical rescaich and innovation.

The Department for Research and Development ("Departement Recherche et Developpemeni") is in charge of the administration of research on a national level.

The Service for the Co-ordination of Pedagogical and Technological Innovation and Research (S.C.R.I.P.T. ^"Service de la Coordination de la Recherche et de 1'Innovation Pedagogiques et Technologiques") of the Ministry of National Education and Vocational Training is in charge of the co-ordination of the different programmes for pedagogical and technological innovation ;ind research as well as the co-ordination of in-service teacher-training and the diflusion of all information concerning them. It is to be noted that one of the most important innovation programmes co-ordinated by the S.C.R.I.P.T. is the implementation of the new information technologies across the curriculum.

Apart from its main function of a teacher-training centre, both initial and in-service, for primary education, the Institute for Higher Educational Studies and Research (I.S.E.R.P.) also carries out pedagogical research programmes.

It should also he noted that the Centre for Educational Technology (C.T.E. = "Centre de Technologie de l'Education") concentrates, at a national level, all logistic resources for both primary and secondary education. Finally, a certain expertise in research and development, particularly as far as the new information technologies are concerned, is being developed by the two public research centres: the "Centre de Recherche Public - Centre Universitaire" (C.R.P. - C.U.) and the "Centre de Recherche Public - Henri Tudor" (C.R.P. - H.T.).

TYPES OF SCHOOLS

In all types of schools, structures and syllabuses are strictly identical for boys and girls. All schools are mixed.

There are three distinct types of schools (see appendices I and 2):

Primary education which comprises nursery schools (2 years), the tirst six years of primary studies, complementary classes, special classes and classes for children with special needs. There are 433 primary schools throughout the country, of which 18 are complementary education centres.

Nursery schools are lo contrihute to the growth of the cliildren'.s personality through the development of basic knowledge and skills, to foster their awareness of the environment and to prepare their integration in society.

Primary edlicalion extends over a period of six years. Apart from languages (German, French and Luxembourgish), mathematics, local studies and elementary science, the syllabus also comprises optional introductory activities during which the computer is used as a tool. It should be remembered that children learn to read in German (which gradually becomes the major language for teaching) while French is learnt as a foreign language from the second year onwards.

Various schools and institutes exist throughout the country to cater for children with special needs.

Although the passage from one type of school to another is generally possible, *post-primary education* comprises three different itineraries:

Secondary education ("enseignement secondaire") which takes place in "lycees" (eight throughout the country) over a period of seven years and the aim of which is above all to prepare pupils for higher education. It is made up of three divisions: the lower division the aim of which is to allow pupils to get used to the new school system and for teachers and parents to get an idea of the pupils' chances of success in this type of school, the comprehensive cycle where, according to their abilities and wishes, pupils can choose between the literary itinerary or the scientific itinerary: the cycle of specialisation where pupils are expected to make a definitive choice between various specialisations (languages, human and social sciences, plastic arts, music, mathematics and physics, natural sciences, economics).

Technical education ("enseignement secondaire technique") which takes place in "lycees techniques" (fourteen throughout the country) over a period oi" six or seven years and the aim of which is to prepare pupils for a chosen profession or for higher education. It consists in the lower cycle which aims at deepening the pupils' general knowledge and at leading.them to the vocational training which best corresponds to their abilities and wishes, as well as in the middle and upper cycles comprising the professional itinerary, the itinerary of general technician and the technical itinerary.

Complementary education ("classes complementaires") comprises three years of studies. Its aim is to complete the basic knowledge of pupils, to develop social skills and to offer basic vocational training. From the school year 1994-1995 onwards, complementary classes will be integrated into technical education.

In Luxembourg different centres and institutes offer courses of higher education:

The University Centre Luxembourg (C.U.L. = "Centre Universitaire de Luxembourg") offers a first year of university education only, the courses being adapted to the syllabuses of foreign universities where students are expected to continue their studies.

The Higher Institute of Technology (I.S.T. = "Institut Superieur de Technologie") offers courses in higher technical education and trains future technical executives in production, applied research and the service industries.

The Institute for Higher Pedagogical Studies and Research (I.S.E.R.P. = "Instirut Superieur d'Etudes et de Recherches Pedagogiques") is responsible for the initial and in-service training of nursery and primary school teachers.

The Institute of Educational and Social Studies (I.E.E.S. = "Institut d'Etudes Edueatives et Sociales") trains educators for children with special needs.

The Higher Vocational Training Certificate (B.T.S. "Brevet de Technicien Superieur") is a high-level vocational training course.

The Service for Adult Education of the Ministry of National Education and Vocational Training organises special courses for adults to prepare for the various diplomas of secondary and technical education as well as intensive language courses offered by the Luxembourg Language Centre (C.L.L. = "Centre de Langues Luxembourg").

The proportion of private schools in Luxembourg is relatively small. Furthermore, pupils attending private schools have to sit official State examinations if they want to be awarded an official diploma.

2. HARDWARE AND SOFTWARE

Since the 1980s, the computer equipment in Luxembourg schools has been systematically developed and completed. Considerable efforts have been rnaile, both from a financial and pedagogical point of view and in as far as teacher-training is concerned, to integrate the computer as a learning tool across the curriculum.

Nevertheless, the needs in both hardware and software continue to increase at a steady rate: an increasing number of teachers are willing and ready to use the computer as a teaching aid in their classes, while new-courses have been introduced LhaL make compulsory the use of the computer as a learning tool.

PRIMARY EDUCATION

In primary schools, the local authorities are responsible for the purchase and the maintenance of all the equipment, hardware and software ineluded. About 75% of primary schools have at present been equipped by the local authorities wilh at least one computer. There is, however, at the moment, a strong move by teachers to have this equipment increased as a result of the emphasis laid in in-service teacher training on the educational potential of computers. Computer equipment in primary schools is thus likely to increase considerably in the near future.

As local authorities are responsible for the equipment of primary schools, the Ministry of Education does as yet not dispose of exact Figures of the quantity of computer equipment available. Computer-types and available software arc also very diverse. Therefore, to increase the portability of computer programs and applications and to advise the local authorities on the purchase of computer equipment, the Ministry of National Education and Vocational Training has issued recommendations concerning both hardware and software.

Hardware

Computers should ideally be able to run MS-Windows and should be laid out in such a way that they can be easily integrated into the teaching and learning methods of primary schools. A decentralised layout of computers should always be preferred so that children can have access lo a computer whenever needed and without having to leave their classroom. In complementary classes, however, computers should be brought together in one "computer room" with at least one computer for every two pupils.

Software

There is very little educational software development in Luxembourg and, consequently, extensive use is made of software developed abroad. However, although such software packages may be of great value, they can rarely be readily adapted to the specificity of the Luxembourg educational system, the methodology used and, especially, the linguistic situation in Luxembourg schools. This problem affects the whole educational system but is particularly serious in primary education.

Therefore, the Ministry of National Education and Vocational Training strongly recommends the use of generic or open-ended software such as word-processors or databases as well as LOGO as a programming language, and has developed guidelines for teachers about the possible ways of integrating such packages into their teaching practice. At the same time, teachers are free to use more specific software, particularly authoring packages which allow them lo create their own exercises, a specific work group having been created within the Institute for Higher Pedagogical Studies and Research (T.S.E.R.P.) to evaluate software packages (computer-assisted learning, dedicated software, simulations, ...) that might he appropriate for primary school classes.

A research project conducted by the Ministry of National Education and Vocational Training has resulted in the creation ofTEO ("Text Editor Oral"), an oral word processor which allows children to record, on the computer, spoken utterances, manipulate them and thus construct oral stories.

ORGANISATIONAL INFRASTRUCTURE

On the national level a group of teachers have been recruited and trained to offer technical advice concerning the purchase and maintenance of computer equipment. Various work groups have also been created to develop pedagogical models, the topics addressed being, among others, "writer's workshop", LOGO projects, the use of databases in the teaching of the humanities and natural sciences, the pedagogical applications ofteleinformatics and simulations.

On the local level, each primary or complementary school which possesses computing equipment is advised by a"computer co-ordinator" ("correspondant inforinatique") who is responsible for the administration of both hardware and software and who can offer colleagues technical assistance and pedagogical advice.

SECONDARY AND TECHNICAL EDUCATION

The Ministry of National Education and Vocational Training is in charge of the acquisition and the maintenance of computer equipment of secondary and technical schools. This centralisation allows a realistic assessment of the financial costs of computers at school (see appendix 3); it also offers a broad perspective that facilitates the co-ordination and the evaluation of the use of computers across the curriculum.

Hardware

A "group of experts in charge of the elaboration of computing standards in education" ("groupe d'experts charges de 'elaboration des normes concernant les equipeinents informatiques") decides on new acquisitions, standards to be observed, the layout of computers in schools, maintenance and safety regulations.

At present, each secondary and technical school has at least two computer rooms, each equipped with twelve IBM compatible computers with 80386 or 80486 processors, VGA colour monitors, 4 to 6 Mb of RAM, 20-80 Mb hard disks as well as two dot-matrix or inkjet printers per computer room. Computer equipment is generally up-graded every Five years.

Schools which otTer specialised courses in computing or any other courses that require special computing equipment have at their disposal further appropriate hardware (e.g. Macintosh computers for schools offering higher level art education classes).

Computers are generally brought together in special computer rooms, such a layout being very suitable for computer-awareness courses. However, further computing equipment is at present being installed in a more decentralised w ~ y to suit the needs of certain newly introduced courses which integrate the computer as a learning tool: the acquisition of portable units has contributed to making the use of the computer in the classroom more flexible; lurthermore, physics and chemistry laboratories have been equipped with appropriate computers and interfaces; each school also has at its disposal one computer upgraded for multimedia applications.

Software

The Ministry of National Education and Vocational Training provides all secondary and technical schools with the software prescribed by the official syllabus, as well as the software to be used in innovative educational projects. Software libraries have been installed where teachers can examine "inspection copies" of various software packages so that they can make an informed decision on which software is most appropriate tor their individual needs. The recent creation of a Centre for Technology in Education (C.T.E.) has made possible the centralisation of those inspection copies as well as of all the documentation concerning the use of the computer in education.

Being more versatile, software such as word-processors, spreadsheets and databases are generally preferred by teachers: they can both be used in computer-awareness courses and they can be more easily integrated into current teaching practices, as opposed to educational software packages which, although often of great educational value, hardly ever fit into the specific requirements of the Luxembourg school system and its complex linguistic situation.

A Lingua project has resulted in the creation of "LTV Deutsch", an interactive video CD- ROM training listening skills in German. The product is used mainly in vocational training. Various other CD-ROM development projects (in the field of language learning, citizen education and vocational training) are also on the way.

Organisational Infrastructure

A computer co-ordinator" ("correspondant informatique") is in charge of the administration of the cornputer equipment in schools. He/she is responsible lor the management of the computer rooms and can offer Pedagogical and technical advice to colleagues.

Teleinformatics

In order to develop the impact of teleinformatics in the Luxembourg educational system, the Ministry of National Education and Vocational Training has implemented the "Teleinformatics Network of National Education" (RESTENA = "Roseau Teleinformatique de l'Education Nationale") which links all schools of secondary, technical and higher education as well as all departments, services and institutes that depend on the Ministry of National Education and Vocational Training. Links with primary schools are under development. All secondary and technical schools have been equipped with suitable computers, modems and telephone lines to allow access to RESTENA. It is estimated that there currently are around 400 regular users of the RESTENA facilities.

Created in 1990, RESTENA offers electronic messaging, a teleconferencing system as well as access to both internal databases and to other teleinformatics networks. It is being used on different levels:

- communication between school administrations and the Ministry of National Education and Vocational Training;
- communication between teachers and the existing information infrastructure: timetables and syllabuses, teaching aids, calendar of meetings and in-service teacher training seminars ...:
- practical applications for the teaching of teleinformatics (computer-awareness course in class V of secondary education and class 9 of technical education, vocational training);
- inter-school and international teleinformatics projects;
- querying of internal and external databases.

The architecture of the network, it should be noted, has been designed in such a way that new gateways to other networks and new services and databases can be implemented progressively and whenever the need arises. H goes without saying the RESTENA offers a gateway to the global Internet.

Luxembourg schools, both from the primary and secondary sectors, have quickly realised the enormous pedagogical potential of teleinformatics. Many schools have already actively participated in teleinforinatics exchange programmes; various schools have set up information pages on the world wide web covering a wide area of topics ranging from information about the courses offered, on-line courses, on-line help for students, chat-lounges, newsgroups, pedagogical projects. The Ministry of National Education and Vocational Training also runs a server accessible on the Internet: information about school organisation and curricula, resource packs for teachers and parents, open and distance learning programmes particularly within the in-service teacher training programme.

3. THE COMPUTER AND THE LEARNING PROCESS

The main objective that the policy-makers of the Luxembourg educational system have given to the use of the computer at school is to make it one of the pillars of the learning process. As such, the use of the computer in education can be seen from two different points of view.

First, the computer is seen as a learning object. In this sense all pupils attend compulsory awareness courses that aim at introducing them to the most common computing tools: all pupils attend, in their last year of compulsory schooling, an obligatory initiation course, the knowledge and skills thus acquired being further developed and deepened during the last years of secondary and technical education.

Second, the computer is seen as a learning tool. Pupils must learn to use computing tools in an active way for project work across the curriculum in specially designed obligatory courses at all levels of education. At the same time, teachers who want to integrate the computer into their teaching method can rely on logislic support and a system of teacher-training activities, such an approach being recommended but not obligatory.

THE COMPUTER AS A LEARNING OBJECT

a. Basic Training in the New Information Technologies

Considering it desirable to make computing an element of the pupils' general education, policy-makers have introduced, in 1986, a compulsory initiation course for all pupils of class V of secondary education and of class 9 of technical education as well as in complementary education.

The aims of this initiation course are:
- to transmit basic knowledge of computing to all young people before the end of their compulsory schooling;
- to train them in the practical use of the most common computing tools;
- to prepare for vocational training;
- to prepare for the more detailed courses in computing in the upper division of secondary education and in the middle and upper cycles of technical education.

The pupils are initiated into computer applications, some of which are compulsory (Logo as a programming language, word-processing, databases) while others are optional (technical applications, teleinfoi-matics). Through practical exercises and project work, the pupils get to know the computer and the various uses that can be made of it.

Pupils attend these initiation courses for one hour a week. The Ministry of National Education and Vocational Training has edited specially designed course-books which are often accompanied by practical exercises on floppy disk.

b. Computer-Awareness Courses in the Upper Divisions of Secondary and Technical

Education

At this level, four objectives can be identified:

Above all, the knowledge and skills acquired in the initiation courses are to be developed and extended to other software types.

The perspective should he to form intelligent users of the computer who are able to solve more complex problems. The knowledge and the practical skills acquired will be useful to pupils who take up a profession and to those who will pursue their studies at university level - two areas where computing tools arc coming to play an increasingly important role.

Pupils who want to embark on a higher education course are to he introduced to formal thinking. If formal thinking has always been of great importance in some fields such as mathematics aıւd natural sciences, it is undoubtedly gaining in significance in linguistics and the humanities - two areas where computers are on the increase.

The pupils' attention should be drawn to the social and economic aspects of the computer in the modern world. The discussion of the impact of the computer in the professional world and in private life should not lead to a negative and fatalistic view of technological progress but should help students develop an informed and critical approach to the achievements and future possible developments of modern technology.

One of the reasons why the upper division of secondary education was recently reformed was undoubtedly the necessity to adapt it to the requirements of modern technology. At present, all pupils of class IV in secondary education attend a onc-hour-a-week obligatory computing course covering such topics as computers and their operating systems, the use of spreadsheets, development and querying of databases,... The course is made up of theoretical lectures and practical project work.

Computer courses in the middle and upper cycles of technical education differ according to the sector chosen by the pupils and according to the level of training pursued:

- In the "administrative and commerce division" pupils are shown ihe various computing tools that can he used in management and commercial activities.
- In the "general technical education division", computer courses aim at introducing pupils to the problem-analysis methods of computing and to programming in Pascal.
- 'The various sections of the "technical training division" comprise special computer courses which introduce pupils to the computing tools used in the profession they are training for. In this context, the "computing section" of the "technical training" division should he specifically mentioned as a considerable amount of the available teaching time is taken up by computer studies.

THE COMPUTER AS A LEARNING TOOL

Apart from the specific computer-awareness courses described above, the integration of the new information technologies across the curriculum is one of the main objectives of the Luxembourg educational system.

a. Primary Education

The use of the computer in primary schools is based on the Findings of various pilot-projects launched by the Ministry of Education from 1986 until 1990. During these projects the computer was mainly used as a working instrument in various primary classes throughout the country. The projects made it possible to define areas in the general syllabus of primary education where the computer can be integrated to improve and diversify teaching methods: they also allowed the development of pedagogical models that fully integrate the computer as a learning tool. Moreover, it was proved that the computer can become a powerful educational tool which diversifies and vitalises the learning process, provided its use is well mastered by teachers and it is fully integrated into a pedagogically sound method. Under these conditions, computers can foster creativity, co-operation, group-work, as well as exploratory and autonomous learning.

At present, the use of the new information technologies in primary education is not compulsory.Their use as a learning tool to support the teaching of the subject matters of the curriculum is, however, strongly recommended. The suggested activities are the following:

- writing activities to develop the children's writing skills and to facilitate oral exchanges during group-work
- working with TEO and developing oral skills in foreign languages;
- the developing and querying of databases to give children the chance to explore their surroundings and to develop information-retrieval skills;
- projects developed with Logo as a programming language for children to create micro worlds,
- computer-assisted learning for remediation and further development of already acquired

knowledge and skills;

- teleiliformatics projects to develop communication skills and lo foster international and inter-cultural relationships.

b. Secondary and Technical Education

Since the beginning of the 1990-1991 school year, two new courses have been introduced into secondary and technical education. They are to be considered as complements to, preparations for, or practical developments of, the computer-awareness courses that already exist on the syllabus.

To introduce pupils right from the beginning of their secondary and technical education to the practical applications of general computer programs and to establish a link between computer applications and the general subject-matters of the curriculum, pupils take part in interdisciplinary projects which are optional in the lower division of secondary education but compulsory in the lower cycle of technical education. First introduced in 1990. the course "Interdisciplinary Projects - Technological Education" aims at giving pupils the opportunity actively to use computing tools such as word-processors, databases, spreadsheets, drawing and desk-top publishing programs during practical and purposeful activities during which they are to develop, through hands-on experience, basic computing skills and to become aware of the impact of the new information technologies in the modern world.

In the comprehensive cycle of the upper division of secondary education pupils can choose between various pre-specialisation options which aim at assisting them in their choice of the specialisation they want to opt for during the last two years of secondary education. First introduced during the 1991-1992 school year, the pre-specialisation options mainly consist of practical project work. The options which prescribe the use of the computer as a working and learning tool include the "mathematics and computing option", the "natural sciences and computing option", the "economics and computing option".

Apart from these obligatory courses, a steadily increasing number of projects integrating the new information technologies have been launched in different schools. At lhe same time, an increasing number of teachers have become aware of the computer's educational potential and use the new information technologies to change, improve and diversify their teaching methods, even in courses where their use is not compulsory.

4. INFORMATION AND TEACHER TRAINING

Every educational innovation, and even more so the integration of the new intorinalion and communication technologies across the curriculum, can only bear fruit if an adequate infrastructure of implementation and support is created both to inform teachers of the educational potential of these technologies and to train them, so that they are not only able to use the technology in their lessons, but that they can also actively take part in the discussion on the fTindainental issues concerning educational innovation and reform in general.

INFORMING TEACHERS

To pass the necessary information along to the teachers concerned, the Ministry of National Hducation and Vocational Training has launched an information campaign which, among others, particularly insists on the importance of the new information technologies.

At regular intervals, the Ministry of National Education and Vocational Training publishes the "Information Bulletin: New Technologies and Education" ("Bulletin d'inforrnation: N'ouvelles Technologies et Education"). Sent free of charge to every teacher, this bulletin is conceived as an open forum for all teachers of primary, secondary and technical education who wish to exchange information and discuss ideas and experiences concerning the use of the computer at school.

A whole range of other publications dealing with more restricted topics concerning the new information technologies can be ordered free of charge from the Ministry of National Education and Vocational Training. These publications can take the form of resource packs, dossiers, information brochures, catalogues, simplified manuals, didactic materials or descriptions of learning sequences that fully integrate the computer as a tool or support.

The "Evaluative Catalogue of Educational Software" is designed to attract teachers' attention to the educational potential of the computer and to assist and advise them in their choices of appropriate software tools for their courses. The catalogue provides bibliographical information, describes the aims apd contents of the listed software packages and contains comments by the teachers who have already used the programs in their lessons.

One of the aims of RESTENA, the Teleinformatics Network of National Education, is to facilitate the exchange of all kinds of information between teachers and all the departments of national education. RESTENA provides databases concerning syllabuses, innovation and research programmes, available publications and educational materials, software evaluation, in-service training sessions, ... The aim of the Internet server run by the Ministry <if National Education and Vocational Training is mainly the information of teachers, students and parents.

TEACHER TRAINING

One of the decisive factors determining the integration of the new information technologies across the curriculum is an adequate programme of initial and in-service training.

Teacher-Training in Primairy Education

Both initial and in-service training for primary education is organised by the Institute of Higher Pedagogical Studies and Research (1.S.E.R.P.).

As far as initial teacher-training is concerned, 90 hours of compulsory training are dedicated to computing and computer-assisted learning. This course aims at giving teachers sufficient knowledge so that they are able to use the computer as a tool and as a teaching resource in their lessons: trainees arc introduced to computers and their operating system and develop basic skills in word-processing, databases and spreadsheets. Tn addition to this course, teachers can choose a supplementary optional training programme of 120 hours which aims at developing basic skills and introduces teachers to Logo as a programming language.

The in-service training programme is organised as "proficiency modules" from winch teachers are free to choose those that interest or concern them more particularly. The modules deal both with the technical and educational issues linked lo the use of computers at school. Their main objective is to integrate the computer as a tool and as an educational resource across the curriculum and to show trainees how to make the best use of the educational potential of the new information technologies.

Teacher Training in Secondary and Technical Education

The initial-training programme for teachers of secondary and technical education is organised by the Department of Pedagogical Training of the University Centre Luxembourg (C.U.L.). During the first year of the probationary period for young teachers, trainees attend a compulsory initiation course which consists in a general introduction into computers as a tool for both teachers and pupils, a preseiitation-of the pedagogical issues linked lo the use of computers at school, an introduction to computer-assisted learning combined with a presentation of specific educational software packages that teachers might find useful for their particular courses, as well as an initiation into the basic functions of general purpose software. It should also be noted that trainees increasingly choose to write their pedagogical report on subjects related to the use of the computer across the curriculum.

The in-service teacher training programme is co-ordinated by the Service for the Co-ordination of Pedagogical Innovation and Research (S.C.R.I.P.T.). It concentrates particularly on topics dealing with the integration of the new information technologies across the curriculum, it works according to the "cascade model": a limited number of teachers attend an intensive training programme which lasts several months or even a year and is often organised in co-operation with a foreign institute or university. The knowledge thus acquired is then transmitted to colleagues, either during a complete cycle of training that extends over a year and gives trainees a general overview of [lie edlicationat potential of computers for a particular subject-matter, or during more isolated seminars addressing more specific topics. It should be noted that as yet no precise legal framework for in-service teacher training exists for secondary and technical education, that attendance at in-service teacher training activities is not compulsory, bui that teachers who participate in seminars or workshops outside their normal working Incurs receive financial compensation.

5. ASSESSMENT AND PERSPECTIVES

If computing has come to play such an important role in the Luxembourg educational system, this is mainly due to four factors:

- the dedication of teachers and teacher-trainers who have greatly contributed to making technological and pedagogical innovation possible;
- the efforts made by the Ministry of Education to create the information and training infrastructure indispensable for all innovation in education;
- the investments made in hardware equipment and in software over the last few years: co-operation on the European and international levels.

The first objective regarding the new information technologies in the Luxembourg school system, i.e. to offer all pupils basic training in the new information technologies and to introduce them to the most common computing tools, has been largely achieved. Great care must, however, be taken in future regularly to adapt computer-awareness courses to the consent and rapid developments of the computing world and to sensitise girls to computers and to technology in general.

The second objective, i.e. to show pupils the practical use of the computer as a learning tool and to allow teachers to take advantage of the pedagogical potential of the computer in their lessons, has as yet not been fully achieved. Considerable efforts have, however, been made in this direction by the introduction of compulsory courses that integrate the computer as learning tool. Furthermore, the spirit of innovation and experimentation with new educational tools shared by an increasing number of teachers must be supported and generalised because it alone can lead to the acquisition of technical know-how and pedagogical skills which are often missing and which cannot he developed by teacher-training alone.

It can nevertheless not be denied that in Luxembourg, as in many other countries, pedagogy itself, i.e. teaching methods and the ways learning is organised, has not yet been "revolutionised" by computing. Maybe the reasons for this are tlial educational systems are deeply anchored in the cultural traditions of each country, that learning processes are very complex and that teaching methods adapt only very slowly to changes in the world outside school.

PERSPECTIVES

The enlargement of the existing computing equipment and the development and diversification of teacher training programmes are the first priorities of the Ministry of National Education and Vocational Training. Furthermore, a certain numbei of existing courses will he adapted to fit the new requirements; finally, various innovation and research programmes are on the agenda.

Confronted to the rapid technological progress in computing, the Ministry of National Education and Vocational Training will have to develop and modernise the existing hardware and software equipment, besides, science laboratories will continue to be equipped with computers, interfaces and peripherals; appropriate hardware to run multimedia applications are also one of the priorities. Eventually, primary schools need to be more systematically equipped in hardware.

Both initial and in-service teacher training programmes must offer an always wider range of seminars and workshops during which particularly the pedagogical issues related to the use of computers across the curriculum must be given greater emphasis. Furthermore, there is a strong need both for a reform of initial teacher training and for a legal framework for in-service teacher training in secondary and technical education.

Ways must be found to integrate new developments in computers, particularly multimedia systems and teleinformatics, so that advantage can be taken of their educational potential.

The gateways to external networks and the information databases offered by RESTENA, the Teleinformatics Network of National Education, are to be developed and adapted to the needs of pupils and teachers. If, in this country, some classes have already communicated electronically with other classes both here and abroad, further international and inter-cultural relationships will have to be established through teleinformatics. Eventually, the potential of teleinformatics for open and distance learning will have to be further explored.

A certain number of research projects, concerning, among others, the integration of computer simulations at all educational levels, the use of multimedia tools in the humanities, the study of oral interaction around the computer, have already been launched. Ways must be found to apply their results throughout the educational system.

It is in the professional world that the new information technologies have so far had the greatest impact and where they developed most rapidly. In order to prepare pupils for their future professional careers, vocational training must regularly adapt to the new developments and requirements of the working world.

CONCLUSION: EDUCATION AND THE SOCIETY OF INFORMATION AND COMMUNICATION

The rapid developinenis of technology and of modern society are in themselves great challenges for education. Indeed one of the most important and uraent questions winch education must answer today is how to organise the education of the future so tlial the society of information which is inexorably developing becomes, for everybody, a society of communication and knowledge.

In this context, two important aspects of education should be stressed as they are essential elements of what general culture should be; as such. they are gradually becoming seen as absolute priorities by the policy-makers of the Luxembourg educational system.

First of all, much more importance should be given to the development of pupils' communicative competence; the learning process should be structured around the acquisition of communicative skills in speaking, reading and writing, and this - of the greatest importance for a small country like Luxembourg - in more than one language. The acquisition of these skills must include what has already become an essential component of general education; awareness and mastery of the media, boih the spoken and written media as well as the modern information and communication media which are strongly influenced by computers. How to use the new information technologies for practical and meaningful purposes is another skill to he included in what general education will mean in tomorrow's world.

Thus the use of the new information technologies will continue to gain in importance in the Luxembourg educational system; the computer allows a pedagogy of communication and exploration which presents considerable advantages; it facilitates the development of pupils' productive skills as well as their communicative competence. Furthermore, the use of the computer across the curriculum helps develop pupils' critical awareness of the role of technology in the modern world.

Computing tools, such as word processors, databases, drawing programmes, desk-top publishing software, ... are essential ingredients of the modern media of information and communication. Not only does their use across the curriculum help develop and increase pupils' communicative skills; by using these tools during practical and meaningful project work students will become aware of the advantages and drawbacks of modern technology. At school, the young should be given the opportunity to master modern computing tools and thus to develop an informed knowledge of technology and a critical awareness of progress. The understanding ol' the social, economic, moral, cultural and artistic implications of technological innovation must indeed become one of the principal ingredients not only of computer awareness courses but also across the curriculum.

Secondly, it should not be forgotten that, in a constantly changing and rapidly progressing world, education can no longer only mean passing on ready-made knowledge *to* the younger generations; teachers should also help their pupils acquire active learning strategies so that the world may become for them an autonomous source ol' information and knowledge. In this sense the mastery of the new information technologies, the new medium of tomorrow's knowledge, must become an essential ingredient ol education.

Furthermore, the interactivity of the new information technologies contributes to making them flexible educational tools which have at least the potential to diversify and improve learning. Teachers should learn to accept and take advantage of anything likely lo help making learning active and stimulating, and refuse and discard anything that enslaves pupils by imposing inflexible structures that limit their autonomy.

To achieve these goals, the Luxembourg educational system will have to continue to adapt curricula and teaching methods so that every pupil is given the opportunity to acquire strategies for autonomous learning, to develop creativity, problem-solving and teamwork skills, to take the initiative and to accept responsibilities, to be open-minded and critical. It does indeed very much look as if the education of future generations in harmony with technological progress and constant social change is only possible in this way.

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NATIONAL REPORT OF MALAYSIA

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES: THE MALAYSIAN EXPERIENCE

1. INTRODUCTION

1.1. COUNTRY PROFILE

1.1.1 Malaysia is a tropical country - situated in the heart of South East Asia. It is divided into two parts, the Peninsula: Malaysia which shares common borders with Thailand in the north, Singapore in the south and Indonesia in the west and Sabah and Sarawak, two eastern states on the island of Borneo. Malaysia has a total area of 329,758 square kilometers and a population of more then 19 million.

1.1.2 Malaysia enjoys a parliamentary democracy with a constitutional monarch as the supreme head of state. The Prime Minister is the leader of the party which commands the majority of seats in parliament The Malaysian population comprises of three major ethnic groups - Malays, Chinese and Indians in Peninsular Malaysia and numerous indigenous groups in Sabah and Sarawak. The Malay Language is the official language. The national ideology, RUKUN NEGARA embodies the aspirations of the people of Malaysia and the principles that guides the effort to realise these aspiration.

1.1.3 Malaysia has developed from an economy highly dependent on the agricultural and mining sector to an economy based on the manufacturing sector which now contributes more than 30% to the GNP. The National Industrialisation Policy which started as early as 1967s has triggered the rapid growth of the industrial sector, especially in the manufacturing services. The 1990s saw the shift towards capital intensive and technologically sophisticated industries. Malaysia embarked on hi-tech industries through its policy of encouraging foreign investments and joint ventures between locals and foreign manufactures to enable the local workforce to gain practical experience and expertise. Malaysia has set a target to become an industrialised nation by the year 2020. In order to realise the goals of Vision 2020

Malaysia needs to have enough human resources in the fields of science, technology and information. The lack of manpower in the varied technical fields has become a major concern as it advances through year 2020. Malaysia has also to keep abreast with the rapid development particularly in information technology in the context of the global village. It services and communication sectors also need to be enhanced in order for it to remain competitive ~ the global market.

1.2. BACKGROUND OF THE EDUCATION SYSTEM

1.2.1. Education plays a major role in preparing the population towards Vision 2020. The RUKUN NEGARA and the National Education Philosophy guide the direction and the development of the education system. With a structure of 6-3-2-2 system of formal education, the system of education represents 6 years of primary, 3 years of lower secondary, 2 years of upper secondary and 2 years of post secondary education. Preschool education by the Ministry of Education (MOE) caters to children who are 5+ of age but who do not have the opportunity to receive pre-school either from privately-run institutions or other government agencies.

1.2.2. Within the government education sector, at the primary level there are 3 types of schools: a) The National Primary School; b) The National-Type Chinese Primary School; and c) The National-Type Tamil Primary School. These schools follow a common curriculum, the New Primary School Curriculum. (NSPC) and common public examination

1.2.3. At the secondary level of education the system has 3 stages: a) Lower Secondary (Form 1-3); b) Upper Secondary (Form 4-5) and c) Post Secondary (Pre-University). These secondary schools follow the Integrated Curriculum for Secondary Schools which is a continuation of the NSPC. On completion of primary education, pupils enter Lower Secondary Level for 3 years. Pupils from Chinese and Tamil media primary schools spend a year in the Remove Class before entering Form 1. Promotion from Form 1 to Form 3 is automatic and at the end of this level pupils sit for a centralised examination, the Lower Secondary

Evaluation (LSE).

At the Upper Secondary pupils are channelled into academic, technical, vocational and religious streams based on the LSE results. At the end of Form 5, pupils sit for the Malaysia Certificate of Education (MCE) or Malaysia Certificate of Vocational Education (MCVE). Based on the results of MCE selected pupils are given 2 more years i.e. in Form 6 lower and Form 6 upper. At the end of Form 6 pupils sit for the Higher Certificate (HSC) examination which is equivalent to GCE (A levels). Pupils may also attend matriculation classes to prepare them for entry into the local universities or sit for the GCE (A levels) or equivalent examinations organised by foreign universities. A substantial proportion of students of the post secondary level proceed to the private institutions that have twinning arrangement programmes with foreign universities.

1.2.4. Higher Education:

Institutes of Higher Education in the public sector include universities, colleges and polytechnics that prepare and produce professionals to meet the manpower needs of the country. There are now 9 universities. Several new institutions are being considered within the near future. In addition to that teacher education programme provides pre-service as well as in-services courses in 31 teacher colleges.

1.2.5. Organisation and Administration.

Malaysia has a centralised system of education administration. Its administrative structure is divided into the federal, state, district and school levels. The MOE at the federal level, formulates polices in accordance with national aspirations and objectives and oversees their implementation. At the division level, these policies are translated into plans, programs, projects and activities. The decision-making process at the federal level functions through a system of committees which consist of the Educational Planning Committee (EPC), the Central Curriculum Committee (CCC) and several policy level committees. The EPC which is chaired by the Minister of Education, is the highest decision-making body in the MOE.

1.2.6. .Laws Governing Education System In Malaysia.

Prior to 1996, two laws regulate education in Malaysia namely the Education Act, 1961 and University and University Colleges Act, 1971. These two legislations have now been replaced by two new legislations in late 1995. With the passing of two other new legislations in early 1996 and one other legislation which will be tabled in Parliament in July 1996, education in Malaysia will be governed by Five major laws. These are:

(i) Education Act. 1996,

(ii) University and University Colleges(Amendments Act, 1995,

(iii) Private Higher Educational Institutions Act, 1996,

(iv) National Council of Higher Education Acts 1996; and

(v) National Accreditation Board Bill, 1996 (to be read in Parliament in July 1996).

(i) The Education Act, 1996.

The principal law that regulates education in Malaysia is the Education Act 1996. This law enshrines the education policy that was initiated by the Razak Report, 1956 and the Rahman Talib Report, 1960. Among the major components of the Education Act 1996 are statements of goals and mission of education; definition of the national education policy; categories of educational institutions; status of the national language; national curriculum; evaluation and examinations; Islamic education; levels of education; technical education, higher education; private education sector; status of the national type primary schools; and power of the minister to enforce the law covering pre-school, primary, secondary, post secondary, higher institutions.

(ii) University and University Colleges (Amendments) Act, 1996.

The University and University Colleges (Amendments) Act, 1996 is an amendment to the original University and University Colleges Act of 1971. The principal aim of the amendments is to update as well as to incorporate, among other matters, provisions to enable the corporatization of public universities. Some of the major aspects of the amendment Act are:

- governance and management system, of public universities;
- right-sizing of the Senates of the public universities;
- flexible and proactive financial management system;
- accountability and contra procedures; and
- student welfare and disciplinary procedures.

(iii) National Council of Higher Education Act, 1996.

The main purpose of the National Council of Higher Education Act, 1996 (NCHE, 1996) is to enable the creation of a body that will be responsible for the planning and strategic policy formulation of higher education in Malaysia. This law is part of the continuing efforts to reform higher education in the country. The University and University Colleges Act (Amendments) Act, 1996 enables public universities to be corporatized as public corporations which will be endowed with flexible powers in finance and personnel management as well as academic and research and services matters. However, the universities will remain government owned and will be supported through government grants. The establishment of many private universities, and the corporatization of public universities, necessitate the creation of an effective regulatory agency to monitor and ensure that higher educational institutions function in line with national policies and requirements.

The Act provides that membership of the National Council for Higher Education shall comprise representatives from government, public and private universities and individuals who are expert and experienced in relevant Acts.

(iv) Private Higher Educational Institutions Acts, 1996

The Private Higher Educational Institutions Act, 1906 (PHEI, 1996) was formulated to enable the establishment, registration, management, regulation and quality control of private higher educational institutions in Malaysia. Among the more important focus of the provisions of the law are:

- procedure concerning the setting up of private institutions of Higher Education with the status of university or university colleges and branches of foreign universities;
- the system of governance and constitutions of private higher education institution,conduct of courses of study after approval by the government, norms and standards of physical facilities and infrastructure;
- power of the Minister with respect to the medium of instruction, required core subject areas for local students, and the rules and procedures of student discipline are the same as for public universities.

The purpose of the PHEI, 1996 is to facilitate the establishment, management and development of quality private higher education in Malaysia to complement that which is provided for by the public sector.

(v) National Accreditation Board Bill, 1996.

The National Accreditation Board Bill is in the process of being prepared for reading and approval by the Parliament. The main purpose of this Bill is to enable the establishment of a National Accreditation Board (NAB) that will be responsible for determining and evaluating the quality standards of courses offered and conducted by private higher education institutions. The proposed Bill is also part of the larger efforts to reform higher education in Malaysia.

The NAB Bill will be established as a public corporation headed by an Executive Chairman appointed by Y.D.P Agong on the advice of the Minister of Education. A maximum of 10 members of the Board will be appointed by the Minister of Education. NAB will be allowed to employ and utilise the expertise from many sources, including from other countries to ensure that degrees and diplomas awarded by Malaysian universities are comparable with established world standards.

1.3. INFORMATION TECHNOLOGIES IN THE EDUCATION SYSTEM

Greater emphasis is now being placed on mathematics, science and technical subjects in schools to prepare students for training in high technology in order to meet the demand for highly skilled labour. Research and planning have to be carried out and policy formulated to enable the education system to address the shortage in quality skilled human resources Computerisation of the Ministry of Education (MOE) and office automation are being undertaken to speed up work and increase efficiency. A good information system is needed to provide reliable and up-to-date information for operational activities, informed decision-making and planning for the future development of education. The MOE is now undertaking a project to strengthen the Educational Management Information System (EMIS).

The development in IT, multimedia, networking and the Internet provide new possibilities For enhancing the teaching and earning process, searching For and sharing of knowledge, communication, distant learning, and better and faster methods of doing things. Computer in Education (CIE) is an important: aspect of the development of the education system and the nation as a whole.

IT has introduced new concepts and possibilities such as intelligent buildings, intelligent city, multimedia super corridor, cyberspace, cybermoney, digital cash, virtual reality and access to a variety of information in the Internet and the World Wide Web (WWW). On the other hand the development of IT also brought with it high-tech crime such as hacking into private data bases, deployment of computer viruses and extortion through 'time bombs' programmes to destroy other people's works. There is also the risk of people accessing unwanted materials from the Internet that could pollute the mind and the values of the society. In this respect how should the dark side of IT be tackled in the light of CIE.

The IT in MOE is operationalised according to a conceptual framework. The following section of the paper will discuss the strategies adopted within the context of information technology' in the Malaysian education system under four main topics.

a). Computerisation for Administration and Management

b). Educational Management Information System

c). Computer in Education

d). Education Networks.

2. COMPUTERISATION FOR ADMINISTRATION AND MANAGEMENT

2.1. THE DIVISION, STATE AND DISTRICT/REGIONAL LEVEL

2.1.1. Computerisation was started in the MOE in 1976 and managed by a small unit in The Examination Syndicate to process national level examinations. Due to the need of computerisation of the other divisions in the Ministry of Education a Computer Service Division was set up in 1986 to serve the Ministry. This division is now known as Information Systems Division (ISD) In the first phase of the computerisation programme terminals and terminal printers were installed in various divisions in the MOE and linked to the mainframe computer at the ISD

2.1.2. The strategies for computerization of the MOE are:

- Integrated application systems
- Office automation towards paper-less administration
- Networking infrastructure

2.1.3. More than 45 applications were developed to help divisions manage their functions. These includes:

- Examination system at the Examination Syndicate,
- Scholarship and training system the Scholarship and Training Division
- Book loan system at the Text Books Division
- Financial system at the Finance Division
- Trainee Teacher intake system at the Teacher Training Division
- Staff system at the Establishment and Service Division
- Student selection system at the Higher Education Division
- Student selection system and teacher deployment system at the Schools Division
- Student selection system at the Technical and Vocational Division
- Supply information system at the Development and Supply Division

2.1.4. The Educational Planning and Research Division (EPRD) is one of the main users of the mainframe computer at ISO. EPRD develops its own applications, collects, manages, analyses basic educational data and disseminates information. This collection provides the information needed for policy analysis, planning, research, evaluation and monitoring and information needs of other divisions in the MOE and other government agencies.

2.1.5. The computerisation of the State Education Department (SED) started in 1990 and was completed in 1992. IBM RISC System 6000 with several personal computers (PC)s and line printers were installed in the SED. The SED is linked to the ISD, MOE using a Wide Area Network (WAN) through leased lines (X.25) running TCP/IP and the District Education Office/Regional Education Office (DEO/REO) is linked to its respective SED through a dial-up system.

2.1.6. An Information Unit (IU) was established at the SED to manage the computer hardware and software and manage the staff system developed for the SED. Divisions that require staff information could extract the information from the staff system. However the SED was unable to maintain up-to-date staff information due to lack of manpower, and technical expertise and the voluminous data that they have to update. In addition to that the esponsibilities of the IU and its personnel, who are technical peoples, were not clearly defined in terms of data collection.

2.1.7. The Information and Computerisation Committee, chaired jointly by the Deputy Secretary General and the Deputy Director General regulates the purchase and upgrading of hardware (HW) and software (S/W) throughout the MOE. A similar committee was set up at the Division and SED to co-ordinate procurement of (H/W) and software (SAV) at these levels. The MOE has set standards for H/W and S/W for application development at the SED and S/W to be used on PCs for word-processing, spreadsheet, data base management and presentation to facilitate exchange and sharing of information.

2.1.8. The MOE had signed a contract with a computer company to supply H/W and S/W and all agencies in the MOE including schools must procure their H/W and S/W requirements through this central contract.

2.1.9. As a part of the MOE office automation programme the ISD has supplied 486- based PCs installed with standard SAV to all divisions. Under the project KPMNET (MOE network) the ISD has planned to network all Divisions, SEDs, and DEOs/REOs and provide linkage to the Internet in 1996.

2.2. THE SCHOOL LEVEL

2.2.1. The ISD starting this year. 1996, is trying a new strategy to have educational data updated at the school level, the objectives of the project are two-fold:

a) Short-term:

To assist the school in its administrative work so that focus can be given to *ifs core business i.e. Teaching and Learning.* At the moment principals and headmasters are heavily burdened with administrative work. Computerisation involves simplifying work processes and updating of information.

b) Long-term

To have a high quality school administrative system that will ensure the school delivers world quality education.

2.2.3. The .project will cover computer applications for all aspects of the School Administration which among others includes:

- Personnel Management
- Financial Management
- Student Management School Inventory
- Time tabling

2.2.4. The approach will be process driven as against a functional approach. Teacher data are captured as soon as the trainee teacher is admitted to the teacher training college and updated when he is appointed by the Establishment and Service Division, posted to SED and finally reports for duty in his school. This will help in reducing duplication of work and redundancy in the collection of information. Each of the above mentioned areas will be further broken down into modules as necessary. It has been identified and established that the information from the school will be needed at all levels of the Ministry. Thus there is a business need for the whole system to be networked.

2.2.5. Status of Implementation

a) Presently all schools with electricity have been supplied with a PC and PC based Personnel System. The Staff Information System is in the process of being installed after training was give", to School Administrative Assistants (7000 schools completed). It is at the moment a stand alone system. Updated data are submitted to the SEDs in diskettes.

b) Work is underway on the development of two other applications namely:

- Students Information System.
- School Physical Facility Information System

3. EDUCATIONAL MANAGEMENT INFORMATION SYSTEM (EMIS)

3.1. BACKGROUND

3.1.1. The existing EMIS consists of data bases managed by different divisions in MOE. EPRD manages basic educational data for policy analysis, and macro planning, and to fulfil the requirement for basic data by other divisions in the MOE and other government agencies. The other divisions manage data closely related to their functions. At the same time they also collect basic data from schools. This creates duplication in data collection, questionable data reliability, and extra burden to schools.

3.1.2. The success of the vertical integration through a network of information collection, the schools, DEO/REO and SED has resulted in the collection of a substantial amount of information about the education system However, the utilisation of these data in policy analysis and planning is hampered by problems encountered in horizontal integration of data, i.e. working relationships among divisions due to restrictions imposed by divisions, isolation of data bases by division, insufficient facility for access and inadequate training of staff in data analysis.

3.1.3. The weak horizontal integration leads to inefficient use of resources and impediment to effective planning and management, deprive education officials from getting information relevant to decisions they are making and results in divisions initiating independent collections of data that are already available in other divisions of MOE

3.1.4. A comprehensive system-wide EMIS is therefore required to overcome this weakness and ensure efficient and effective planning and management. EMIS is an important part of improving the quality, efficiency and effectiveness of the education system and building a "World Class" education system for Malaysia. A successful EMIS will depend on co-operation among those who share responsibility for the development and management of the education system - policy makers, managers, administrators and teacher in the MOE, SED. DEO/REO in both public and private schools throughout the country. The EMIS must be capable of providing relevant, reliable and timely data/information to support policy-making, planning, management and administrative activities if it is to support the development of an information-based decision-making culture in the education system.

3.1.5. In recent years a number of attempts have been made to achieve higher levels of co-operation across divisions and levels of the education system in an effort to minimise duplication of data collection, improve the collection, flow and use of data and information in schools, DEO REO, SED and MOE. While notable progress has been made in terms of IT set up and infrastructures there is still much to be done. Relevant data and information is still often not available when needed and when available it is often of questionable quality Educators and staff at all levels express concerns that:

- efforts to develop EMIS have been dominated by the particular needs of selected divisions in the Ministry,
- the needs of, impact on, and operational constraints on state, district and school-level managers and administrators have not been sufficiently considered,
- directives and instructions from those responsible for EMIS development have not always been clear,
- the overall effect of introducing new IT and associated applications has been a net decrease, not an increase, in their effectiveness. Principals reports of increasing amounts of their time being spent on responding to requests for data and information at the expense of time for supervising teaching and learning activities.

3.1.6. EMIS development has been hampered by Four dominant factors:

- lack of sufficient involvement of professional educators from all levels both in design of the overall conceptual framework for EMIS and the development of specific computer applications,
- insufficient communication among the various levels across divisions in the education system and between education professionals and technical professionals.
- lack of adequately trained staff at all levels
- insufficient resources allocated for human resource development.

3.1.7. Until recently EMIS design and development has been approached largely as an effort to place enough of the right IT through the education system but EMIS is more than computers and computer-generated products. EMIS development represents an organisational and institutional challenge. Its success depends on improving existing channel of communication and opening and maintaining new communication paths and requires change in the work culture.

3.2. THE EMIS OBJECTIVES

3.2.1. The primary objective of EMIS is to monitor the implementation of education system policies and progress towards the realisation of Vision 2020, the National Education Philosophy, the National Education Policy, the 12 Fundamental Shifts and attainment of goals and objectives of the education system.

3.2.2. The EMIS will be both an Early Learning/Early Warning Indicators System to identify schools, programmes, districts and states that are being effective and to identify those that are not achieving standards.

3.2.3. The EMIS will provide a core data set that can be used by all divisions. This involves the integration of data from various databases sources to a system which will be able to disseminate and provide comprehensive information for purposes of planning, management and policy analysis of education. The core data set may not reside in the same physical location but follow standards in data definition, codes and key variables to identify schools and personnel and to allow merging of different databases for analysis across divisions. The core data set will consist of data elements commonly needed by every divisions, SED.DEO/REO and school.

3.3 STRATEGIES FOR STRENGTHENING EMIS

3.3.1. Development of an EMTS Policy

a) An EMTS policy is essential for the success of EMIS and covers the following items:

- Clear objectives on Information needs
- Data and Information Standards
- Management principles
- Procedural Standards for vertical & horizontal integration,
- Changing standards
- Reporting Standards for dissemination
- Security and access.

b) The objectives of Information Policy are as follows:

- Achievement of more effective and efficient creation and use of information for educational policy and management activities through:

  - the creation of organisational arrangement for information management, structures, positions, funding, procedures, and authorities:
  - the creation of controls for *ad hoc* data collection,
  - the creation of authoritative calendar for data collection, and
  - the creation of standard data definitions and collection procedures for core data.

Achievement effective links between educational goals of the Ministry and the information available for policy and management decision making and action through the definition of indicators for assessment of goals and procedures for indicator ratification, description of procedures and policies for publication of educational performance indicators.

Linking Information to Management Performance by defining incentives and procedures for assessment of system performance and administrative effectiveness linked to indicators and information-based assessments.

Linking Information to Accountability for school performance by designing school performance profiles and policy for access and publication of performance results.

Linking Information flows to organisational interactions to promote Integration of operations and management by:

- defining role of EMIS committees, including membership, basic agenda, scope of responsibility, subcommittee structures, and decision making authority.
- determining use of working task forces or other co-ordinating mechanisms needed to implement and supervise information integration activities
- designing procedures for annual review and assessment of EMIS operations.

c) Elements of Information Policy:

- Articulation of the Government's commitment to improving the management and effective use of information in education.
- Identification of the nature and extent of improvements and outcomes desired.
- Identification and specification of the means through which these improvements are to be achieved:

  new rules and regulations

  new organisational arrangements

  allocation of necessary resources: staff, finances, space, equipment, etc.

3.3.2 .Strengthening Management in EMIS

There are several aspects of management in EMIS that have to be worked on. They are as follows:

a) Information management which includes:

- access, documentation, dissemination, linkage with user communities
- Reporting, monitoring, evaluation, analysis and communications tools
- Infrastructure
- Data flows and updating
- Maintenance - archiving (securing data from loss)
- Data security (securing data from falling into unauthorised hands)
- Documentation centre (data documents, application documents),
- Dissemination and communication of information
- Integration, packaging, and distribution of information

b) EMIS management which involves:

- Formulation of terms of reference for EMTS units and EMIS committees
- Integration of data and personnel across divisions and levels
- Ongoing and annual reviews
- Establishment of EMIS committee - role and responsibilities
- Identification of Chief Information Officer - role and responsibilities
- Identification of State Information Officer - role and responsibilities

c) Technology management which covers:

- H/W and S/W purchase, upgrades, maintenance
- Maintenance of an Inventory.

d) Application management or management of development tools which covers

- Design & development of applications
- Liaison with relevant user groups
- Maintenance & modifications.

e) Human Resource Management which deals with human resource development and investment. This includes:

- Training objective and schedule
- Prerequisite and types of training required
- Assessments - procedures for assessing utility and success of education and training activities.

f) Resource Requirements which deals with phasing activities and priorities in terms of:

- Management resources
- Work Groups

- Training
- Equipment
- Cost implications
- External inputs

3.3.3. Horizontal and Vertical integration of Committees and Information Centres.

EMIS involves horizontal and vertical integration of MOE EMIS Committee MOE Information and Computerisation Committee, Division/SED Information and Computerisation Committee and other related committees and co-ordination of information management and administration of all levels of management into a network of information collection and dissemination centres.

4. COMPUTERS IN EDUCATION (CIE)

4.1. BACKGROUND

4.1.1. IT and the use of computers as a technology was introduced to the Malaysian education system since 1980s through computer clubs as a part of the schools extra-curricular activities. The MOE encouraged schools to set up computer clubs with the help of Parent-Teacher Associations and later initiated pilot projects using computers and telecommunications for teaching and learning across curriculum in primary and secondary schools as part of an on-going effort to integrate the use of computers and computer-based technologies in the Malaysian Education System. Looking at the development in computer and communication IT has potentials and role in education and is an important means of developing a Malaysian society who is knowledgeable, informed and skilled in IT as aspired by vision 2020. The use of IT in education has been seen to have brought about changes in methods of teaching and learning, the orientation of students towards information and the process of school administration and management.

4.1.2. Most computer clubs were leaching members how to use application software such as Wordstar, dBase III. Lotus 1-2-3 and graphic packages such as Print Shop. Many of the computer clubs in schools are managed by computer companies who provide the hardware usually on a hire-purchase scheme and a teacher to instruct club members on how to use the software. The school will appoint teachers as club advisors. As the clubs are usually present in schools situated in the urban area, this has resulted in disparities between the rich and the poor as well as the urban and the rural.

4.2. THE ROLE AND INVOLVEMENT OF MOE IN IT

4.2.1. From time to time Malaysia leaders have expressed the importance of computer in education so that our pupils will not be left behind in the current educational development of the world and will be able to fit into future socioeconomic development. Nevertheless the government is very cautious on investing in IT in education. The Government will have to spend more than RM 1.3 billion (US$ 0.52 billion) to implement CIE nation-wide. This budget includes the cost of buildings and equipping computer laboratories in 6965 primary and 1470 secondary schools and 31 teacher training colleges and the cost of upgrading and maintenance in order to provide CIE fo7 about 4.42 million pupils.

4.2.2. A CIE unit was established in the MOE to handled CTE projects. Several pilot projects have been carried out in selected schools to ensure the feasibility of CIE programme. MOE set up a joint committee with the Malaysian Institute of Microelectronics System (MIMOS) a R&D government agency to implement CIE programmes.

MIMOS set up the Joint Advance Research Integrated Networking (JARING) which is the Malaysian information highway for linking to the Internet. The MOE-MIMOS Computer Technology Laboratory developed a courseware authoring tools called ComIL (Computer Integrated Learning System) which could be used by schools and training centres for CAI/CAL courseware development. A Window version which could handle multimedia application is being developed.

4.2 3 The role and involvement of MOE in IT is spelt out in the 3 principal work targets of the MOE

- to educate and teach computer literacy to the whole population through the learning programme
- to teach and guide in effective application of IT as a tool for innovation, creativity and increasing productivity
- to produce experts in science and technology in order to continue the advancement and development in IT

4.3. DEFINITION OF IT

- IT is normally defined as a field of computerisation and communication which covers all techniques of information management. It is a combination of computer, communication tools, management techniques, processing, and gathering of information.
- In education IT is defined as the use of computer based technology, telecommunication and electronics to fulfil the requirement in education. It involves contro!, gathering, processing, storing, and dissemination of educational information.

4.4. THE IT POLICY FOR CIE

The overall goal of Information and Computerisation policy is firstly, to provide up-to-date, valid and timely information for the formulation of policy, educational planning, programme monitoring, research and evaluation through the integration of information, secondly, to strengthen the teaching and learning process towards improving the quality of education using the latest and appropriate technology as an effort to realise the mission and objective of MOE, and thirdly, to realise the concept of democratisation of education through the IT programme which would provide students with the opportunity to gain knowledge, skill and develop acceptable attitude to face the challenge of the information era. The implementation of IT will cover all schools, polytechnics, teacher training colleges, higher institution and the MOE.

4.5. GOALS AND OBJECTIVES OF IT PROGRAMME

• To produce a knowledgeable and Information Rich Society to Face- the challenge of information era in the 21 century. This goal can be achieve through the following objectives:

- to produce students who are skilled in the use of computer and using it as a tool for learning, a tool for communication and a tool for expanding creativity
- to develop knowledge culture among the students in line with the information era.
- to encourage individual development without depending too much on teachers as the source of information.
- to upgrade standard of education through the use of computer and telecommunication technology.

4.6. CATEGORIES OF COMPUTER-IN-EDUCATION

The use of IT in education can be categorised as follows:

Teaching about computers

- Computer Literacy of students - Teaching students about the use of computer hardware and software.
- Specialisation in IT:

Using computer in teaching and learning

- Facilitate student learning and enhance teacher effectiveness
- Using application packages such as accounting packages and CAD/CAM packages for innovation & creativity in technical schools, besides spreadsheets, databases or word-processing packages.
- Using computer as a tool or means for performing some educational or administrative function such as accounting packages and CAD/CЛM packages for innovation & creativity in technical schools, besides accessing and sharing information and communication.
- Application packages spreadsheets, databases or word-processing packages.
- Resource centre/Internet. E-mail to enhance access to a wide range of information databases and as well as interaction between student and teacher, and between student and other computer users world-wide.

4.7 . STRATEGY

- Equipping schools with computer laboratories. The schools that are selected for the CTE project are equipped with computer laboratories at the ratio of two laboratories for school with more than 750 students 2nd one laboratory for schools with less than 750 students. Each computer laboratory is provided with 21 computers.
- Introduction of curriculum on computer literacy and computer aided instruction Teacher Training and Technical Training Levels. Computer and telecommunications are used in teacher training and technical training as a medium of instruction and also a tool for communication.
- Distance learning in Higher Education.
- New information technologies such as computer-mediated-communications, video-conferencing- and audiographics are used in higher learning institutions as instructional medium either for on-campus or distance education, and as a tool or means in performing some educational or administrative functions.

4.8. STATUS OF IMPLEMENTATION

Pilot projects

1986 - Computer Literacy in 20 secondary schools, involving Form 4 (Grade 9) students.

1992 - Computer Literacy for Form 1 and Form 2 students in 60 rural secondary schools.

These two pilot projects covered the fundamentals of computer hardware and software and exposed students to some standard application packages, such as word-processing, graphics, spreadsheets or databases. To minimise cost the schools were supplied with PCs designed by MIMOS.

1994 - CAI/CAL in 15 primary schools, confined to the teaching of Mathematics and English using courseware.

In this instance, the computer was used as an adjunct to other forms of instruction. Typically, the content was presented through class presentation, and tutorial or drill exercises provided on a computer using courseware developed by the CIE Unit of the ministry. The courseware were developed using Linkway or ComIL system authoring tool.

1995 - Education Networking, whereby 50 secondary schools were linked to the Internet.

- Electronic Resource Centre, which provided 14 secondary schools linkages to the Internet. The activities carried out were electronic messaging, on-line access to library catalogues, access to databases, and file transfers.

1996 - 90 Secondary and 20 Primary schools will be involved in the CIE programmes. Computer equipment are being procured.

Full implementation

1989 -Information Technology course at Diploma Level was introduced in 2 Polytechnics. Other polytechnics will follow in phases.

1993 - Computer Literacy was made compulsory in 31 teacher colleges

1994 - 14 weeks CIE training for teacher in teacher colleges was introduced.

4.9 . PRIVATE CONTRIBUTORS TO CIE

The private and non-government bodies played a significant role in CIE. This includes:

a) the Malaysian Council for Computers-in-Education (MCCE) a non-profit non-governmental organisation that serves as a clearing house of information on developments in educational computing. The MCCE organise EDUCOMP (National Educational Computing) symposiums where IT educators and professionals and teachers gather and exchange idea and experience in CIE.

b) Computer-Assisted Learning Laboratory (CALLAB) introduced by a local computer company where courseware it developed for Mathematics, English and Malay are used.

c) Knowledge Resource Centre (KRC), a project by a private company which involves the setting up of an Electronic Library System in participating schools using the latest computer technology featuring multimedia CD-ROM based software.

5. EDUCATION NETWORKS (EN)

5.1. This is an integrated EN project which includes the incorporation of Internet activities in schools for leaching and learning and use of E-mail and Internet for information, communication, administration and management. For the schools the objectives of the project are:

- to enhance communication and information exchange among teachers and pupils;
- to enhance the skills in finding equating and sorting of information among pupils;
- to provide the opportunity for teachers and pupils to communicate and to retrieve information from various sources around the world.

5.2 .As a part of CTE pilot project severs have been installed for the EN at the Computer Technology Laboratory. CIE Unit and EPRD and linked to JARING and the Internet. This enables schools participating in the pilot project to use the Internet. Homepage on the MOE are being developed at EPRD. Some schools have also developed their own homepage.

5.3. Under this project Divisions, SED. DEO/REO Teacher Colleges, Polytechnics, Teacher Activity Centre, Electronic Resource Centre and schools, will be networked to JARING taking into consideration the CIE pile: projects and the KPMNET. MIMOS have been identified to implement the nation-wide EN.

6. FUTURE DIRECTIONS

6.1. MOE will network all agencies in the MOE from the federal level, SEI3, DEO/REO to schools through wide area network for administration and management. This includes networking to the Internet through JARING.

6.2. The Education Network Project wil1 be implemented nation-wide in 3 phases during the 7th Year Plan The network will allow people to send and receive electronic messages, communicate, contribute and access information. It will also be used for administration and management

6.3. A CIE Division will be established to expand and implement the CIE programmes. The main Functions of this division are:

- to plan, implement and supervise the activities of CIE, in the MOE, and
- to plan and implement research and development on the use of computer and computer network in teaching and learning.

6.4. A computer subject will he made compulsory in schools to ensure that the country will have more people who will be able to manage high technology projects.

6.5. Higher education will he expanded through distant learning using the Education Networks (EDUNet), a nation-wide fibre-optic and digital microwave networks which will facilitates video-conferencing between and within the institutes of higher education.

6.6. MIMOS, the R&D government agency that has collaborated with MOE in CIE will develop cheap multimedia computers costing less than RM 1000 (US$ 400) a unit. This will enable MOE to provide each school with between 40 to 45 units of computers and every student the opportunity to benefit from CIE programmes. The production of cheap multimedia computers will ensure that MOE's goal to network computers in schools nation-wide to the Internet in the 7th Malaysia Plan is successful. RM 1.6 billion (US$ 0.64 billion) has been allocated to support computer supply to schools.

7. CONCLUSION

Malaysia has a clear vision of what it wants to be in 2020 and that is to become a developed country that will have among others an information rich society to enable it to be a competitive player in the 21st century global market. In order to realise this Malaysia will adopt and master the technology that will fake it there. The development of the Information Superhighway and Multimedia Super Corridor between Kuala Lumpur, the capital and the new International Airport and the launch of the First

Malaysia East Asia Satellite (MEASAT) which marked the country's entry into space technology will give us the structure needed for IT development.

Malaysia will require a variety of IT skills, experience and expertise to enable us to become an information-rich society. Education is the key to acquiring these thus the MOE has taken serious measures to equip all schools before the end of the 7th Year Plan and has launched the EN Project. Information network has become an educational need in line with the change in socio-economic activity which is increasingly dependent on IT as the strategic technology For national and educational development. An integrated network system covering the whole country must be implemented for the MOE to make educational activities, administration and management more efficient and productive.

Through the CIE programme students are exposed to computer literacy programmes that will enable them to use and manipulate the computer as a tool for learning and doing works while teachers are learning to the use IT in enhancing their teaching and facilitating their works. The Internet provides a new mean of communication and a source of information for both students and teachers. Institutions of higher learning are now venturing out to more sophisticated and advanced areas in IT like internetworking and multimedia. The private institutions are offering more specific IT related courses including twinning programmes with foreign universities.

With the launching of MEASAT new technologies in education are now available. The EDUNet open possibilities for universities to offer higher education cheaper and to more people through distant learning. The EN project will help to produce a set of people who will be able to contribute in the future construction of a National Information Superhighway linked to the global network so that we can become part of the global community and capable of exploiting the most advanced information technologies and help make Malaysia a regional IT hub. With these developments Malaysia will be ready to meet the challenges of the Vision 2020 and the 21st century.

PREPARED BY

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MINISTRY OF EDUCATION

NATIONAL REPORT OF MEXICO

INFORMATICS IN EDUCATION IN MEXICO

According to Mexican Laws (Constitution, article 26, and Law on planning, article 5), President as Federal executive power is to work out the Plan of National Development and to submit it to the Congress for approval.

The present government came into action in December 1994, so the plan, which has already been approved, spans the period from 1995 through 2000. To carry this plan out, programs in various sectors, the educational sector included, were developed.

Education in Mexico is public, as provided by article 30 of our Constitution. The number of students in this country has reached 30 million on all levels, and 80% of them learn in state-supported institutions.

It is pointed out in the plan that "technologies are changing very rapidly, which leads to the necessity of drawing up all the resources so as not to fall behind in the global competition of nations". It is said also that "realizing these tendencies, development of education, raising of qualification, and creating an adequate technological infrastructure are the main factors that will allow this country to make use of the ever growing world scientific potential for the benefit of our economical growth and for raising the standard of living of our people.

In the Plan of Development for 1995-2000 some priorities in the field of informatics are outlined. Some excerpts from this document follow.

"Using electronic devices, such as audio and video players, telecommunications, computers, in education plays a great role in distribution of knowledge and of information to the society. The rapid growth of the branches of science related to communication has enlarged the amount of information available to the society and gave strategic importance to the skills required for using information in various areas of social life.

"Even now many countries, Mexico included, have gained experience to the effect that electronic technologies have a great potential in education. On the on hand they facilitate and enhance teaching and learning, on the other hand they allow to provide the population of remote and diffusely populated areas with education.

"We have some experience in computerization both on the federal level and in separate states of the Republic, where the work was done in cooperation with Latin American Institute of Education and Communications (ILCE) from 1985 through 1992. It is then that the project known under the name "Computerization of primary education" was carried out. The aim of this project was to teach teachers to use the computer in class for didactic purposes. 16,000 ten-year primary schools took part in this project. As a result, 138,000 teachers learned to use the computer for didactic purposes and 26,750 computer systems were supplied to schools for optimization of the educational process.

"Although not all of the purposes of the project were fulfilled, it marked the start of introducing new technologies into schools and familiarizing teachers with computers.

Unfortunately, the economical situation prevented the works begun in 1985 from continuation, and in 1992 they were completely suspended. At present there is no possibility either to develop the software that meets the demands of the society, or to purchase it, because there are but a few programs intended for school education, and all of them are extremely expensive.

At present, only 5 of 32 subjects of federation continue to work systematically in this direction and can to some extent hope that the authorities will fund the purchase of computer equipment and educational software for their projects.

The remaining states practically do not have the resources for the purchase of computer equipment and software, let alone development and financing the research. Even the schools that received equipment and software between 1985 and 1992 years, do not receive enough finance to work with it.

However, "taking into account the progress in informatics and its introduction into the society in which the modern youth is being formed, installation of computers in classes seems possible in the nearest future".

This is why the state structures are planning the development of informatics in education in the coming year 1997, both in the primary school and in baccalaureate (thirteen-year school) by way of an experiment. To that end, it is necessary to purchase and/or develop educational software, to enhance and/or upgrade research equipment, to secure the assistance of experts in didactics and teachers, to create a system of networks on all levels of education (pre-school, elementary school, primary school, and baccalaureate) which will meet the modern needs of Mexicans.

The above stated purposes can be also fulfilled with the restructuring of the telephone network, which began in Mexico in 1997 with a great success. This is related to the monopoly of the company Telmex in this field and with the activities of private companies, which laid optical cable and undertook to introduce most modern technologies.

"In view of all the above stated, the Mexican state is planning to introduce new technologies in communication and informatics, which will allow to raise the quality of education to the level it has never had, to make the educational system more flexible and adequate to the needs of the Mexican society. As a result of the efficient usage of electronic educational equipment, the prerequisites for creating the culture of continuous education will be provided for, which will allow people to widen the horizons of their personal and social development".

MEXICO CITY,
THE UNITED STATES OF MEXICO

NATIONAL COMMISSION OF MEXICO FOR UNESCO

NATIONAL REPORT OF THE NETHERLANDS

POLICIES ON COMPUTERS IN EDUCATION IN THE NETHERLANDS

By constitution, all schools in the Dutch education system (public and private) are funded by the Government provided that they meet the standards of quality set by the Ministry of Education and Sciences. Within the framework of these standards, schools are free to organize their teaching and learning processes. The introduction of new technologies in education began in 1982 with stimulation policies that launched several promotional programs over four time periods until 1992. Since 1993, the Dutch government has considered new technologies a regular part of educational practice.

STRUCTURE AND NATURE OF THE DUTCH EDUCATIONAL SYSTEM

FREEDOM OF EDUCATION

The Dutch Constitution, dating from 1848, establishes a principle of educational freedom in the Netherlands. Freedom of education means that groups of private individuals have the right to establish schools on the basis of their own particular philosophy of life or their own views of society and education and that these schools will be funded equally by the government. This produces a wide variety of types of schools which fall into two main categories. Publicly-run schools are controlled by the municipalities. Privately-run institutions fall into three groups, Roman Catholic, Protestant, and non-denominational private schools, which are not based on a religious belief, but have a private school board. In 1992, a total of around 6,300 school boards, existed in the Netherlands, and nearly two-thirds of them belonged to private schools (Krins, Plomp, & Scholtes, 1992).

All schools qualify for government subsidy provided that they meet the criteria for quality laid down in various statutes and regulations and provided that they are likely to meet the minimum standard for student numbers. The principle of financial equality between publicly-run and privately-run education has been established since 1921. This means that government expenditures for publicly-run education have to parallel the expenditures made on privately-run education. Until the age of 16 years, children have to attend an educational institution that meets statutory requirements and measures up to the standards of quality set by the Ministry of Education and Science. These standards define the subjects or areas of the curriculum that are compulsory under statute for various types of schools and specify examination requirements or attainment targets. Regulations regarding subject combinations, the time-tabling of lessons, and examination syllabi guarantee a degree of standardization in the intake and output of the different schools. Within the framework of these standards, schools may choose from a variety of methods to organize the teaching and learning processes they will use.

REGULATION OF EDUCATION

The central government controls the education system by means of legislation and regulation while the administration and management of Dutch schools are accomplished on a decentralized, municipal basis. Major central government responsibilities with regard to educational policy include ensuring that adequate facilities for education are properly spread around the country, providing funding and supervision, controlling the procedures and quality of examinations, and promoting innovations. The provinces play only a modest role. Their duties are mainly supervisory (to ensure that sufficient public provision of education is available at the primary and secondary level) and judicial (to settle appeals brought against decisions made by municipal authorities).

The municipalities are the de facto authorities with regard to managing publicly-run education. They are also charged with certain executive duties, such as supervising school compliance with the Compulsory Education Act and reimbursing the costs of school facilities, for which they in turn receive reimbursement from the central government. Municipalities reimburse the expenses of privately-run schools on the same basis as they reimburse publicly-run schools.

Funding

Education is funded by the Ministry of Education and Science. Excluding student grants and loans, the 1992 budget totaled 27 billion guilders (14.2 billion in U.S. dollars). This amount is equivalent to 5.8 % of the net national income and accounted for approximately 13 % of the total government expenditures. Money for the education budget comes from tax revenue and, to a limited extent, from the tuition fees charged by schools, evening-class institutions, universities, and polytechnics. Students beyond the age of compulsory education (above 16 years) are asked to contribute to the cost of tuition, but student financing schemes exist to ensure that these contribution requirements do not limit access to education.

The government distributes resources throughout the education system according to either a declaration-based model of funding or a norm-based system of funding. In the declaration-based model, schools declare their expenses (in accordance with various rules) and then actual costs are reimbursed on the basis of the declaration. In the norm-based system, schools receive funding according to a standard limit, so government control over the legitimacy of expenditures is less detailed and the schools have greater freedom to spend their money as they see fit. Recently, the government has gone over to the norm-based system for an increasing number of school sectors. Already established within higher education and senior secondary vocational education, the norm-based system is also expected to be applied to general secondary and primary schools over the course of the next few years.

LEVELS OF POLICY DECISION-MAKING

External bodies *advise* the Ministry of Education and Science with regard to policy-making. One permanent advisory body, the Education Council, was established by statute in 1919. It has 80 members and can advice the Minister at his request or on its own initiative. The Council takes a supervisory role in maintaining financial equality between the publicly-run and privately-run institutions, coordinating educational policy and regulations, and preserving the educational freedom that schools have to organize their teaching within the standards set by the government.

For new policy proposals, the Ministry of Education and Science *consults* with various bodies composed of representatives of the schools and institutions, staff, parents, and students. In consultation, these bodies are represented by four umbrella organizations, one for publicly-run education and one for each of the three ideological categories of privately-run education (Roman Catholic, Protestant and non-denominational). Such consultations precede any discussions of policy proposals that take place in parliament. Parliament then ratifies the main lines of approved policy proposals, by statute or otherwise.

As a consequence of its freedom of education principle, the Netherlands has no national curriculum. The substance of educational is regulated at the national level only through the specification of examination requirements and attainment targets. Based upon these, commercial educational publishers develop textbooks and compile sets of teaching and learning materials called "methods". The individual schools or teachers then decide which of these methods to use, always with the opportunity to choose among the products of several publishers.

The government subsidizes the design of new curricula via development projects carried out by the National Institute for curriculum Development of by one of three national educational support centers (one Roman Catholic, one Protestant and one non-denominational). Since no curricula can be prescribed by government, the products of these government-subsidized endeavors can only serve as than examples. However, development projects of this kind prompt educational publishers to modify their products.

VARIATION BY TYPE OF SCHOOL

Table 1 lists the different types of schools in the Dutch educational system while Figure 1 illustrates the structure of the system. A development of each educational sector follows below.

Table1.

Number of Students and Teachers (in Thousands)
In Dutch Educational System, 1990 - 1991

Type of Education	Teachers full-time	Students full-time	part-time
Primary education	71,8	1,441	---
Special education	17,9	109	---
General secondary	69,7	897 [1]	119 [2]
Mbo and adult education	31.7	432	157 [3]
Higher vocational	--- [4]	183	50
University education	--- [4]	160 [5]	

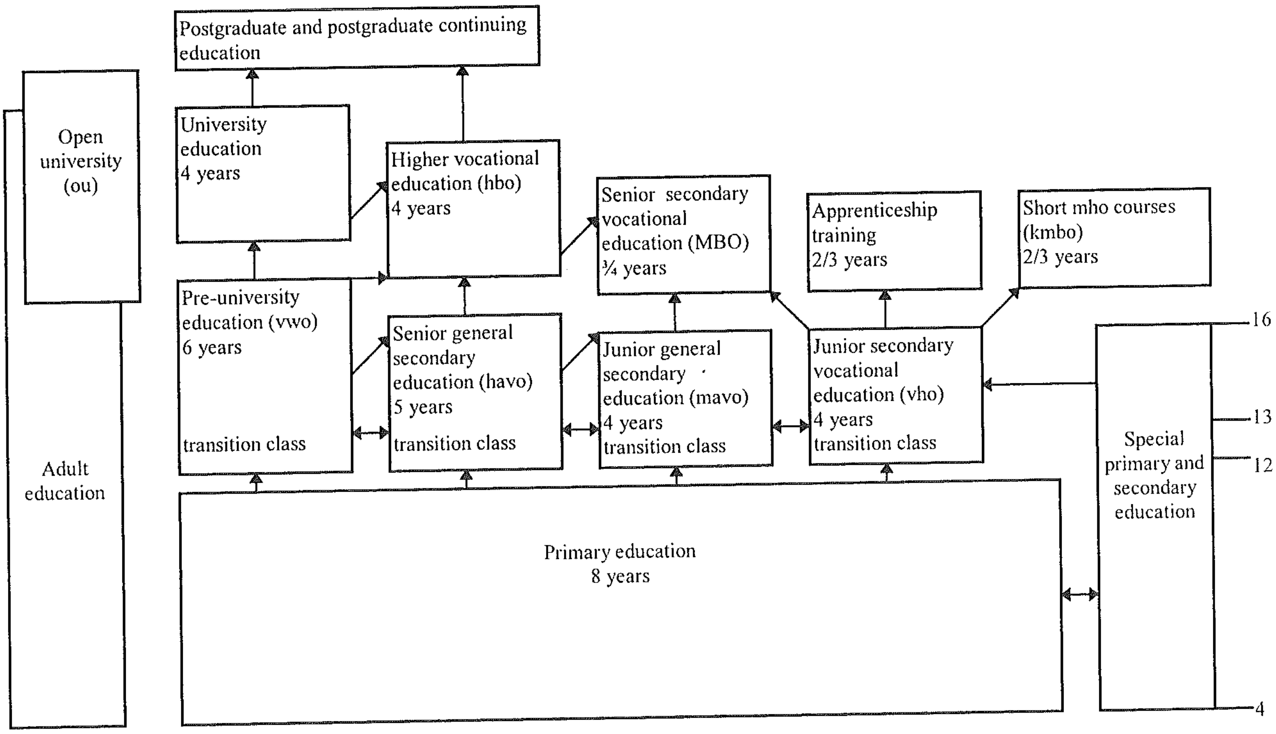
Notes:
1 = 75% of these are enrolled in vwo/have/mavo (general secondary).
2 = All part-time students are enrolled in general secondary (vwo/have/mavo)
3 = All part-time students are in vocational secondary (mbo)
4 = data not available
5 = This number includes part-time enrollees.
Source: Education budget 1992, Key educational statistics.

PRIMARY EDUCATION

The Primary Education Act took effect in 1985 and introduced a new-style primary school that integrated the old-style nursery and elementary schools. The new-style primary education offers children between 4 and 12 years of age an uninterrupted period of schooling geared to the progress and development of the individual child. Schools providing special education exist for children with handicaps or with learning or developmental difficulties who are unable to attend mainstream schools.

GENERAL SECONDARY EDUCATION

Within secondary education, a distinction is drawn between general and vocational education. The Secondary Education Act of 1968 sought to improve coordination between the different types of secondary schools, provide opportunities for horizontal and vertical transfers between the different types of schools, and offer a combined first year called the transition class. The intent of the transition class is to bridge the break (or transmission) between elementary and secondary schooling and between the different kinds of schools within secondary education. Two kinds of transition class eventually emerged: one for general secondary education and one for vocational education.



Source: Netherlands, Ministry of Education and Science.

Figure 1. The Dutch Education System Today.

Since 1968, debate on the structure of secondary education has continued. The most recent proposal, a new plant for Basic Education, was implemented in August 1993. Embracing the first three years of secondary education, it provides a basic comprehensive curriculum for all pupils aged between 12 and 15.

The objectives of the new basic Education are to allow the postponement of selection decisions, to encourage personal development, and to offer a more broadly-based education. The Basic Education Bill assumes that these objectives can be achieved without many statutory change in the existing education structure. Therefore, the different types of secondary schools (vbo, mavo, havo, and awo) will continue to exist and, following the period of Basic Education, pupils will be able to opt to complete their secondary education at any of these four types of schools.

VOCATIONAL EDUCATION

The four boxes in the upper corner of Figure 1 depict the alternate paths available for vocational education in the Dutch school system. Preparatory secondary vocational education (vbo) provides general pre-vocational education and it is not intended as terminal education. Its first three years are intended primarily for basic education while the fourth year is more vocationally-oriented. Schools in this group offer courses in technical subjects, commercial fields, and agriculture as well as in the personal and social services and health care. Senior secondary vocational education (mbo) is entirely vocationally-oriented. In a period of three to four years, it trains students for middle-management jobs in industry, the service sector, health care and government.

Short senior secondary vocational courses (kmbo) provide an alternative to pupils who are leaving either general or vocational schooling at the junior secondary level without having found their way into vocational courses at the mainstream senior secondary level. These short courses, which last two to three years on a full-time basis, lead to occupational qualifications. Finally, the apprenticeship system offers a form of vocational training that combines one or two days of classroom education a week with on-the-job training for the remainder of the week. Trainees in the apprenticeship system are paid for their on-the =job time.

SOME FACTS AND FIGURES

Table 2 indicates the overall size of the Dutch educational system. Over the last few years, growth in special education has halted while the number of pupils in primary education has slightly increased. The number of students in higher education is also increasing. In general, as compared with a decade ago, young people are staying on longer at school before entering the labor market.

Table 2.

Number of Schools and School Size in 1991

	No. of Schools	Average No. of Pupils
Primary education	8,422	170
Special education	1,004	109
General secondary	1,228	588
Junior secondary vocational	420	388
Junior-senior secondary vocational (combined)	39	1,962
Senior secondary vocational	146	1,395
Higher vocational	73	2,507
University education	12	13,879

Source: Education budget 1992, Key educational statistics

In addition to expansion in the size of the system, there is a continuing expansion in the scale of educational establishments as Table 2 indicates. It began with higher vocational education in 1987, continued with senior secondary vocational education in 1990 and is now occurring within all of secondary education. Primary education is likely to experience the same trend. This expansion in scale was prompted by government measures that defined minimum school sizes provided extra financial considerations for bigger schools. Expansion is motivated by the goal of greater efficiency.

COMPUTER-RELATED POLICIES

Beginning in 1982, the Dutch government applied a series of stimulation policies to promote the use of new technologies in education. The stimulation took place via group of promotion programs that can most easily be described in terms of four separate time periods. Figure 2 summarizes the goals, budget, and scope of each of these promotion programs in turn. Only a limited number of issues have been settled by statue-namely that new technologies should be used in physics in upper secondary school, in informatics in vocational administrative (upper secondary) schools, and in informatics and computer literacy (as a small course of 20 lesson periods) in lower secondary education.

Exploration, 1982 - 1983

The first steps were taken with the so-called "100 Schools Project". The aims of this project were broad: "Let a thousand flowers bloom". At that time, the possibilities of information technology (IT) for education were too little understood to be able to formulate clear objectives. The 100 School Project focused on creating computer awareness and improving computer and information literacy. It included the provision of computer hardware, inservice training, and assistance with curriculum development.

PROVISION AND INTRODUCTION, 1984 - 1988

The INSP (Information Technology Stimulation Plan) project embodied a developing national policy to promote the use of information technology (IT) in education. Policy proposals and their companion budgets were organized either according to educational sector or according to

Figure 2. Comparision of Promotional Program for New Technologies in the Netherlands

project	100-school	insp	nivo	poco	na-bont	opstap	print	comenius	presto	enter	new media
Period	82-84	84-88	86-90	87-91	87-92	89-92	89-92	90-94	91-93	93-96	87-92
Budget (in millions Dfl.)	6	270	100	26	95	50	100	105	45	450	14
Sectors											
Primary education		x		x		x	x	x		x	x
General secondary education	x	x	x	x		x	x			x	x
Junior and senior sec., voc. Education		x		x	x	x	x		x	x	x
Higher vocational education		x			x						
University education											
Adult education		x				x	x			x	
Infrastructure*		x				x	x			x	x
(in service) Training		x			x	x	x			x	x
Aims											
Training for citizenship**	x	x	x			x	x	x			
Human capital***		x			x	x	x		x	x	
CAI		x	x	x		x	x	x		x	
Computerization of administration											
Expenditure											
Hardware acquisition	x	x	x			x		x		x	
Courseware development	x	x	x	x			x		x	x	
Courseware acquisition			x			x		x	x	x	
Application software acquisition		x							x	x	
In service training	x	x	x		x		x	x		x	
Curriculum development		x	x				x		x	x	
Support for implementation							x			x	
Information			x			x	x	x	x	x	

Notes: * = measures to stimulate production of educational software; ** = preparation for the information society; *** = preparation for satisfactory performance at work

Source: Krins, Plomp, & Scholtes (1992)

function (for example, to facilitate inservice training or software development). INSP put forth two primary objectives: (a) to promote information and computer literacy as an essential element of preparation for life in society, and (b) to improve the quality of vocational education ("human capital") by preparing skilled workers. The use of IT to enhance the learning process itself was mentioned only as a secondary possibility, although a significant proportion of the development activities focused on this aspect.

The INSP project led to a number of parallel projects. (See the four columns subsequent to INSP in Figure 2. The NIVO and POCO projects will be described in some detail below. The NaBoNT project created substantial opportunities for people in vocational education to receive inservice training from specialists in business and industry. The New Media project explored possibilities of technological innovations for education. All four projects are described in Krins, Plomp, and Scholtes (1992).

The NIVO (New Informational Technology for Secondary Education) project involved collaboration among government, business, and the educational umbrella organizations (see the section on 'Level of Policy Decision-Making") to provide hardware and in-service training on a large scale. It was financed jointly by the government and the companies who initiated the project, IMB-Netherlands, Tulip Computers, and Philips. Efforts to acquire sponsorships from other companies were disappointing. The NIVO project was organized into several subprojects. In the *hardware subproject*, at lower secondary schools (vbo, mavo, havo, vwo) received a configuration consisting of one file server and eight network-linked pupil workstations (16-bit; MS_DOS 3.1 or higher) plus two stand alone computers intended for specific use in the subject areas. In fact, this approach established a hardware standard.

In *the inservice training subproject*, a minimum of three teachers at each secondary school (of whom at least one was a woman) received 80 hours of initial training in educational computer use. To cover all schools and build a broad base of training within a short period of time, a cascade model was applied. Sixty lecturers from teacher training colleges were trained by specialists from computer manufacturers and software houses; these lecturers then trained three teachers per school; and the trainees themselves were asked to determinate further introductory training to their school colleagues. In addition to the introductory course, all teachers could receive in-service training in information and computer literacy and the use of IT for subject area teaching.

The *courseware subproject* (in combination with the curriculum development subproject) was directed at developing teaching materials for information and computer literacy as well as for use of the computer to teach other subjects. Each school received a "starter pack" of software consisting of an author language and word processing, spreadsheet, and data base programs. Schools are also received a software coupon of Dfl 200 (105 US dollars). Sometimes exemplary lessons were provided. The actual use of the software in the classrooms was, however, disappointing.

The POCO (Software Development for Computers in Education) project was intended to bring onto the market a critical mass of rapidly usable courseware. It began in response to the failures other projects were having in producing sufficient courseware capable of meaningful and easy use by teachers. The POCO project was distinctive for taking its ideals for courseware from a curriculum analysis and from the wishes of the educational world. As a result, a standard user interface was developed, and the courseware development took place according to a fixed pattern. The products developed were then offered to educational publishers in order to make them available to schools through the usual channels and at acceptable prices. (Schools could use their software coupons for buying software). Vendors were required to return to POCO a certain percent of their sales profits for starting new projects. A disadvantage of the POCO project was the separation of responsibility for courseware development on the one hand, which a specially established management team handled, from the responsibility on the other hand for converting the courseware into marketable products, which, according to Dutch rules, must remain in the hands of the publishers.

IMPLEMENTATION, 1989 - 1992

The OPSPAP period began when the government decided to provide a further boost for IT within education by making funds available for another period of four years. The Dutch word "opstap" means "going away" or "moving on". The government used the word to express its intention that, after this additional period of support, schools in principle should be able to implement and independently maintain the use of IT in their educational practices. The aims of OPSTAP were much like the aims of the INSP project, but the new project broke with the procedures of the INSP by ending the integrated approach. Thenceforth, hardware acquisition and infrastructure measures were brought under the control of the Ministry. (See the Comenius project below). Meanwhile, courseware development, inservice training, and the support of schools became the responsibility of the educational support organizations. (See PRINT project description given below).

The PRINT (Project Implementation New Technology) project derived from the OPSTAP idea that a single development project should promote and implement the use of IT in the schools. The PRINT project took up that task, originally encompassing the sectors of primary education, special education, general secondary education, and secondary vocational education. Its aim was to offer schools help with their own processes of introducing IT into their educational practices. More specifically, PRINT offered assistance through organizing courseware development (in conjunction with the POCO project), through organizing professional development activities, and by fulfilling a general "help" function (providing advice and information about the use of IT and IT-related products).

The PRINT project activities, however, were organized somewhat separately sector by sector. For the sector of primary and special education, PRINT operated in conjunction with the Comenius project. In the sector of general secondary education, PRINT continued with the lines set out in the INSP and NIVO projects. Activities new to the PRINT project included the development of a 20-hour course on "information and computer literacy" for the new Basic Education curriculum at the lower secondary level. Other PRINT activities concerned the use of IT in a subject areas such as Dutch language, mathematics, and general technique; curriculum development in the area of computer science for the middle years of secondary education; and the integration of IT in the examination syllabi of upper general secondary education subjects such as physics, social studies, mathematics, and business economics. In this period, a norm-based reimbursement level was introduced for hardware maintenance or replacement, software acquisition, and the costs of consumables. The guideline implied that a school with 1000 pupils could spend approximately Dfl 12,000 (6.300 in US dollars) a year.

The Comenius project paid new attention to primary education. Because the INSP project had given priority to vocational and general secondary education, only a few experiments had been carried out to explore the possibilities of IT for primary education. Nevertheless, many primary schools took the initiative to acquire hardware in the INSP period and started to get familiar with the new technology on their own. By 1988, the government concluded that the time was ripe for a hefty push to stimulate IT in primary schools and approved the Comenius project as a mechanism for doing so.

From the Comenius project, primary schools in 1990 began to receive MS-DOS AT computers (1 computer for every 60 pupils) for the purpose of exploring IT's possible uses in primary education. Based on experiences from the INSP period, schools were given a year to prepare themselves for working with IT. A the computer coordinator was trained in advance and hardware was supplied to the schools while the inservice training of teachers (on a school team basis) was still in progress. The schools also received a starter pack of Windows software, part if which could only be used by teachers.

The PRESTO project developed as an offshoot of the PRINT project. After PRINT had been in operation for more than a year, it was decided that vocational education differed too significantly from education in the other sectors to be managed in quite the same way. PRESTO was set up to organize PRINT activities separately for vocational education, paying special attention to the culture of vocational education and the kinds of IT applications it involved.

POLICY INTENTIONS, 1993 - 1996

"ENTER: The Future" was activated when the State Secretary for Education and Science published his intentions in February 1992 for the near future of information technology policy in education. Four principles direct the ENTER project. First, with schools having autonomy and control over their own affairs, any further implementation of IT in education would take place under the authority and responsibility of the schools themselves. Second, because a technology based had been established within the schools during the preceding 10 years, schools themselves were now in a position to direct the integration of IT into their educational practices. Third and also because a certain infrastructure had been established in each school, IT in education no longer needed to be as much of a policy theme in itself as it needs to become instead an aspect of other policy themes. (For example, an aspect of the policy to introduce Basic Education in lower secondary education in the degree to which IT can function in relation to accomplishing those goals) Finally, central government would take a more selective role toward IT in education. Its work would be restricted to monitoring technical developments and translating them into curricula or examination syllabi and to encouraging courseware development for small target groups.

When it became clear that only a relative small number of teachers used computers as medium for teaching and learning in lower secondary schools, a new project started in 1993: Project on Information Technology (PIT). About 200 schools were selected for participation in this two-year project in which groups of about 25-30 teachers form a network for mutual support, exchange of experience and lesson ideas. Participating schools were financially facilitated and made a commitment to stimulate ICT use in at least three curriculum areas.

Because of the unique potentials of ICT for new teaching and learning practices, teachers have to be prepared for these developments. Therefore the Dutch ministry have planned to set up seven regional centers for information technology. These centers will be related to teacher training institutes and offer teachers the opportunity to learn about and to deal with the teaching and learning conditions of the future.

ISSUES

EQUAL OPPORTUNITIES FOR GIRLS AND BOYS

Of the Education Department's total expenditures on the promotion of information technology since 1986, 0.1 % (some 0.5 million Dfl, or approximately one-quarter million U.S. dollars) was spent on promoting the equal participation of boys and girls with IT in schools. In addition to this, emancipation budgets within the Education

Department and the Ministry of Social Affairs have enabled other measures to be taken to stimulate girls' participation in math and science courses and technical education.

In the beginning very few were aware of the danger that IT might become a male province in the schools. This risk was pinpointed when the National Center for Woman and Informational Technology, on its own initiative, presented the Minister with a report on the matter. The report successfully focused attention on the issue, at least in secondary education. (One of the most practical measures that followed was the NIVO project's rule to assign at least one woman among the three teachers sent to compulsory inservice training by each school.)

Since the time of their 1984 report, the National Center for Woman and Informational Technology has received increasing numbers of commissions from the Ministry of Education and Science to develop learning materials and promote equal participation. The first such commissions related to primary and secondary education. In 1991, efforts also began to provide extra encouragement for girls in vocational education to get involved in IT. Nevertheless, IT still continues to be a male preserve in most schools (Janssen Reinen & Plomp, 1993a, 1993b) and no prospects of further promotional measures to combat that fact are currently on the horizon.

OTHER AREAS FOR SPECIAL ATTENTION

Krins, Plomp, and Scholtes (1992) claimed that a number of additional issues are practically alive in the contemporary relationship of IT to education in the Netherlands. One question is whether IT is already deeply enough rooted in the schools for management to continue to ratify it as priority. Funds for IT promotion have been "changing color" in that the financial resources for stimulating IT in education are increasingly being concentrated within the ordinary reimbursement of running costs. In other words, instead of receiving funds that are earmarked for IT expenditures, schools are now expected to decide for themselves whether to devote such funds to the purchase of software, hardware, and IT courses or to new books, curtains, window-cleaning, and other things that might also appear as priorities. Likewise regarding vocational education, the main question is whether reforms can continue to be introduced at the same pace now that -- given the norm-based budget system – the schools themselves have to take the initiative to make investment decisions to invest in favor of IT.

The extent of implementation within secondary education is a matter that concerns many minds. The number of school hours available for "information and computer literacy" is very limited, and integrating IT in other subject areas has proved to be an uphill struggle. Some people blame this lags on the belief that too few initiatives have yet been taken to supply hardware, software and teacher training to all the schools and all the teachers. Others blame the lack of a proper marketing approach, one which would be based on the principle of the teacher as the primary user. Yet a third category of observers believe that the benefits of IT to secondary education are either insufficient or too threatening for IT to have been embraced more fully by the schools.

In primary education, the issue is now mainly one of the acceptance of IT in the schools. As already noted, expectations are running high.

For a while, ways were being sought to induce greater activity on the part of the educational publishers. A study on the potential for public-private partnership with regard to courseware development produced some ideas, but these were rejected. The government is not currently undertaking any special action to stimulate publishers.

CURRENT TRENDS IN COMPUTERS IN EDUCATION

IT IN THE CURRICULUM

The integration of IT in the curriculum differs from one educational sector to the next. In primary schools, it is too soon after the introduction of an infrastructure to be able to speak of IT's integration in the work plans of the schools. Furthermore, it is not the intention of the government to prescribe "information and computer literacy" as a subject area for the youngest students. Within special education, IT has not so much affected the content of the curriculum as the types of aids that can be used to teach pupils with sensory handicaps.

In general secondary education, virtually all schools were already teaching "information and computer literacy". For that reason, introducing a compulsory 20 hours on the subject as part of the new Basic Education curriculum in 1993 was not expected to create many problems. In other school subjects such as physics, mathematics, and Dutch language, it is unclear how the integration of IT will progress. Recently, as part of the new Basic Education program, support was made available for 125 schools interested in integrating IT with the curriculum. Work to develop integration methods for social studies and business economics is still in hand.

Within the technical sector of vocational education, the curriculum now includes the use of IT in a degree parallel to where it occurs in the workplace. The same generally applies to commercial courses. The updating of the curriculum lags somewhat behind in the health care sectors, but IT use seems to be increasing in the more vocationally-oriented courses of the health care training programs. Many vocational schools are getting involved in contract education to professionals in business and industry.

All student teachers are now receiving training to prepare them for the use of computers in teaching. In addition they have the opportunity to attend a basic course in information and computer literacy if they have not already received one as part of their previous training.

AVAILABILITY AND USE OF HARDWARE AND SOFTWARE

In 1989 and 1992, information on the use of computers in education was collected from a representative sample of schools in the Netherlands within the context of the comparative international study on "Computers in Education" (Pelgrum, Jansen, Reinen & Plomp, 1993; Pelgrum & Plomp,1991). The survey was organized by the International Association for the Evaluation of Educational Achievement (IEA) and was carried out in the Netherlands by the Center for Applied Research in Education (OCTO) at the University of Twente.

NUMBER OF COMPUTERS

A main finding of the Computers in Education study is the degree to which hardware standardization has been achieved within Dutch schools. Secondary and vocational education establishments are gradually replacing or supplementing their XTs with ATs, which are already the standard within primary education. Table 3 summarizes the changes in computer availability that occurred between 1985 and 1992.

Table 3.

Increase in Percentage of Schools with Computers and the Average Available Numbers of Computers during the Period 1985 - 1992

	Primary		**General Secondary**		**Senior Secondary Vocational**	
Year	%	nr	%	nr	%	nr
1985	10	2	62	10	68	14
1986	20	2	76	11	82	18
1987	37	3	84	13	87	24
1988	48	3	88	17	91	31
1989	52	3	93	21	93	44
1990	68	3	100	22	na	na
1991	77	4	100	23	na	na
1992	89	5	100	24	na	na

Note: na =data not available
Sources: Ten Brummelhuis (1993); Ten Brummelhuis & Plomp (1993).

AVAILABILITY OF EDUCATIONAL SOFTWARE

All primary schools possess a word processing program while most of them have educational games programs and drill and practice software. Virtually all secondary schools and all senior secondary vocational schools have educational tool software such as spreadsheet, data base, and word processing programs. In addition, most secondary schools have drill and practice software, computer-assisted learning programs, and an author language. All the schools providing senior secondary technical education have cad/cam software.

SUBJECT AREA SOFTWARE

Most primary and secondary schools have programs for arithmetic, the Dutch language, and geography. Software for "information and computer literacy" is available in 90 % of the secondary schools, 80 % of the senior secondary vocational schools, and 47 % of the primary schools. Few schools in senior secondary general education have software available for general subjects like the Dutch language (17 %), mathematics (20 %), and foreign languages (21 %). In senior secondary vocational education, there is a little use of computers in relation to general school subjects; however, most of the schools (94 %) do have software available for the vocationally-oriented subjects. (For more data, see: Krins, Plomp, & Scholtes (1992); Pelgrum, Jansen, Reinen & Plomp, 1993; Pelgrum & Plomp,1991; Ten Brummelhuis (1993); Ten Brummelhuis & Plomp (1993a, 1993b).

CHANGES IN SCHOOL PRACTICE AND ORGANIZATION

No essential changes in school organization have resulted from the introduction of IT in the sense of shifting from traditional to individualized teaching or re-interpreting the role of the teacher. Yet a number of facts make it clear that IT has had impact on school functions and procedures, especially in secondary schools. Most schools now have a computer coordinater, and many schools have an IT working group. In some schools, experienced computer-using teachers are providing courses for their novice colleagues and a teacher or technical assistant acts as a system manager. Often schools have had to take some measures with regard to booking computer rooms or use of the network in order to avoid scheduling conflicts. Schools themselves now have to decide how to spend their IT budgets, which inservice training courses to use, and who should attend them. Moreover, in the vocational field, schools are using their hardware and software facilities to provide commercial courses on a contract basis for professionals in business and industry.

RESULTS OF THE STIMULATION POLICIES

Obviously, the stimulation policies of the Dutch government have resulted in a situation in which it is impossible to imagine Dutch schools today without computers. But the promotion programs brought some unanticipated disappointments as well as successes. Judging the status of IT in education in these terms, as Krins, Plomp, & Scholtes (1992) have done, is one way to consider what important lessons can be learned from the Dutch stimulation policies.

SUCCESSES AND DISAPPOINT MENTS

Primary education

Experience from earlier projects helped in developing a sound stimulation strategy for primary education. Furthermore, with many schools already pursuing IT on their own initiative—despite benign discouragement from the first INSP stimulation project, Comenius was frequently able to tap into a spontaneous process already underway. In the period 1990 - 1993, the Comenius project supported 85 % of the schools with inservise courses to familiarize teachers with potentials of computer hardware and software. (The remaining 15 % of the schools receive the same support in 1994.) By 1993, 98 % of the primary schools had begun implementing IT in the classroom and in their administrative systems, hardware standardization had been achieved, and an average of two out of every three teachers were making use of computers for educational purposes.

Nevertheless, initial signals from the Educational Inspectorate suggest that? For many of the primary schools, a single year's preparation preceding introduction of computers is too short a period to prepare for their sound educational use. One reason for this was that both the new hardware and software standards were different from what the schools were used to. The choice of a modern software standard (Windows user interface) is producing delays in the availability of courseware and development of software. Another reason the year's preparation time seemed too short was that the implementation of IT in elementary schools followed the strategy of a team decision, and takes time to introduce all members of a school team to IT and to motivate them and convince them of its usefulness.

General secondary education

Even though the Basic Education curriculum now earmarks 20 hours for the teaching of "information and computer literacy", almost all the schools in this sector had been providing similar courses even before it was required by statute. The level of success in this sector is indicated by a number of observations. When new curriculum are in development, computer use is being integrated as a matter of course, and a variety of companies have emerged to market properly usable courseware. In the schools, hardware standardization has been achieved. In fact, the computerization of school administration has taken off in a big way. As for the teachers , to date some 16,000 have attended introductory courses, 2200 have taken at least one course relating IT-use to their subject areas, and approximately 1500 have been retrained to teach "information and computer literacy".

It is important to point out though that some general secondary schools were spontaneously offering as much as 80 hours in "information and computer literacy" before the 20 compulsory hours of the Basic Education plan took effect. Also, no decision had been made to introduce "computer science" as a course in the senior general secondary schools, and no strategy has been established with regard to qualifying teachers for the Basic education course. The use of computer-assisted instruction (CAI) in secondary education occurs only on a very limited scale, among a select group of teachers. Systems management facilities, too, are extremely limited. Moreover, since the ending of subsidies to the schools, the contribution of educational publishers have been disappointing.

One critical success factor, the support of principals for IT, was recognized too late. Another recognized success factor, offering personal computers to teachers at reduced prices, was not possible for the government to undertake given the structure of the Dutch educational system. School boards could have arranged to provide such opportunities, but they rarely took up the recommendations to do so. Finally, to accomplish implementation, too little attention has been and is still being paid to the teacher as the main focus for change and acceptance. A related difficulty is the speed with which the training base in the schools can be eroded. Many of the three teachers per schools who attend the obligatory NIVO inservice training are no longer employed in the schools. Of the woman given training, no more than a third are still active in the field of information and computer literacy.

Vocational education (mbo and apprenticeship)

The initial results of the demand-driven approach are encouraging. In terms of hardware, software, and modifications in the curriculum, most key elements of IT have now found a place in vocational education. Schools have themselves purchased extra computer equipment, and teachers have been given the chance to attend professional courses on a large scale. (Course enrollments have totalled approximately 40,000.) In addition, regional centers have been set up where students can go to become familiar with some of the more advanced systems that are used in the workplace. In general, the contacts between vocational schools and local businesses are well established, so the increase in contact courses provided to business and industry is not much of a surprise.

Initially, motivated by the then current realization of their lack of equipment, the vocational schools were really only interested in obtaining hardware. A current question is whether senior secondary vocational schools will fall by the wayside with regard to future innovation now that adopting new strategies primarily depends on the schools taking the initiative to do so on their own. Then, too, it was at first difficult to establish in consultation with the labor market what skills the education system should be producing. The potentials for IT have prompted many schools to adopt yet further specializations and options, even through the business world's main requirement is for the thorough teaching of basic skills.

Software development and inservice training. It took a long time to get an infrastructure for software development in place and to make good inservice training available for teachers. Subsidies for inservice training could only be gotten when the training was provided by teacher training organizations. In other words, no financial support or encouragement existed for peer-group training in the schools, even though this form of training proves effective where it is used. Increasingly, too, the importance became clear of having users participate in courseware development. The attempt to organize software development along the lines of models used in industry not only created products too expensive for the schools to purchase, it also led to lines of development that offered the inexperienced educational world too little opportunity to adapt the original ideas of the developers. A successful effort in the software area was having one central organization evaluate and catalogue the available software. This information provided schools a means for preparing themselves to act as critical consumers.

THE FUTURE

The principles of 1993's ENTER policy work toward fulfilling the "opstap" goal set out in 1989 – that is, to "move on" to a time period wherein schools are taking nearly all the responsibilities for integrating and maintaining IT in their educational practices while government retains only a limited involvement in the relationship of IT to the Dutch educational system. Federal activity was so much limited by the ENTER policy that the Technological Coordination Unit established within the ministry in 1984 could be disbanded. Yet the ENTER policy still very much represents a period of transition between government and school responsibilities.

The IT budget for 1993 - 1996 totals Dfl 573 million (301 million in US dollars), of which Dfl 400 million (210 million in US dollars) will go straight to the schools via the reimbursement of running costs as dictated by the norm-based financing system. Because the schools can decide themselves how to use their budgets, this amount can be regarded as a "passive promotion" of IT. Of the remaining of Dfl 173 million (91 million in US dollars) in the budget, approximately 82 million is tied up for projects which were begun in previous periods such as Comenius and Presto. This leaves more than Dfl 90 million available for "active promotion" by the government. On appealing area for stimulation is courseware development. Finally, to assure that education keeps up to date with advanced applications of IT, a federal task force will be created of representatives from government, educational organizations, and computer experts to commission studies and support projects. For this purpose, a small budget of about Dfl 1 million (0.5 million in US dollars) per year is assigned.

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THIS ARTICLE DRAWS HEAVILY FROM A SUMMARY REPORT TO THE EUROPEAN COMMUNITY BY KRINS, PLOMP AND SCHOLTER (1992)

NATIONAL REPORT OF NEW ZEALAND

THE USE OF INFORMATION TECHNOLOGIES IN EDUCATION IN NEW ZEALAND

1. SUMMARY

This paper first discusses the New Zealand education system and recent reforms in education. It then provides information about the development of the technology curriculum of which information technology is an important aspect. The background to the development of the use of information technologies in education is described followed by information about the current use of information technologies in education settings in New Zealand. Comment is made about the use of information technologies in post compulsory education and the paper concludes by suggesting likely future directions.

2. THE NEW ZEALAND EDUCATION SYSTEM

Education is compulsory from ages 6 to 16, but almost all children start school on their fifth birthday. Education is free from age 5 to the end of secondary schooling. Most children spend eight years in primary school and up to five years at secondary school. More than half of the country's children receive the Final two years of their primary education in an intermediate school.

There are about 2500 primary schools and over 400 secondary schools, catering for about 500,000 and 250,000 students respectively. Many of the primary schools are small and in a rural setting with 1-3 teachers. About 4% of all schools are privately owned and operated.

Prior to 1989, the education system in New Zealand was centrally organised. Although school curricula and syllabuses were determined nationally, schools had flexibility to interpret the national requirements to suit their individual circumstances. Education was administered through ten Education Boards and a Department of Education. In 1989 substantial changes commenced as part of government social and economic re-forms.

3. REFORMS IN NEW ZEALAND EDUCATION

ADMINISTRATIVE

Over the last seven years, education in New Zealand has undergone fundamental and wide-ranging change. These reforms were part of wider Government social and economic reforms designed to strengthen the economy and enhance social cohesion. The purpose of the educational reforms was to make education more responsive to the needs of the community and to make schools more accountable for the way they used publicly owned resources.

The key common principles in the reform of all sectors included:

i Charters
ii Devolution
iii Bulk Funding
iv Review

KEY PRINCIPLES OF REFORM

i Charters

All education institutions receiving Government funds must have charters which indicate what they will seek to achieve. These charters are approved by the Minister of Education. In developing their charters, there is a clear requirement that institutions consult with their local community.

ii Devolution

Employer responsibilities and management are devolved to the individual institution level. This includes senior staff with managerial responsibilities being employed under individual contracts.

iiiBulk Funding

All government-funded education institutions are "bulk-funded," based on formula allocation systems, to provide for their salary and operating costs. The control of input expenditure is minimal.

iv Review

The performance of all chartered institutions is reviewed by the Education Review Office against their agreed charters and the requirements of the Public Finance Act.

The general themes and principles of Government education reform, in particular the devolution of administrative responsibility and management to institutional boards of trustees, required the establishment of a number of new agencies and new mechanisms for accountability, review and management. These included a Ministry of Education, replacing the former Department of Education; an Education Review Office; a New Zealand Qualifications Authority; a Special Education Service; an Early Childhood Development Unit; and a Teacher Registration Board.

The overall aim of the administrative reforms was to improve the quality of education for all New Zealand children. There was a major underlying commitment to greater equity. To achieve this aim, the reforms aimed to improve administration of education by providing more effective management and greater community participation in schools. It is also important, however, to view the reforms as part of the general movement for greater accountability in education.

CURRICULUM

As part of the reforms in education in 1989 the rather large and bureaucratic Department of Education, including the Curriculum Development Division, was dissolved and a leaner Ministry of Education was established. Curriculum development is now undertaken in a different way - by contractual arrangements. The Ministry of Education has a Learning and Evaluation Policy section responsible for developing policies for the development of the New Zealand Curriculum, and a Curriculum Implementation Division responsible for the letting and monitoring of curriculum contracts.

THE DEVELOPMENT OF THE NEW ZEALAND CURRICULUM FRAMEWORK

During the late 1980's there were calls for a more coherent curriculum policy. Following its inception in 1989, the Ministry of Education began developing a comprehensive framework for a new New Zealand Curriculum.

In May 1991 a draft document *The National Curriculum of New Zealand* was issued to schools for comment. After widespread consultation this draft document was revised and published in May 1993 as *The New Zealand Curriculum Framework.*

The New Zealand Curriculum Framework is the policy statement for teaching, learning and assessment in New Zealand schools. This statement and the associated national curriculum statements [1] set national directions in education and provide a basis for clearly indicating to parents, students, teachers and the wider community what should be taught and learned during the compulsory period of schooling. The framework has the following elements:

- *Principles - the broad curriculum fundamentals*
- *Essential Learning Areas - the broad aspects of knowledge and understandings for all students*
- *Essential Skills - the skills and qualities for all students* [2]
- *Attitudes and Values*
- *Assessment*

One of the seven essential areas of learning described in *the New Zealand Curriculum Framework,* and a new area of learning for New Zealand schools, is technology.

4. THE DEVELOPMENT OF THE TECHNOLOGY EDUCATION CURRICULUM

BACKGROUND RESEARCH

In 1989 a research project was set up to study students' concepts of technology and attitudes to technology. The research instruments used were those developed at the Eindhoven University of Technology (as part of the PATT project) in The Netherlands and used in many countries. The PATT tests, together with an open-ended question, were administered to a national sample of year 8 students.

It was found that New Zealand students had poor concepts of technology but positive attitudes, to technology. Many students perceived technology to be the physical products of recent developments such as computers and high technology equipment, and of overall benefit to human beings. Concepts were positively related to attitudes. Boys had generally better concepts than girls, though girls were less likely to gender-stereotype technology. Concepts and attitudes were generally better among higher ability than lower ability students, European students than Maori students, students taking technical studies than students not doing so, and boys in single-sex schools than boys in co-educational schools.

It was decided in 1991 that further developments in technology education needed to be based on research about how students develop technological skills and understandings. A survey of overseas literature revealed that there had been little research in this area. As a result a three year research project, *Learning in Technology Education (LITE),* funded by the Ministry of Education, was let to the Science and Mathematics research Centre at the University of Waikato. The research questions investigated were:

- What are the technological capabilities of students?

- What are appropriate teaching strategies for developing the technological capabilities of students?

- What are the appropriate curriculum models for the teaching and learning of technological capability?

Information from this project provided information and direction to the Ministry of Education regarding the development of technology education and to teachers about learning in technology and appropriate strategies for the teaching of technology.

THE FRAMEWORK FOR THE TECHNOLOGY EDUCATION CURRICULUM

During 1991 a major literature search was undertaken by officers in the Ministry. Discussion papers arising from the literature search and review of overseas curriculum documents were made available on request and have been helpful to teachers and educators seeking further information.

In November 1991 the Learning Media section of the Ministry of Education distributed a video to schools showing some current technology initiatives in schools and in March 1992 a discussion booklet *So this is technology* was issued to schools based on teachers' suggestions and questions. Both of these items were designed to encourage discussion about technology education. A further discussion document *Technology in Schools* was issued in June 1993.

During 1992 a series of policy papers were prepared for the Minister of Education suggesting a framework for technology education. These papers formed the framework for the development of the draft curriculum statement for technology education. Over 200 teachers were involved in the preparation of the statement, as well as people from business and industry. The draft statement was distributed to schools for trial and comment in December 1993, and all teachers were invited to comment. The statement was revised in the light of the comments and the final statement was issued to schools in October 1995.

THE TECHNOLOGY CURRICULUM STATEMENT

The curriculum statement commences with a definition of technology and technology education:

Technology is a creative, purposeful activity aimed at meeting needs and opportunities through the development of products, systems and environments. Knowledge, skills, and resources are combined to help solve practical problems. Technological practice takes place within, and is influenced by, social contexts.

Technology education is a planned process designed to develop a student's competence and confidence in understanding and using existing technologies and in creating solutions to technological problems. It contributes to the practical development of students, as individuals and as informed members of a technological society.

And a rationale for technology being introduced as an essential learning area. The aim of including technology within the curriculum is the development of technological literacy through the development of:

- technological knowledge and understanding:
- awareness and understanding of the relationship between technology and society.

These three objectives lead directly to the three inter-related learning strands and their associated achievement objectives. The strands are:

- technological knowledge and understanding;
- technological capability;
- technology and society.

The curriculum statement specifies seven technological areas. The technological areas are as follows:

biotechnology involves the use of living systems and organisms to manipulate natural processes in order to develop processes and products to benefit people;

electronic technology and control technology includes knowledge and the use of electrical and electronic systems and their use in the design, construction, and production of systems and devices, from simple electrical circuits through to integrated circuits, robotics, and control systems:

food technology includes the understanding and use of safe and reliable processes for producing, preparing, presenting and storing food and the development, packaging and marketing of foods;

information and communications technology includes systems that enable the collection. structuring, manipulation, retrieval and communication of information in various forms This includes audio and graphical communications, the use of electronic networks, and interactive multimedia:

materials technology includes the investigation, use, and development of materials to achieve a desired result; knowledge of different types of materials; and the processing, preservation, and recycling of materials;

process and production technology includes both the manufacture and assembly of products from individual components; the processing of fluid-bulk raw materials; primary production of agricultural and forest products; transportation;

structures and mechanisms includes a wide variety of technologies, from simple to complex structures, from simple to complex mechanical device';

Most technological activities which students undertake will address all, or a number, of these strands. Some sample learning experiences and assessment examples are described for each technological area.

The curriculum statement has been supported by production of a television series *Know How* designed to inform parents, teachers and the community about the nature of technology education and what will happen in classrooms. Official implementation of the curriculum statement is from the beginning of 1997.

5 BACKGROUND TO THE USE OF INFORMATION TECHNOLOGY IN SCHOOLS

COMPUTERS IN EDUCATION DEVELOPMENT UNIT

Computing courses were introduced into New Zealand schools in the 1970's. With the availability of microcomputers in the late 1970's and early 1980s the potential for the use of computers in education was recognised. In 1982 the Department of Education set up the *Consultative Committee on the Use of Computers in Schools.* Following the release of the report of this Committee a Computer Courseware Unit was established within the Curriculum Development Unit of the Department of Education. This Unit later was renamed the Computers in Education Development Unit (CEDU). A major project involving the evaluation of educational computing in New Zealand was commenced by the CEDU in 1987. This project was known as the *Exploratory Studies in Educational Computing.* Schools in this project were given or loaned hardware and the research aspect of the studies was evaluated by the New Zealand Council for Educational Research.

These studies had enormous impact on the use of information technology in New Zealand schools. The case studies arising from the action-research provided, valuable models for schools on the potentially most useful classroom activities.

Many of the teachers who were involved in the exploratory studies are now in key positions as advisers and trainers of other teachers.

The restructuring of education in New Zealand in 1989 led to the closing down of the Computers in Education Development Unit. This ended the provision of any central co-ordinating agency for educational computing in New Zealand.

ADVISERS IN EDUCATIONAL COMPUTING

Six advisory positions entitled District Adviser in Educational Computing were established in 1990 and one adviser was linked to each of the six Colleges of Education. The advisers attempt to keep abreast of emerging technology and give advice to schools on both the administrative and educational use of computers.

All colleges of education also have specialist staff to co-ordinate information technology courses for pre-service teacher training. Today educational computing, as a separate study, is receiving less emphasis. It is now more common for colleges to incorporate the use of information technologies across subjects in the curriculum such as science, art, music, and social studies.

CONSULTATIVE COMMITTEE ON THE USE OF INFORMATION TECHNOLOGY IN EDUCATION (1990)

In 1990 the then Minister of Education established a Consultative Committee on the Use of Information Technology in Education. The Committee made three recommendations in their report (Sallis Report). They were:

that the government make a commitment to a major upgrading of the levels of teacher professional development and support and service for school communities and boards of trustees in the use of information technology across the school curriculum;

that the government immediately establish a contestable equity fund for the purchase of hardware and software;

that the New Zealand curriculum objectives assert the importance of appropriate applications of information technology in learning.

The recommendation relating to teacher development was immediately acted upon and contracts for teacher professional development have been offered each year subsequently. The proposed equity fund was not established, and the essential skills in *The New Zealand Curriculum Framework* assert the importance of information technology skills.

IEA STUDY (1991)

In 1991 the Research Division of the Ministry of Education published a report on computers in New Zealand schools based on the results of New Zealand's involvement in the International Association for the Evaluation of Educational Achievement (IEA) study on computers in education.

The information for this report was gathered during 1989 before changes of government and education policies. The report provided data which supported the recommendations of the Consultative Committee on the Use of Information Technology in Education. The report stated:

Data showed that there was a strong call for major training programmes for teachers to be implemented if computers were to be used successfully within education in subjects other than computer studies.

The study also noted that there was a need to look at teaching methods, and to give teaches confidence to accept, and capitalise on the fact that students often have more knowledge about computers than the teacher does.

THE CONSULTED REPORT (1992)

This report *The Use of Telecommunications Technologies for the Enhancement of Educational Services,* commissioned by the Department of Prime Minister and Cabinet, focussed on the uses of telecommunications technologies in school and tertiary education, particularly their use in distance education. It also discussed workplace based training. The report made a number of recommendations, many of which have since been implemented.

6. INFORMATION TECHNOLOGY IN NEW ZEALAND SCHOOLS

In common with the rest of the developed world, uses of information technology in education in New Zealand have focussed in three broad areas: educational administration; the "ordinary" classroom; and facilitation of distance/open learning opportunities. The most recent survey undertaken by New Zealand Telecom in late 1995 reported that there was one computer per 18 students in primary school and one computer per 10 students in secondary schools. Half of the computers in the schools were more than three years old. Statistics from a Ministry of Education survey show that there is a ratio of one computer per 15 students and that a high proportion of schools have one or more CD Rom drives.

EDUCATIONAL ADMINISTRATION

The most up-to-date information available suggests that all tertiary institutions and secondary schools, and almost all primary schools, are using computer technology to facilitate elements of their administrative or office procedures.

Observers in the field report that all schools routinely use word processing software and spreadsheets for administrative purposes. More than 97% make extensive use of facsimile and an increasing number make use of e-mail. Many use sophisticated software publishing programmes to develop news sheets for communication with their communities.

Primary schools are using a variety of data file-handling computer programmes to record and process roll, class, and pupil details. Various programmes are used to record and process financial and asset records.

Secondary schools use a variety of software applications (from fully integrated relational data bases to suites of separate packages) to record and process for example: timetable; roll; class; and pupil details; achievement profiles and records; and Financial and asset management information.

The Schools Electronic Network (see chapter 10) was originally established to improve information flows between schools and the Ministry of Education.

THE "ORDINARY" CLASSROOM CURRICULUM

Computers have been used in New Zealand schools for a variety of teaching and learning purposes since the 1970's. In primary schools most computers are located in individual classrooms while in secondary schools traditionally computers have been located together in computer labs. However, today there is. an increasing tendency to locate some of the computers in classrooms dedicated to particular subject areas, i.e. in the science area for data logging exercises; in the graphics area for computer-aided drawing. Information technology is considered important in the classroom for three fundamental (not necessarily exclusive) reasons:

- information technology as a tool for learning;
- as an aspect of modern life information technology needs to be learned about in its own right;
- information technology to enhance the delivery" or the learning of thetraditional curriculum.

A TOOL FOR LEARNING

The most widespread applications in classroom learning are productivity tools. Word processing and publication programmes are very commonly used in the learning and practising of written composition especially in primary schools; spreadsheets, and data analysis and presentation programmes are often used in numerically rich curriculum areas such as science and maths; data file programmes are often used in situations where students are developing classification skills such as in social sciences. Various kinds of computer aided drawing programmes are used in art, music and technical subjects.

Since the mid 1980s an increasing number of schools have been using e-mail to communicate with other schools and educational institutions. Some schools are also linked to the National Library and the New Zealand Bibliographic network. Today approximately 61% of secondary schools and 39% of primary schools report using on-line services. A small number of schools have full access to Internet and World Wide Web but costs of access are preventing other schools from making use of this service.

A number of educational computing applications that might be called "virtual learning environments" have proved useful in New Zealand classrooms and overseas. This genre of software includes simulations such as virtual laboratories and problem solving/decision making "games" which require students to apply thinking, communication, decision making, or mathematical skills relevant to their current area of learning,

LEARNING ABOUT INFORMATION TECHNOLOGIES

The need for students to become confident and competent users of information technology has been a motivation in most schools' decisions to introduce computers into classroom programmes. While in the 1980s computer awareness was an explicit rationale for computing courses today most schools have seen the development of computer awareness as an implicit rationale, that is a goal which will be achieved as a byproduct of achieving more directly curriculum related benefits.

While in earlier computing courses the teaching and learning of computer programming was an important aspect today most courses now concentrate on the use of application software for problem solving.

Some schools have also introduced students to the idea of computer control by interfacing computers to electromechanical (robotics) devices. Given a particular problem students design and then build appropriate devices and write computer programmes to control the devices in solving the specified problem.

COMPUTER AIDED LEARNING/COMPUTER MANAGED LEARNING

A number of educational institutions have used computer aided instruction and computer managed learning programmes. Some programmes are particularly engaging and students enjoy using them (particularly relative to "ordinary" classroom experiences). However, there is little evidence that the use of this kind of software produces better learning gains than "ordinary" classroom experience. The programmes have been most successful with students of lower ability or with students who have specific skills in need of remediation and which can be improved by repeated practice.

DISTANCE EDUCATION/OPEN LEARNING

New Zealand has a long history of successful provision of distance learning. Correspondence education was initially stimulated by difficulties of conventional school access for children in geographically remote locations. The clientele for distance education now spans primary, secondary and adult students with diverse reasons for not attending conventional institutions. Additionally many secondary school students who are enrolled in "ordinary" schools use distance education programmes delivered by The Correspondence School [3] to study subjects which are not available at their schools.

At the tertiary level two universities offer distance education courses and the polytechnics have been active in providing a wide range of distance education courses.

In 1985 more than 70,000 students were enrolled in distance education courses.

Distance education in New Zealand has embraced the use of broadcast radio, telephone services and the use of 0800 numbers, broadcast television and recently satellite television, desk top video, delivery of audio and videotape materials, and computer disk based materials, including CD Roms.

The use of electronic mail and bulletin boards and audiographic networks is now an important aspect of distance education, particularly in rural areas in New Zealand. This has resulted in an increasing number of telephone lines coming into schools. Most primary schools, except small primary schools, have two or more lines and secondary schools have three or more lines.

7. TEACHER DEVELOPMENT IN THE USE OF INFORMATION TECHNOLOGIES

A major emphasis in New Zealand over the last six years has been the training of teachers to use new information and communication technologies effectively in the classroom. Over that period the Government has committed over $5.0 million to teacher training in the use of IT and more than 8000 teachers have received school-based training. These teacher development courses have been evaluated by independent researchers who have provided feedback to the Ministry of Education on how successful the programmes were in providing effective training for teachers. These teachers are now confident and competent users of technology in their classrooms and are often involved with assisting other teachers to be more effective users of technology. In

[3] The Correspondence School is the sole provider of distance education for primary and secondary school students in New Zealand.

- addition most trainee teachers in Colleges of Education undertake training in the use of information and communication technologies.

The snowball effect of this group of teachers growing ever larger as they share their skills with others is leading to a leaching force who are, more and more, making effective use of technologies in the classroom. However technology is changing at a rapid rate and teachers are having difficulty in keeping up with the advances, e.g., use of Internet. A further problem is that teachers skilled in the use of information technologies are actively recruited by industry.

8. FUNDING OF INFORMATION TECHNOLOGY IN SCHOOLS

lip until the end of 1989 almost all computer equipment in schools had been financed by parent contributions or community fundraising schemes to the value of about $60 million. Although there is no conclusive evidence available it is reckoned that most of the further $55 million worth of computing equipment placed in schools since the review of educational administration in 1989 has also been financed directly by parents or local communities. Since 1989 schools have been bulk funded for operations and schools have been able to use funding from their Operations Grant [4] to purchase information technology equipment. Rural schools have also been able to obtain funding through a proposals pool for innovative curriculum delivery.

As a rule of thumb it is generally held that a sum equivalent to about 40% of initial capital cost should be budgeted annually for: costs of software and consumables such as paper or floppy disks, line usage, maintenance costs, and for provision for replacement. On this basis schools should be budgeting about $46 million annually to cover the ongoing costs generated by the currently installed equipment. No Figures are available about what schools actually budget for these costs. However over the last two years many schools have realised the need to budget in this area and an increasing number have information technology plans. Recently the Ministry of Education put out a planning kit to help individual schools develop an information technology plan for their school.

Government initiatives in the information technology area have been focussed mainly on teacher development and on providing seeding funding for pilot projects such as the use of audiographics, development of CD Roms, use of satellite television, desk top video conferencing, schools electronic network, and exploratory studies in educational computing.

9. INFORMATION TECHNOLOGIES IN POST COMPULSORY EDUCATION

Post compulsory education providers are bulk funded on a equivalent full time student (EFTS) basis. Within this funding they decide the proportion to be spent on information technologies. While no Figures are available observers report that all institutions use computers for administration and most make provision for extensive student and teaching staff use. Some institutions arrange for students to have e-mail addresses. Two universities and several of the polytechnics offer distance learning courses which, besides print based materials, also make use of a range of telecommunications technologies for course delivery.

[4] Calculation of the Operations Grant did not include resourcing for computing equipment.

10. CURRENT AND RECENT INFORMATION AND TELE-COMMUNICATION TECHNOLOGY PROJECTS

DEVELOPMENT OF INTERACTIVE CD ROMS

The Ministry of Education contracted The Correspondence School in 1993 to produce interactive CD ROM's - one in beginning Japanese and one in translation geometry. (This was at a time before there were any commercial developers of CD Roms in New Zealand.) These were trialed in schools and are being used in distance education courses. A more extensive CD Rom in Japanese is currently being developed.

ELECTRONIC NETWORK LINKING SCHOOLS

The Ministry of Education has a text-based network the *Schools Electronic Network* linking approximately 500 schools and with approximately 4000 active users. Over the next few years this network will be expanded to eventually link all primary and secondary schools. The network includes bulletin boards and electronic conferencing facilities. New Zealand Telecom also has an educational network. *New Zealand On Line,* to which about 500 schools are linked, and Massey University has a smaller educational network linking about 200 schools. In all nearly one half of New Zealand schools are connected to electronic networks.

AUDIOGRAPHICS FOR RURAL SCHOOLS

Over 60 schools are connected in various clusters via audiographic networks. This enables teachers in schools to have classes spanning several schools. Over 20 subjects are delivered in this way. Funding ha:, recently been made available to further rural schools to implement this technology and so be able to offer students a wider range of courses.

DESK TOP VIDEO

Two remote schools and one city school were linked to The Correspondence School for this project. Courses in languages and social sciences were delivered to students. Both teachers and students were enthusiastic about the potential of desk top video for delivery of teaching and learning to small groups. At the time of the trial it was considered that until costs of hardware and software became more reasonable this technology was beyond most schools budgets. Since this trial some schools have been using the See You See Me product (slow scan video) and report favourably on its use.

SATELLITE TV DELIVERY OF EDUCATIONAL PROGRAMMES

In 1995 the Ministry of Education contracted The Correspondence School to undertake a pilot study in the delivery of languages and technology education via satellite. There are 90 official trial schools and 30 other schools who receive the broadcasts. Programmes in three languages and technology are broadcast daily. This is the first use of satellite delivered TV in New Zealand by any institution or commercial organisation. To date the trial is going very well.

USE OF WORLD WIDE WEB (INTERNET) FOR THE DELIVERY OF EDUCATIONAL MATERIALS AND PROGRAMMES

The Ministry of Education has home pages on World Wide Web (http://www.govt.nz/ps/mi.n/edu/) where information about curriculum and administration is available. A trial is being undertaken with ten schools to determine the viability of using World Wide Web as a replacement for the text-based schools electronic network mentioned earlier. It is estimated that currently approximately 100 schools access World Wide Web through a commercial provider.

11. FUTURE DIRECTIONS

TECHNOLOGICALADVANCES

The rate of increase in the number of possible applications of computers has been as rapid as the change in computing technology itself. Developments in multimedia which enable users, in an interactive way, to access text. sound, still and video pictures, potentially provide a number of rich learning opportunities. The rapid growth of the Internet and the resulting access to vast amounts of information, to international discussion groups, and access to up-to-the minute research provides exciting learning opportunities for students. As "broad band" technologies become available these technologies have great potential for facilitating educational interactions between students and learning materials, and between students at physically remote locations. Technologies such as video conferencing and Internet provide an infrastructure for more open learning opportunities.

EDUCATIONAL OUTCOMES

A great deal of the literature on the use of information technology in education reports on: the enthusiasm and engagement of students; the changed but important role of the teacher; the apparently enhanced role of the teacher; greater productivity; and enhanced co-operation between students. These findings are important because the changes in learning behaviours which students exhibit when using computers appropriately, are strong indicators that enhanced achievement will result. Papert in *The Children's Machine,* explains that the extension to human capability conferred by modern information technology changes the nature of knowledge itself. The fundamental questions of learning are no longer "what?" but "how?" "why?" and "how do I know?" Access to information has the potential to change the role of the learner from just seeker of answers to asker of more questions. Recently schools have been set up whose curriculum is supported by an information technology-rich learning environment. While it is too soon to say what the long term effects of such schooling are interim conclusions are positive. It is important to observe such experiments.

A further issue is whether in fact developments in information technology will make schooling less relevant and students of the future may learn from home, or other community institutions such as the library, using information technologies. This perspective ignores some of the important outcomes of schooling including socialisation. While some students may prefer to learn in this way it is still considered in New Zealand that in the foreseeable future most students will still attend schools. However, advances in technology will change the role of the teacher and of the school. In some curriculum areas students will learn mainly through information technology and in other areas through more traditional teaching methods. Information technologies will generally support and enhance the work of teachers.

FUNDING

Two particular thrusts are being considered by Government in New Zealand: provision of one computer per five students in schools and secondly to ensure all schools have Internet access. The costs of providing a ratio of one computer per five students together with on going maintenance software and replacement cost have been provided to Government and are Still being considered by Government. With regard to Internet access some clusters of schools are organising joint purchasing arrangements with providers, but this is moving slowly because of the high costs of Internet access in New Zealand.

PRINCIPLES

Whatever possible roles are considered for government, whether that be intervention strategies, or support for research or development projects, it is proposed that the following principles be adapted as a basis for future decision making.

Information technologies should he considered for use in education only if {here is good reason to believe that they will

- *increase student choice; and/or*
- *increase access to learning opportunities; and/or*
- *provide enhanced learning opportunity, and/or*
- *increase the productivity of students: and/or*
- *provide unique opportunities to learn IT skills.*

12. SUMMARY

The past six years has been a time of great change in New Zealand education. A new administrative structure has been put in place and major curriculum reforms, involving the total curriculum, are now more than half completed.

The importance of including technology as an essential area in the curriculum has been recognised as has the need for students to be able to access and use information and communications technologies for a range of purposes. Government has accorded in-service professional development programmes for teachers a priority. A range of initiatives are underway for ensuring that teachers are confident and competent users of technology; in encouraging the use of new information technologies in the classroom, and for distance education and open learning. Some of the initiatives, it is hoped, will be a catalyst to encourage schools to undertake further initiatives. As evaluations of these initiatives are undertaken these will give an indication of where future funding is best directed in terms of the use of new technologies for enhancing teaching and learning.

Exciting developments are occurring in information and telecommunications technologies. The potential of these technologies to support and enhance teaching and to provide new and exciting approaches to learning for students is being recognised by Governments' worldwide, particularly as part of wider social and economic reforms designed to increase productivity and competitiveness.

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[1] There is a national curriculum statement for each of the seven essential learning areas.
[2] Two information technology skills specified in the essential skills are:
Students will:
- become competent in using new information and communication technologies, including augmented communication for people with disabilities (p 18);
- be able to use a range of information-retrieval and information processing technologies confidently and competently (p 18).

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NATIONAL REPORT OF NORWAY

NATIONAL REPORT ON NIT IN EDUCATION IN NORWAY

NTRODUCTION

The use of NIT (New information technology) in Norwegian schools, colleges and universities has developed gradually over any years. The number of computers in schools seems to have doubled every 2-3 years. Several national plans have been launched and carried out over the last 10-15 years, and the last one, for the period 1996-99, was presented in August 1995.

The 1996-99 plan is based on a white paper to the parliament, submitted in January 1994 and handled in the parliament (Stortinget) in May the same year. The parliament stated that a high educational level in the population is a prerequisite for the further development of the Norwegian society, and also for our contribution to development in poorer countries. Equal access to education and training for everybody, independent of residence, sex, social background, handicap or disabilities are basic and fundamental principles in the Norwegian educational system.

Therefore all educational institutions, from primary level to university are directed to show continuous attention to this area, to secure a good general knowledge in this field, and to avoid the development of new differences between those who master NIT and those who do not.

THE EDUCATIONAL SYSTEM IN NORWAY

Children in Norway start school at the age of seven, (from 1997 they will start at six) and the compulsory school lasts for 9 (10) years. However, more than 90% of the pupils also enter the upper school, either to study general subjects leading to higher education, or vocational subjects leading to a profession. And since all pupils now have got a right to three years of upper secondary education, soon 90-95% of the young people will have 12 years of formal education.

Name:	Grade	Age	Description		
Grunnskole	1 - 6	7 - 13	Primary school		compulsory
Ungdomsskole	7 - 9	14 - 16	Lower secondary school		
Videregående skole	10 - 12	17 - 19	Upper secondary school, General subjects	Upper secondary school, Vocational subjects	
HØgskole universitet			College, university	Apprenticeship	

SCHOOL OWNERS

In general terms the primary and lower secondary schools (compulsory) are owned by our 435 local municipalities (kommuner), the upper secondary schools are owned by the 19 countries (fylker), while most of the colleges and all universities are state-owned.

The national control of primary and secondary schools is secured through national syllabus, laws regulations, circulars and other documents.

On average, 40% of the local budgets are distributed on a national level to ensure that all units can afford a high quality school-system. Most of these money is not for specified use to ensure autonomy of expenditure.

According to the NIT action plan the school owners are responsible for the supply of computers, software, facilities and maintenance.

STATISTICS

In the beginning of 1995, Statistics Norway (SSB) carried out a survey on behalf of the Ministry of education to determine the state of NIT in different parts of the educational system. This survey had four parts:

1. To determine the situation regarding computers, software and other equipment, and how this equipment is being used in different subjects.
2. Asking selected students in primary and secondary schools about their experience regarding the NIT situation at the school, and their access to computers at home and at school.
3. Questioning students in higher education about their access and use of computers and software at home and at their institutions.
4. Questioning teachers in primary and secondary schools about their opinions regarding the NIT-situation in their school, and their access to computers both private and their teaching situation.

SOME FINDINGS

Gender Issues

There is a considerable difference between boys and girls in this field. Boys are much more interested in NIT than girls. Boys who have access to a computer at home are using it a lot more than girls in the same situation. the same difference appears at all levels of education.

Number of students who have access to PC (personal computer) at home

School level	Boys	Girls
Lower secondary level	62%	52%
Upper secondary level	66%	51%
Higher education	69%	56%

Parents education

In homes where one of the parents have higher education, many more students have access to computers at home than in families where the parents have the basic education only.

	Highest level of formal education	Pupils with access to PC at home
Father	Lower secondary school	40%
Father	Upper secondary school	51%
Father	Higher education	80%
Mother	Lower secondary school	48%
Mother	Upper secondary school	55%
Mother	Higher education	73%

Density of PC's at schools

Upper secondary school appear to have the highest density of computers. There is one modern (Windows) computer available per 11 students. In primary (PS) and lower secondary (LS) schools the situation has improved since 1992, but a lot of new computers were bought for administration, and hence not available for pupils.

Number of pupils/students per computer in schools

	PS	LS	US	HE
PCs for pupils:				
- Windows PCs	75	41	11	29
- All types	21	20	8	24
PCs in total:				
- Windows PCs	40	25	8	8
- All types	20	14	6	6

There are significant regional differences. The Oslo area (Capital) has the lowest density while the northern and western parts of Norway have the best situation.

Schools in rural areas have significantly higher computer density than the cities.

Small schools are better off than large schools.

Teachers

Teachers at all school-levels, both male and female, are generally interested in NIT and they are or want to become personal computer users.

Teachers have access to computers at home to the same extent at the population in general, but there are some interesting findings regarding teaching level, sex and age.

Teachers with access to PC at home

	male	**female**
	Age less 45	
Primary school teachers	46%	60%
Lower secondary school teachers	48%	66%
Upper secondary school teachers	54%	78%
	Age 45 and above	
Primary school teachers	53%	48%
Lower secondary school teachers	60%	56%
Upper secondary school teachers	76%	70%

A large part of teachers call themselves "personal computer users", 60-75% in secondary schools.

Access to computers at home

In all the main groups of pupils/students and teachers in the survey, more than 50% have access to a computer at home.

Number of persons with access to computer at home

	Have access to PC at home
Lower secondary school students	57%
Upper secondary school students	59%
Students in higher education	62%
Primary school teachers	53%
Lower secondary school teachers	57%
Upper secondary school teachers	70%

NATIONAL PLAN FOR 1996 - 99

The NIT plan is an element in the realisation of the general objectives in the sector of education. The parliament has stated some key objectives for NIT in education:

- improve the learning environment for each single pupil and student;
- create a ground for new ways of teaching and learning;
- enable each pupil/student to evolve their talents and to realise their own goals better than before;
- give equal opportunities independent of sex, age, residence area and ethic background;
- give persons living outside school facilities an option to study at their home;
- increase international contact and understanding;
- become and integrated aid where suitable, in all subjects and at all levels of the educational system;
- increase the level of knowledge and skill in society and at work;
- use of domestic and foreign databases.

INCREASE EFFORTS IN FIVE AREAS

The main activities on NIT in education can be subdivided into in five main areas as shown below:

Teacher education	Using NIT to learn	Organisation
	Learning to use NIT	
	Technical issues	

Using NIT to learn

This is the central activity and is about NIT being used as an aid for learning every subject, fro simple vocabulary learning and math learning aids, over to simulation in science, to collection of information from data bases and to making contacts and co-operation with schools and students everywhere in the world.

Learning to use NIT

Learning to master NIT, for example word-processing, spreadsheets, database tools and communication programs, tools that more and more people have to master in the future. "Learning to use" is also about achieving professional skills on NIT. Without a large group of competent NIT experts and competent teachers, Norway as a nation will not be able to utilise NIT to its full extent.

Technical issues

They are about the technological infrastructure which is needed for NIT, for example computers, communication lines and services, and information highways.

Teacher training

Without well trained teachers and personnel who are able to put NIT into practical use, any effort in this area would be useless. Because it is of such critical importance for success, teacher training has been set up as a separate main activity.

Organisation

Norway with its small population of 4.3 mill. cannot carry through the broad types of projects as can nations with large populations. the small group speaking Norwegian has certain consequences for publishers, market, funding and competence. To compensate for these disadvantages it is important to be well organised, to develop good co-operation, do the planning well and succeed to use the creatively and competence of existing organisations and institutions.

ACTIVITIES

In each of these five areas mentioned above, a number of activities are defined, each with a description and one or more bodies responsible for its progression. Totally, 31 activities are defined and described, a few of them will be mentioned here:

A: RESEARCH AND DEVELOPMENT ON PEDAGOGICAL USE OF NIT

The research in this area in Norway has been limited, so far, at the same time as the international market for educational programs has exploded.

Therefore we need to know more about how NIT best can be integrated in the classroom situation. Methods for use of NIT in education should be given priority in the ordinary R&D activities in the teacher education institutions and other educational research bodies

Besides using NIT in various subjects and topics, the possibilities for cross-curricular activities should be developed. It is also important to promote the use of NIT in different types of special education.

B: GIRLS USE OF NIT

All the information the NIT-plan is based on indicates a need to stimulate girls to be more aware of NIT from a very young age. There are reasons to ask if the ways NIT is being approached could be improved in order to adapt better girls and women way of learning.

C: THE STUDENTS AS A RESOURCE

Many teenagers have obtained a considerable knowledge of NIT, from within of from outside the school. The students may therefore constitute an important resource, and it is a challenge for the teachers to utilise these students knowledge, and to stimulate them to continue there development.

D: NIT FOR THE DISABLED

NIT opens many new opportunities for handicapped and disabled students. Through earlier programs, several activities have been carried out to utilise these opportunities. These efforts must be carried on. It is above everything from adapted keyboards and switches, through specialised software to the development of methods of education. Close contact and co-operation between all active units in this area is essential for the results. Special attention should be paid to training adults.

E: NIT IN ENVIRONMENTAL AWARENESS TEACHING

Hundreds of Norwegian schools already have experience over several years in the use of NIT as an aid in several national programs for environmental education. Use and analysis of satellite pictures is one of applications.

F: THE NORWEGIAN INTERNET BOOKSTORE (INFORMATION WELLS)

Most of information available on the Internet is English. Even books written by famous Norwegian authors are often available in English only. In this situation it is important, from a national point of view that also the Norwegian language texts are available.

The Norwegian Broadcasting Corporation are going to publish some of their material on WWW, and carry out a research-project where five Norwegian authors will be presented in a multimedia form.

the National Library has the responsibility to collect and keep all Norwegian literature. They are now in the process of producing digital copies of their archives and making the material available on Internet.

G: NEW ELECTRONIC AIDS FOR LEARNING

Piles of CD-ROM and other material for education are available today in English. Some of it may certainly be translated and adapted for the situation in Norway. At the same time, it is important to develop modern educational aids based on the Norwegian social and pedagogical traditions. Publishers should be encouraged to produce electronic aids for the Norwegian market.

H: CERTIFICATION OF NIT COMPETENCE OF "EUROPEAN COMPUTER DRIVING LICENSE (ECDL)"

Also the adult population need to develop and document their skills in NIT. Courses can be held at the workplace, through the national employment agency, through study or distant learning organisations and through ordinary schools at all levels.

The Norwegian Computer Society (DND) is developing a test and a certificate for general computer literacy, in co-operation with sister organisations in many European countries (CEPIS). The original idea comes from Finland where more than 10.000 persons already have passed the tests. The final test will probably contain several modules, covering subjects as word processing, spreadsheets, graphics, general NIT-knowledge and more.

A pilot set program has been carried out in Sweden, Denmark, Ireland, Netherlands and Norway, and the first certificates are supposed to be issued before the end of 1996.

I: NEW URRICULUM IN TEACHER EDUCATION

Up to now, many teachers have gone through a four year education without using a computer. NIT now has to be implemented in all teacher education as soon as possible. This is about integrating NIT in education of each subject. The Ministry of education is in the process of developing a new curriculum. In the meantime preliminary documents will be issued describing the goals and directions to go. This can be aid in educating the teachers of the teachers.

J: ACCESS TO GLOBAL NETWORKS

There will be established an infrastructure to allow all Norwegian schools to be connected to national and international computer networks (Internet). Several suppliers of services seem to become available as the telecom market will be opened for competition next year. It is important for education system to take advantage of this situation.

For security reasons it is recommended to keep networks and services for school administration separated from the education network.

All institutions in Norway for higher education are already tied together in an extensive network by Uninett A/S, a firm owned by the Ministry of education. The experience and competence of Uninett is an important asset in the process of connecting all schools.

K: THE LIBRARIES AS A MEETING POINT

Not all students will have access to computers and networks at home. And even if they have a computer they may not have access to all the software and services they need. The school-libraries and public libraries can contribute to solve this problem by giving access to computers, various software and network services.

ANNUAL WORKPLAN FOR 1996

On the 1996 budget the parliament has granted NOK 33 mill. in addition to the normal NIT-related programmes. A work plan has been made to define in more detail the distribution of these funds within the 31 activities in the main plan. There is an opening for schools, institutions and individuals to apply for a contribution to their projects, if it is within the framework of the NIT-plan.

OTHER FUNDING

These 33 mill. are only a small part of the funding that will be used for NIT in the Norwegian educational system.

For primary school NOK 5 mill. have been set aside fro special purposes.

Resources have been reserved to perform the necessary training of teachers in connection with introduction of a new curriculum in upper secondary school (Reform'96), and primary school (L'97). Part of it is familiarisation to NIT.

It is also understood that the state-owned and co-operative bodies, for example teacher education institutions will be using their own budgets to accomplish their part of NIT activities.

The largest part of the funding still comes from the schools and school owners. They are responsible for equipment, software, facilities, maintenance and so on.

NATIONAL REPORT OF PAKISTAN

EDUCATION POLICIES AND NEW TECHNOLOGIES IN PAKISTAN

THE CONTEXT

In recent years, remarkable development has taken place in information and communication technologies. Media combinations have emerged to shape the "Information Society". Similarly, education is challenged to re-examine its position critically, specially since technologies seem to develop faster than education has capacity to make use of them. In this paper the general structure and background of education system in Pakistan is documented before the initiatives of latest technologies have been listed. This is to make sure that the use of technologies may be taken in the right perspective keeping in view the challenges for improvement of both quantitative and qualitative issues regarding educating the masses

1. INTRODUCTION

Pakistan is an Islamic Republic with an estimated population of 128 million. The country has four provinces and four territories under federal administration. They are variations of topographic features, size and distribution of the population, status of social indicators, socio-cultural practices and languages. The economically has been growing but there is a dichotomy between economic and social indicators.

2. CONSTITUTIONAL RESPONSIBILITY

Education has been and continues to be primarily a provincial subject. However, under the 1973 Constitution, it has been placed on the Concurrent List and the Federal Government has been given the responsibility for policy, planning and promotion of educational facilities in the federating units to meet the needs and aspirations of the people. It also acts as the overall policy-making, coordinating and advisory authority.

3. EDUCATIONAL ACHIEVEMENTS AND LIMITATIONS

Pakistan inherited a weak educational set - up at the time of independence. Masses were illiterate and institutions insufficient to impart education to the children of the new state. Moreover, the system itself did not suit the aspirations and demands of an independent nation. Therefore, a National Education Conference was convened in 1947 which, interalia, recommended that universalization of primary education should be achieved within a period of twenty years. Since then, universalization of primary education has remained one of the cherished goals of all governments in Pakistan. New facilities and infrastructure have been created; cadres of trained manpower have been produced; various projects have been launched and attempts have been made to give the country an educational set-up becoming a free nation on march to progress.

When Pakistan came into being in 1947, there were only 8900 primary schools with an enrolment figure of 0.77 million. As against this, the number of primary schools in 1994-95, including mosque schools, are 123,119 with an enrolment of 16.7 million. The number of middle schools is about 13,615 in 1994-95 with an enrolment of 4.1 million, and about 12,513 high schools with 1.4 million students. The number of colleges (Arts, Science and Professional) is 802 with an enrolment of 706,656 while that of universities at 24 with 87,403 students. In addition, in 1994-95, there are 724 secondary vocational institutions with an enrolment figure of over 93,000. Participation rate at the primary stage is 71%, at the middle stage at 45% and at the secondary stage at 30%

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Levels of literacy between 35 and 40 percent result from low access to schools and a high dropout rate irrelevant curricula, un-stimulating teaching practices and unattractive environments do not offer incentive to poor families. Child labor, lack of sanitary facilities, and teacher absenteeism are other contributing factors.

The literacy rate among women is much lower than among men. Lack of participation in planning and management, as well as lack of support at home are key underlying causes - basis of which are social taboos, the feudal power structure and inequitable distribution of resources.

There is demotivation and apathy at the programme manager level while mechanisms for participation of communities are not fully developed. Participation of Non-Governmental Organizations (NGOs/Community-Based Organizations (CBOs) private sector, media, religious and political forces and extended families is limited. Little emphasis is given to coordination of efforts or impact assessment.

In terms of access to primary schools, of the estimated 20 million school-age population, 13 million, or approximately 70 per cent are enrolled in schools. Gross enrollment of girls is about 54 per cent. Half the number of children who enroll do not complete primary schooling. The implication is that input into the education system, i.e. school infrastructure, teachers and materials, whether provided by the government or donor and other development agencies, has not been matched by outcomes in terms of completion and student performance. This situation has raised serious concerns about such process parameters as quality of school administration and management, supervisory practices, teaching methods and the role of local communities in the education process. Introduction and implementation of Social Action Programme is a step forward to improve the situation, particularly in basic education.

Participation rate at the primary stage is estimated to he 71 percent, at the middle stage at 45 percent and at the secondary stage at 30 percent. Pakistan's literacy rate is only about 37 percent - 49 percent among male population and 24 percent among females. Literacy rate for both sexes in urban areas is 58% while in the rural areas it is 28 percent.

There is a large network of infrastructure and extensive system for delivery of the educational programmes. Education officials at district level are responsible to manage education delivery. However, only 40 percent of children complete primary education under this system. Reasons given include poor quality of services, non availability of basic supplies, inappropriate behaviour of service providers and cultural barriers.

The annual budget for education during 1993, 1994 and 1995 has been Rs.33.0 billion, Rs.44.0 billion and Rs.55.0 billion, respectively. The allocations represent an increase of almost 66 percent in two years. In terms of GNP, the allocations have registered an increase from 2.1 percent to 2.5 percent. The government has also introduced a Bill which, will ensure that minimum 3% of GNP is spent on education by the year 2000. The Eighth Five Year Plan has provided Rs.69.0 billion for education during 1993-98 which is three times higher than the provision of Rs.23.0 billion during the Seventh Plan period (1988-93).

4. EDUCATION POLICY

Pakistan is a developing country and struggling both for quantitative improvement as well as quality. The low literacy rate and the less-than-desired participation figures have been matters of grave concern for successive governments in Pakistan The present government has consequently given a New Education Policy in 1992. It set the following major targets to be achieved during the next ten years.

Keeping this situation in context and considering the challenges of the 21st century the following initiatives have been taken (which also include the use of modern technologies in education):

- Universal Primary Education (100 per cent participation);
- 106530 new Primary and Mosque Schools to be opened;
- 24,750 shelterless Primary Schools to be provided two-room buildings.
- 20,000 existing Primary Schools to be provided additional rooms.
- Major repairs to be carried out in 50,000 schools.
- 2,65,000 Primary School teachers to be trained.
- Predominant attention on girls education, both

in respect of enrollment and incentives.

- Employment of 265,400 Primary teachers.
- Adult/Functional literacy to be raised from 35 per cent to 70 per cent.
- Literacy programmes to be implemented by NGOs and the private sector.
- 50 per cent participation rate at secondary level.
- Almost 200 per cent increase in the number of vocational institutions.
- 500 Middle schools to provide technical education facilities.
- Polytechnic output to be doubled.
- More than 100 per cent increase in the enrolment of university education.
- High quality technical manpower produced by colleges of technologies to be doubled.
- Four universities in public sector and 16 universities in Private sector to be set up.
- Eminent role to be given to the private sector and NGOs in the implementation of the Policy.
- National Testing Service for Equitable Academic Reliability.
- Increased content of meaningful Islamic Education and improvement in the existing network, and
- Computer education at school level to be made part of curricula.
- The potential of electronic and print media will be fully utilized for motivating the public at large for supporting literacy effort, and for delivering the literacy programmes.

4.1. THE FOLLOWING CHANGES COULD BE SUMMARIZED AS THE INNOVATIONS OF 1992 POLICY (IN CONTEXT OF NEW TECHNOLOGIES INCLUDING TECHNICAL EDUCATION, USE OF COMPUTERS FOR EDUCATIONAL ADMINISTRATION AND STATISTICS AND VOCATIONAL ED UCATION

Implementation of the Policy during the next 10 years will cost Rs. 143 billion (Rs. 107 billion in Public sector and Rs. 36 billion in the Private sector). Recurring expenditure will be Rs.92.160 billion.

The present Government is reviewing the various programmes contained in the National Education Policy with a pragmatic approach and has initiated action to further improve them. An Advisory Council on Educational Reforms has already been set up.

In fact, the present Government has, from the very beginning, shown full realization of the need to revolutionize the education sector. This commitment is reflected in subsequent policy announcement and in resource allocations to primary education and the enrolment targets given in the 8th Plan. The allocation of the Plan for Primary Education is Rs.32669 million and the enrolment target at Primary Education level (classes I-V) is 15 779 million - 8.8 million for male and 6.97 million for females. Participation rate in percentage is projected to be 87.7 (95.5 for male and 81.6 for females).

4.2. TECHNICAL EDUCATION

The Government has also been actively working to encourage and promote technical education as it is fully conscious of the fact that a sound system of technical education and vocational training (TEVT), in line with the needs of the job market, is essential for the rapid economic development of the country. Over the years, there has been manifold increase in the number of technical/vocational education institutions with corresponding increase in enrolment.

In order to formulate long and short term strategies for the development of TEVT, a comprehensive study has recently been concluded and, based on its Findings, a project proposal has been drawn up, which aims at improving quality relevance and efficiency, equity, access to TEVT facilities and cost effectiveness. A project proposal costing USS 100 million, covering specific project areas - such as (i) development of TLVT facilities for boys; (ii) development of TEVT facilities for women: (iii) development of Commercial Education, and (iv) vocationalization of general education - has been conceptually cleared for loan organizations with the Asian Development Bank.

Like all other Fields of education, women are also receiving special attention in technical education. A Polytechnic Institute for Women has been established at Islamabad, which offers 3-years diploma programme in modern technologies, such as Computer, Architecture, Dress Designing and Electronics.

To back up the country's technical education programme, a National Technical 'readier Training College was established in 1987 to promote excellence in technical education. It regularly organizes long courses for in-service polytechnic teachers and short courses for the managers, administrators and planners of technical education. In addition, the College also undertakes industry-based and demand-oriented programmes. Beside the training facilities at NTTC, polytechnic teachers are also provided opportunities for training abroad. There also exists a programme to develop technical teaching/learning resource materials within the country.

4.3. TECHNICAL EDUCATION PROJECT

In pursuance of policy on technical education a project to be assisted by the Asian Development Bank will focus the rehabilitation and consolidation of the Polytechnic system in Pakistan. It will improve selected existing Polytechnic in the four provinces in terms of teachers competency, managerial and Financial sustainability, industry linkages and where appropriate, private sector's participation.

Under the project, two Polytechnic for Women, one for Quetta and the other for Sukikur will be set up, and 23 new technologies will be introduced in 30 institutions all over the country, in addition, 43 Polytechnic Institutes will be provided equipment and furniture, 610 teachers will be trained abroad and National Institute of Technical Education will be established to impart B.Ed (Technology) programme. It will be implemented during five years i.e. 1995-2001.

All the above projects are being generously funded by donor agencies. The total number of schools under these schemes comes to 35,000 catering to the needs of about 2.6 million children. However, this is not enough to make a real dent.

Much more needs to be done and is being done both to expand educational facilities and improve the quality of education.

4.4 COMPUTER LITERACY POLICY AND PROJECT

According to 1992 education policy the computer education has stressed:

Computer Literacy and computer education will be emphasized and made a part of education curricula at all levels. All training programmes for teachers, and educational administrators will include computer education as a compulsory component. Computer aided instruction will be used as an important tool for enriching teaching-learning process. Special funds will be provided for introducing computer hardware and software in schools. Science curricula will be designed so as to include computer-based creative educational activities.

As mentioned in the highlights of the 1992 education policy for including the computer education in school curriculum, the Ministry of Education, in collaboration with IBM, has launched a project for introduction of computer literacy for class VI-VIII in 150 selected schools throughout the country. Under this project, 2 computers and one printer is being provided with training of one teacher in each project school. Additionally in each of the project schools, one teacher will be trained for computer operation and use. The total cost of the project is Rs. 17.59 million including IBM donation of hardware for Rs. 13.4 million for a period of 3 years. The project initiated in 1993-94 has so far covered 90 schools throughout the country. This will be finally integrated with Prime Minister's Programme for Computer Literacy.

4.5. PRIME MINISTER'S VOCATIONAL EDUCATION AND TRAINING PROJECT

Based on the guidelines provided in an Inter-Ministerial meeting, the government has recently launched an innovative and productive Technical and Vocational Educational Programme. Costing approximately Rs. 1.00 billion. The programme aims to establish 70 Model Vocational Schools throughout the country with intake capacity of 12250. The project will impart demand oriented skills in order to provide jobs to the individuals and needed services to the society besides increasing the economic activity in the country and raise the living standard of the people.

4.6. USE OF COMPUTER FOR EDUCATIONAL DATA

For the proper development of the education sector, it is imperative that accurate and reliable information about all aspects of the system should be made available well in time to help enlightened decision making, pragmatic strategic planning and efficient administration on the one hand, and to ensure effective monitoring and evaluation on the other. Be it the targets set under SAP or be it the objectives of other on-going projects, development of the education sector can neither be objectively planned nor effectively monitored without the availability of scientifically collected authentic data about the existing facilities and future needs.

With this in view, a project called National Educational Management Information System (NEMIS) was launched in 1991 with the collaboration of UNDP, USAID and UNESCO. Under this programme, computerized EMIS centers were created throughout the country at district level and educational data under various indicators was collected and processed. By the time the project completed its life in 1993, its tremendous importance and relevance to the development of education had been fully realized and it was decided to extend its life with the World Bank assistance.

In its second phase, the project continues to work not only in all the four provinces as educational data collection mechanism but also at the federal level as a national data processing and analyzing center. It acts as a catalyst for the promotion and institutionalization of technical development of EMIS throughout the country.

Known as FedEMIS, the central unit receives data from the four provinces and, after consolidating with it the data collected by itself from the federally administered areas i.e. Federal Capital Territory, FATA, Northern Areas and Azad Jammu and Kashmir, present a comprehensive national picture of the country's educational scene. This data constitutes one of the most important components for the monitoring and evaluation of SAP and the various other programmes launched to promote education in the country.

4.7. USE OF TELEVISION/RADIO FOR EDUCATION

Pakistan television has established its second channel, which is exclusively used for educational programmes. These include both formal as well as non-formal programmes to promote literacy. This programme has its definite advantages as it does not require the infrastructure of school buildings, personnel and related facilities. In Pakistan, Allama Iqbal Open University (AIOU) has a mandate of educating people through its open packages. AIOU is also using, educational channel of PTV for its literacy massages and lessons. But there are certain in built short comings regarding the use of Television for educational purposes, particularly in developing country like Pakistan. Some of the difficulties in these initiatives can be the following. Literacy lessons are telecast at a particular time by the PTV, which may not suite all the illiterate population. There may be people who may not have electricity in their areas and still others who may have electricity but still not in a position to benefit from these telecasts due to technical constraints and limitations. There may be variations in the convenience and suitability of timings for illiterate population. For instance experimentation of literacy projects in various parts of the country revealed that female illiterates used to derive maximum advantage of literacy centers as they were located at convenient places closer to the houses of illiterate population. Timings of the Center were arranged with mutual consent of the teacher and the learners either in the morning or in the afternoon. This made the programme attractive for female illiterates. TV lessons on the contrary have fixed timings, which may not suit a sizeable number of people.

Radio also plays an important role in conveying and communicating important messages related to national development and well being of the society. Its main emphasis is on illiterate peasants and working community, which enjoys their leisure time listening to folk music and songs. But unfortunately, it does not provide the reading and writing skills, which are essential ingredients of literacy.

It is generally believed that computers and video games sharpen the memory and understanding of school going children. Their grasp of multimedia technology as compared to adults is sharper. They interact with computers through video games and easily develop mastery over electronic gadgets. On the basis of such assumptions certain schools have been provided computers but again it has to be seen how far the students have benefited from such facilities.

4.8. DIVERSIFICATION AND VOCATIONALIZATION

Side by side with the Universalization of primary education and eradication of illiteracy, emphasis is being laid on the diversification and vocationalization of education, particularly at the secondary level. The secondary level happens to be the terminal point for the majority of the country's youth, as they leave schooling after this stage and go out to join the world of work. Hence, the need for equipping them with relevant, knowledge, skills and work attitudes and enable them to contribute effectively to the development of the country as useful citizens. Moreover, the secondary stage is a preparatory stage for higher education and, therefore, it is necessary to impart at this stage a kind of education, which provides basic foundation relevant to the requirements of higher education. With this in view, stress is being laid on stronger diversification and vocationalizing of education to enable each individual to opt for the vocation of one's choice or prepare the persons adequately for higher studies. To achieve these targets, various programmes and projects have been launched to overcome the deficiencies and improve the overall quality of education at the secondary level. Science education obviously receives a very high priority.

In an effort to make qualitative improvement and quantitative expansion in the field of science education, a Science Education Project (cost Rs. 1.0 billion) for secondary schools was launched a few years ago. It is about to complete its life after attaining almost 95% of its targets. In addition to the construction of science rooms and laboratories in middle and high schools, development and provision of science kits and improvement of science teachers' capabilities and skills, the project also envisaged the establishment of an Institute for the Promotion of Science Education and Training (IPSET). This Institute has already been set up in Islamabad with a network of four regional Science Education Centers, one in each province.

In line with the new approach outlined above, steps have also been taken to provide facilities for creating computer awareness and promoting their applications in schools to prepare the youth to face the challenges of the 21st century. A project has been developed for introducing computer literacy in 150 secondary schools across the country. Phase-I and Phase-II of the project have already been completed, under which 40 schools have been covered. Rest of the schools will be covered during 1995-96.

5. SUMMARY AND CONCLUSION

Literacy is considered as an essential prerequisite for the acquisition and spread of knowledge. It provides building blocks for raising the quality and standard of life of the people and opens up avenues of access to knowledge. Those who are knowledgeable can benefit from new technologies and can lead the nation to progress and prosperity.

Use of new technologies in the school system will definitely enhance the comprehension level of students in their early phase of learning. Introduction of multi-media technologies like Internet, e-mail, etc. in the college and university libraries, will not only link them with each other but also with other such facilities abroad. This will further improve the knowledge base of young students enabling them to compete along with other students of the developed countries. These technologies need to be developed on a war footing and expanded so as to move ahead along with other notions of the world.

As far as the use of multimedia technology for low literacy area is concerned, it is inconceivable that the backward areas will be catching with the developed areas. The backward areas will be caught in the vicious' circle of perpetual backwardness unless efforts are made to develop proper infrastructure, which facilitate the growth and development of multi media and new technologies. Existing shortage of energy further restricts the growth and development of such technologies even in the developed areas what to speak of backward areas. However the establishment of institutes in various parts of the country for the growth and development of such technologies will he an important step in this direction.

Some efforts have been made in Pakistan in the field of educational technology, i.e. opening of

ETV (Educational Tele-Vision): FedMIS (Federal Educational Management Information Systems): and Educational Technology sections in Allama Iqbal Open University: Computers has also been included in school curriculum and also provided in DEOs Office for the effective educational management Pakistan's education system is paying proper attention to promotion of science education, technical and vocational education and computer literacy programmes.

NATIONAL REPORT OF THE PHILIPPINES

NEW INFORMATION TECHNOLOGIES AND EDUCATIONAL POLICIES: THE PHILIPPINES

I. STATE OF THE ART IN THE NEW INFORMATION TECHNOLOGY

Information Technology (IT) is considered as a strategic resource and vital tool for national development. It provides the necessary infrastructure and support systems that will enable nations to achieve the goals of economic stability and global competitiveness. Advancements In this field are changing the course of all other technologies. In addition, IT is revolutionizing lifestyles, workstyles and is changing the process of learning. President Fidel V. Ramos has underscored the importance of IT by declaring 1996 as Information Technology Year.

A. IT IN THE NATIONAL PLAN

In recognition of the important role of IT, President Ramos instructed the National Economic Development Authority (NEDA) to incorporate IT in the Medium Term Philippine Development (MTPDP, 1993-1998). The Plan mandates the enhancement of IT research and development (R&D) to support technology development in agri-industry and other areas; develop and upgrade science and technology (S&T) manpower capability by strengthening engineering and science education and providing relevant technical training, improving literacy in IT, and equalizing the participation of women and men in S&T activities, strengthen industry-academy linkage in the development of IT in different sectors.

The National Information Technology Plan (NITP 2000) was formulated to provide direction to IT strategies, programs, applications, and activities of both government and private sector towards national development. Moreover, the Science and Technology Agenda for National Development (STAND) 2000 identifies IT, specifically computersoftware and manpower development in IT that should receive massive S&T support to enable the country to take full advantage of its potential. Likewise, programs have been identified in the Science and Technology Education Plan (STEP), a companion plan of the Science and Technology Master Plan (STMP), which provides the framework for S&T development in the country. Moreover, support programs for the education sector in IT are provided under NITP 2000.

The education and training IT component of NITP 2000 has two major concerns: IT literacy and IT manpower development. IT literacy is a major concern of the educational system and IT Solution (hardware, software and consulting) providers with much help from the mass media. IT manpower development is a major responsibility of the educational system in strategic alliance with technology sources for the academic requirements and with various industries for the practical training requirements.

Among the targets and key result areas (KRAs) identified for the NITP 2000 education sector programs are:

Development of a critical mass (i.e. from 30,000 to 50,000) of competent IT workers for domestic requirements;

Offering of IT degree programs in universities and colleges (i.e. From 10% to 50%) ;

Increased IT literacy (to 50%).

The above targets are to be performed along with the other structural component programs of NITP 2000, aptly given the acronym T-I-G-E-R, which stand for Telecommunications, Industry, Government, Education and Research.

B. IT IN THE EDUCATIONAL SYSTEM

The Congressional Commission on Education (EDCOM) which conducted a study in 1990-92 with the goal of improving the quality and access to education recommended the restructuring of the present Department of Education, Culture and Sports (DECS), into the Commission on Higher Education (CHED). Technical Education and Skills Development Authority (TESDA), and the Department of Basic Education (DBE). Except for the latter which is still under deliberation in Congress, the first two agencies have already been established by law. All these agencies, however, recognize the need to integrate IT as a critical resource in making education more relevant and accessible.

The Philippine Educational system consists of government and private tertiary vocational, technical, secondary and primary schools. For developing the country's IT capability, the formal education system is tasked to develop a pool of computer competent professionals, which include scientists and engineers, while the non-formal education system is targeted to develop IT skilled workers for government, industry, and education sectors.

Among the broad policy actions adopted by the government's Cabinet IT Cluster Committee in support of the effort to accelerate IT in the education sector are: (a) the teaching of computer knowledge in universities and colleges and its integration with mathematics or science subjects in the primary and secondary schools, and (b) liberalization of computer entry in the country.

Technical Panels for various fields, which include IT and Teacher Education, have been created from a pool of Filipino experts by CHED. The Technical Panels give advice to Commission on academic matters relating to tertiary education. At present, CHED has authorized the integration of computer courses as part of the requirements for offering baccalaureate degrees. In particular, teacher educational institutions offer computer courses as part of their pre-service and in-service training programs.

There are four main sources of IT training and education in the Philippines, which are:
- educational institutions (private or state owned colleges and universities) which offer formal education leading to a professional certificate or formal degree;
- proprietary training centers which conduct short term training courses and seminars.
- computer vendors and suppliers who offer training programs as part of their marketing efforts, and
- in-house training programs conducted by user organizations for the development of their own employees.

The first two categories produce the largest numbers and constitute the main source of manpower for the country's IT software industry. As of 1992, there are five (5) different baccalaureate and seven (7) associate degrees offered in 103 curricular programs in various educational institutions in the country. Forty-eight (48) of these institutions offer baccalaureate degrees leading to B.S. in Computer Science. Recently, some schools have began to offer the 2-year Associate in Computer Data Processing programs.

Eleven Metro Manila-based schools produce about 1,500 IT graduates yearly. Nationwide, the number of graduates is estimated to be more than 2,500 per annum. More than 1.2 million students are enrolled in Philippine colleges and universities which constitute a large population from which the country's IT industry can draw on its manpower needs. Specifically, graduates in science and engineering courses (more than 40.000 in 1995) constitute another pool of future IT professionals. Enrolment in propriety training centers for short term courses reached more than 50,000 in 1992.

II. DEVELOPMENT EFFORTS ON IT FOR EDUCATION

A. PRESENT INITIATIVES

Several institutions have undertaken measures to introduce teachers to the world of IT and computer aided instruction. The Coordinating Council for Private Educational Associations (COCOPEA), the Philippine Association of State Universities and Colleges (PASUC), Association of Christian Schools and Colleges (ASCC), Catholic Educational Association of the Philippines (CEAP), PACU, Philippine Association of Private Schools, Colleges and Universities (PAPSCU), PAPTI, Fund for Assistance to Private Education (FAPE) and computer training institutions like AMA Computer College, Science and Technology Institute (STI),. I/ACT, Innodata, Metrodata, etc., conduct computer training programs for teachers and educational administrators.

Modularized lectures and hands-on computing skills, such as design techniques like flowcharting, software concepts, programming, concepts and computer languages, application softwares like word processing, spreadsheet, data processing, multimedia presentation and desk-top publishing are offered.

The University of the Philippines Institute for Science and Mathematics Education Development UP-ISMED), offers, along with its short-term courses on science and mathematics teaching, the courses on microcomputer-based chemistry and mathematics lessons: and a course on computer programming and mathematics. Among its resources are the 24 computer programs in BASIC Language for Mathematics, Physics, Chemistry and Biology for Teacher Education. In addition, INNOTECH has regular teacher training offerings on Computer-Aided Instruction (CAI) and authoring. Private institutions like the ASIA-PACIFIC College and Eduvision 2000 likewise have package programs in teacher training. DECS also conducts regional summer training on computer education.

Several initiatives like those undertaken by the Department of Science and Technology (DOST) through its Science Education Institute (SET), support the upgrading of science instruction by providing computer hardware and software, audio-visual facilities and instructional materials to a network of public and private schools. The Philippine Business for Social Progress (PBSP) and the Foundation of Audio-Visual Technology for Basic Education likewise provide for similar support to underserved schools in the country.

An education modernization program is also being launched by DECS to equip schools with facilities, equipment, materials and skills and to introduce new learning/delivery systems necessary to capitalize on recent technological developments. Specific areas of focus are S&T education, computer education, and language education. Distance learning through educational television and other delivery schemes are increasingly being used in the school system. Science laboratories, computer laboratories, language laboratories, eco-technology classrooms and supportive equipment are also provided. At the same time, a massive training program for teachers is being implemented to develop the skills for making effective use of modern school facilities.

The DOST was instrumental in the setting-up in 1994 of the PHNct, the Philippines' gateway to Internet. With PHNct, an efficient medium of information exchange and coordination among researchers and S&T workers was established. This government intervention program of putting-up the gateway has encouraged the private sector to invest in a number of Internet service providers. With 17 Internet service providers at present, the Philippines seems to have the biggest number for such within the ASEAN region. For W3 servers in the S&T community alone, the following are now in place:

Institutions/Sector	Number
Academe	11
Government	9
Philippine Related	7
Others	6

Eight institutions of higher learning in the country have been wired under the DOST's Engineering and Science Education Program (ESEP). The following universities at present have fully operational electronic facilities: University of the Philippines in Diliman, Manila and Los Bacos, De la Salle University, Ateneo de Manila University, University of San Carlos, Xavier University and Mindanao State University-Iligan Institute of Technology. The Mendiola Consortium of Universities is likewise in the process of wiring its member institutions.

B. CAPACITY BUILDING

The efforts to build the IT capability of the Philippines are focused, among others, on: (a) upgrading of IT training and educational institutions; (b) building a critical mass of IT workers of adequate number and quality, and (c) building a capacity for self-reliance in the country's educational institutions in the area of IT education and R&D.

Agencies of DOST composed of the Philippine Council for Advanced Science Research and Development (PCASTRD), Advance Science and Technology Institute (ASTI) and the Science Education Institute (SEI), are committed to programs on IT manpower development. Support for scholarships in various IT fields from B.S. to M.S. and Ph.D. levels including diploma and short-term training are available as part of their major programs. Scholarships are likewise provided by CHED for IT courses through its State Assistance Program and the Higher Education Find. Graduate level scholarships on IT will be made available through its designated Centers of Excellence.

PCASTRD provides assistance to local scientists and researchers, on R&D, which includes IT for education. Among the priority ID R&D areas are: human interface technologies (windowing software, expert systems, speech recognition, multimedia); communication technologies (LAN, WAN, EDI, wireless technologies); and system support technologies (parallel processing object oriented, data extraction and conversion software, on-line database searching computerized libraries, storage/retrieval technologies, client/server technologies. Among the on-going projects of ASTI in R&D on IT with applications for education are:

- RF/Microwave Communications;
- Radio Packet Telecommunications;
- Applications of Digital Sign Processing;
- Neural Networks and Fuzzy Logic.

In terms of services for providing accurate information on the country's land and water resources, periodic surveys are done through satellites facilities on remote sensing by the National Mapping and Resource Information Authority (NAMIRA) of the Department of Environment and Natural Resources (DENR), the central mapping agency of the government.

As part of building the capability of universities to offer quality IT education to teachers in science and mathematics, SEI is establishing model IT classrooms at the UP-College of Education and the Philippine Normal ~ University (PNU). In addition, SEI is developing a mobile IT classroom, a vehicle equipped with hardware and software units, as pilot project on IT at the elementary level in the sciences.

C. DATA BASES IN EDUCATION

The Fund for Assistance to Private Education's (FAPE's) Education Data Bank was established in 1979 for the purpose of gathering and processing information on private education and the entire educational system. It is tasked with the job of monitoring the condition on the educational system with the end in view of providing the proper context for the evaluation of its programs and projects. At present, other data bases include the DOST's HERDIN (Health Research and Development Information Network), and SCINet (Science Information Network), and form its line agencies. HERDIN was initiated with UNESCO support and is now highly organized on-line retrieval system. Data bases from the SCINet and from other DOST agencies provide for relevant information needed by researchers, students and policy makers. Current efforts of SEI are now underway on the development of data bases for science education which is being done in collaboration with universities and government educational institutions.

D. BROADCAST TECHNOLOGY IN EDUCATION

Early experiments on educational technology were done for programs on radio on the air of the Bureau of Public Schools through the Government's Public Broadcasting System and similar initiatives at the University of the Philippines in Dilinian and Los Bacos, University of Mindanao and a few other educational institutions. There was also a pilot project on educational TV, the Metropolitan Educational TV Association which delivered pilot courses in physics and social studies in over a hundred secondary schools in Metro Manila and nearby towns through commercial TV during specific hours. A closed circuit TV project at Ateneo de Manila University also started about the same time. At present TV programs in the sciences are made available for kids (Sineskuwela of Channel 2) and physics and chemistry teachers of secondary schools (CONSTEL of Channel 4).

Very recently, the concept of open or distance learning became acceptable especially with the enactment into law of the University of the Philippines (UP's) open University System. Early initiatives in the late 80s include the CAP College Open Learning Program, which started as a correspondence course and now utilizes multi-media in its undergraduate and graduate degree courses. The AIDE (Asian Institute of Distance Education) also started about the same time by offering continuing education courses primarily for workers in government and factories. The most ambitious program is that of UP-Open University which offers both degree and non-degree course for students in the country and overseas Filipino workers. The Polytechnic University of the Philippines (PUP) Distance Education Program also extends to its various campuses like that of UP. Other initiatives include that of the Philippine Women's University which has established a consortium with a network state and private universities and the Technological University of the Philippines. The Meralco Foundation Institute and the Don Bosco Technical College have also started their continuing education programs. The Asian Institute of Journalism and Communication complements these initiatives through teacher training in the development of learning modules. A new institute, the Wizard Academy has embarked in the projection of computer courseware. At least two networks, the ANTEP (Association of Non-Traditional Education) and Force (Foundation for Continuing Education) provide the catalyst in mobilizing and sustaining these initiatives.

E. TECHNOLOGICAL DEVELOPMENTS IN THE COMMUNICATION SECTOR

Media programming is becoming more specialized as media users or markets are segmented according to profession, interest, ethnic background, political affiliation, religion, etc. This is referred to as demassification of media.

Cable television has introduced specialized channels featuring exclusively news, sports, music, sports, public affairs, environment, education, etc. Radio stations are becoming even more differentiated.

There is a proliferation of specialized publications-magazines for sports, hobbies, agriculture, entrepreneurship, environment ad infinitum. One local publishing company has a distinct magazine for pre-schoolers, elementary kids and teeners.

The commercially-oriented Philippine (VHS) television stations are airing more diversified programs for specific audience groups. More educational or instructional programs are being aired such as Negosiyete (entrepreneurship). Agrisiyete (agribusiness). More than Export, Ating Alamin, Sineskuwela (Science Lessons for children), CONSTEL (Continuing Studies via Television in Science and English), etc. Lately, there has been a market increase in the number of educational children's program, some receiving international recognition such as BATIBOT (Channel 9) and FIVE and UP (Channel 5). HIRAYA MANAWARI (New Age Stories for Children) and BAYANI, a show focusing patriotism and love for country.

There are three educational cable TV stations. Ed TV 36 of the Sky Cable Network is the first educational TV channel in the Philippines. It offers educational, cultural, religious, information and public affairs programs. Discovery Channel Asia (available through Palapa B2P and Apsrar 1), offers programming in the areas of science and technology, nature, history, human adventure, and world culture. TV 101 or Youth Campus Network serves the educational TV of nine Manila schools.

III. POLICIES TOWARDS STANDARDIZATION

SEVERAL LEVELS OF STANDARDIZATION ARE BEING CONSIDERED HERE: STANDARDIZATION OF OPERATING SYSTEMS, SOFTWARE

The growing popularity of the Internet provides an enormous opportunity for IT service providers in tapping big market shares of IT users. Considering the importance given by the academe, private industries and government sectors to the wide utilization and need for exchange of IT services and products, it is but necessary for institutions to standardize their operational systems. Among the networks with standardized operating systems are the 17 existing IT service providers.

Although actual application programs used by different agencies are not at present standardized, there is dominance of Microsoft's Windows 95 in the local market. It may be noted that the network of universities and colleges like the DOST-Science and engineering Programme (JSEP), and the Mendiola Universities Consortium are committed to use standard operating systems and software. On the other hand, the Government Information Sharing Technology (GIST-NET) will provide for value added service to agencies of government consisting of several network hubs composed of the network and internetworking equipment. GIST-NET will be accessed by the general public through the Public Information Service Points called INFOKIOSK.

The broadcast technologies that are now in place, a relatively modern and standardized with few problems on interfacing. Telephone systems are, however, mixed. The cellular phone system is operated by various companies, each one pushing its own variations of analog and digital, and digital-analog technologies. Urban areas tend to have the advantage of using the latest fiber optic systems which allow for easy access to information databases.

STANDARTIZATION OF CONTENT

Standardization is a problem with the proliferation of many systems and types of hardware. However, computer packages sold in the Philippines are IBM clones; the Macintosh platform has captured only a small market and its use confined mainly to art and design applications. The rise of many chip manufacturers in Asia offering their own versions of standard platforms may however be an emerging technology.

A proposal during a meeting of information technologists in ASIA was to adopt Asian Standards of hardware that would be more realistic for Asian needs and culture.

The trend towards networking of information systems is expected to lead to standardization of hardware. Computers with telephones and televisions will eventually "converge" and be hired out instead of bought which will result in a high level of standardization of both hardware and software. Moreover, the National Telecommunications Act and NITP 2000 are now working on policies leading towards greater uniformity and standardization. What should concern ASEAN and worldwide policy makers is the inter-operability of the many systems and hardware now in existence. Development is taking place so fast on so many fronts that the end user does not have time to learn the nuances of their usage. On the other hand, policy makers are in the dark as to the implications of certain technology and software shifts.

Because DECS has set a minimum learning competencies that are to be learned by each grade level, there is little debate as to what and how much is to be learned. Values education is integrated in almost all subjects, something that is very apparent in all the programs aforementioned. What is lacking in many of the television and radio programs is the lack of opportunity for learners to interact with one another which is characteristic of information technology-based learning materials. The latter allows the student to explore by experimenting on various combinations and options - something that a one-way medium like television does not allow.

At the tertiary level, computer science has been made as a compulsory subject for students enrolled for baccalaureate degree programs. The inclusion of this subject in all degree programs would assure the development of IT literacy among potential members of the pool of professionals in the country.

IV. ISSUES/CONCERNS ON IT IN EDUCATION

Despite the perceived advantages and potential of the Philippines, a number of problems hamper the accelerated growth of IT in education. Among these are the following:

1. Brain Drain

Considering the recognition given to IT professionals by other countries, there is a marked exodus of such professionals to lucrative position abroad. Close to 1,000 highly skilled system programmers are lost per year to overseas employment.

2. Slow expansion of trained personnel, mismatch of expertise/manpower developed-ment and industry requirements

Skills of graduates coming out of the formal education stream diverge from the requirements of industry as shown by some local studies (Teodoro, 1990). This is due to tile fact that academic institutions have the long-term objective of preparing students for lifetime vocation. As a result, software houses and user organizations require new recruits to undergo a training regimen before job assignments are given. In addition, most private universities suffer from faculty shortage, poor access to computer facilities, and lack of quality standards and accreditation system.

3. Unreliable quality, low productivity of software services, slow diffusion of IT

Such are partly due to the lack of access to software engineering and productivity tools. Universities and R&D institutions play negligible roles in adoption a diffusion, despite the rapid changes and R&D intensity of IT.

4. Inadequate training and exposure of IT faculty members

While the faculty stock of degree-granting institutions are equipped with masters and doctoral degree-holders or some may be in the process of obtaining post-graduate degrees, the weight of their leaching, loads prevent them from undertaking continuous development. Further, a number have not had actual experience on IT, and are therefore more theoretical in their approach. For propriety training centers, their teaching staff was found to consist mainly of part-time lecturers whose academic preparation would generally be less focused and less intensive than in degree-granting institutions.

5. Undercapitalized software companies

Except for a few large software companies that were born out of large diversified corporations or joint ventures as subsidiaries of foreign companies, the Philippine software sector grew out of efforts of individual entrepreneurs with minimal capitalization. Government intervention may be needed as catalyst for developing educational software which is presently quite costly in the market.

6. Poor telecommunications/data communication infrastructure

The country suffers from pour communications infrastructure, which has a direct effect on access to IT by schools and households.

7. Poor access of IT in education

The inaccessibility of information technology at a mass level has made poor rural schools and developing countries more vulnerable and marginalized in the globalizing economy. While most private schools already have their computer laboratories, only 0.03% and 6.22% of Philippine public elementary and secondary schools, respectively, have computers. About two-thirds (65.72%) of public elementary schools and one-fifth (19.94%) of public secondary schools still do not have electricity. The structure of the national budget for education eats up 75% and 12%, respectively, for personnel and schoolbuilding, leaving little for quality improvement and modernization. Furthermore, teachers and school administrators need upgrading in instructional application of modern technology.

8. Abuse of IT

Practically, any material that can be digitized, such as pornography, abusive language, prostitution, pedophilia, and even organized crimes may find itself in the information superhighway, which makes IT prone to abuse. The Philippine Congress is now debating on possible legislative measures for regulating and preventing abuse of IT.

9. Software production, protection, property rights and copyrights

The existing policies on intellectual property and copyright are vague. This is shown by the relative ease by which software have been pirated. On one hand, software developers, including the content providers, have been deprived of billions of dollars in royalties due to the proliferation of piracy, especially in the developing countries.

On the other hand, millions of offices, educational institutions, small businesses, and individuals have benefited from affordable pirated information technologies and products tools such as CD-ROMs, diskettes reprinted textbooks, photocopied and digitized copies of program codes.

10. Educators' Perception of IT

Within the Philippine educational system generally remaining hierarchical, the introduction of innovation has been uphill climb. Many decisions are made at the top, with little preparation of school administration and teachers in both management and implementation levels. Teachers and education officials especially in the public sector have been quite cynical of information technology. They perceive IT as a threat to their job as educators. They fear that it may take over their functions so that they would hardly be needed in the classrooms. This has been a stumbling block in the introduction of information technology in the educational system.

In the area of conceptualization and production, and eventual use and implementation of learning materials for actual learning institutions, teachers are seldom consulted by software makers. Considering that NITP 2000 will establish a Philippine Software Development Institute which will involve both IT production and concept personnel, this problem, hopefully, will be looked into.

The utilization of information technology for education is dependent on up-to-date technology, a deregulated telecommunications industry, a receptive policy environment, and competent, sophisticated, and creative content providers. There has to be parallel growth and expansion among information technology, information technology tools, telecommunications facilities, and quality content providers to ensure the substantial impact of information technology on education. This underscores the need for: 1) a policy environment that motivates the private sector to make affordable, quality, and value-added computers and other form of interactive technology; 2) a telecommunication industry that is deregulated and expanded to include major industry players and independent enterprises and that provides for social clauses on public access for education as part of the franchising agreement: and 3) competent content provides with a working knowledge of how computer information technology tools can be integrated into the learning environment.

V. PARTICIPATION IN INTERNATIONAL PROGRAMS

The Philippines has participated in several international conferences such as those sponsored by UNESCO, the International Telecommunications Union and the Pacific Telecommunications Council and dozens of other global initiatives. It has participated in establishing regional information coordination mechanisms and networks such as ASTINFO (Regional Network for the Exchange of Information and Experience in Science and technology in Asia and the Pacific to contribute in the elaboration of regional strategies relating to access and use of specialized information. The Philippine Computer Society itself is active in ASEAN and international conferences on the use of IT. In all these conferences, the concerns have always been the need for guidelines on content of programs for airing on international satellites TV. The focus is how to take into account the diverse social, political, cultural, and economic needs of the nations involved in the open, borderless world of international broadcasting while preserving strengths found in traditions, values and family.

Other projects where the country participates include the SEAMEO Philippine Center On Innovation and Technology's (INNOTECH's) information and exchange program for the Regional Educational Information Network (REIN) with its databases on educational policies for use in teacher training institutions. In addition, DOST in cooperation with the Philippine Computer Society (PCS), annually send a youth delegation to the International Software competition.

As member of the Asia—Pacific Economic Conference (APEC), the Philippine is committed to the establishment of the Asian-Pacific Information infrastructure discussed in the Ministerial Meeting on Telecommunications and Information industry of the APEC held in Korea in 1995.

SUMMING UP: CHALLENGES AND THE FUTURE

There is a national consensus that the key to IT development rests in the development of human resources in this sector. The country is now recognized as one of the best sources of programming talents in the world mainly due to the efforts of Filipino computer training, schools, software companies and computer users in developing computer professionals. In addition, the Filipinos' competence in English is perceived to be an advantage in sustaining the country's IT software capability. However, due to migration, the sector is reeling from lack of trained IT professionals. Current efforts are now focused on looking into knowledge-based programs and effective teaching methodologies in the educational curriculum, allocation of scholarship programs as well as providing necessary incentives to IT learning institutions and training centers. The Commission on Higher Education (CHED) has created a Technical Panel on IT to recommend minimum curricular and other requirements for IT-related degree programs. Government investment in R&D for IT in education should be accelerated to sustain national capacity building efforts in the field. Moreover, the commitment to develop human resources cannot be overemphasized.

The role of information technology, for a country like the Philippines, is to identify knowledge brokers-institutions or people who can help the learners pursue information and knowledge by suggesting leads where the information could be found. In such a manner, teacher and students will revolutionize education by assuming a new role: that of navigators in a field of data, triggered by a research process beginning with curiosity and desire to learn.

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NATIONAL REPORT OF THE RUSSIAN FEDERATION

EDUCATIONAL POLICIES AND NEW TECHNOLOGIES

If Russia is to become GREAT it is only through its culture. It is not existence that shapes consciousness, it is consciousness that shapes existence. We will live to the extent we are educated, cultured and moralistic.

D.LIKHACHEV

INTRODUCTION

Today Russia is probably going through one of the most dramatic periods in its quest for socio-economic, state and political transformation. In the near future, Russia's role in the world wide process will be determined by the resolution of its Government and its people to set a strategic objective of transforming Russia into a world power with intellect- and science - consuming production prioritised.

To make the state rank the world's first positions, with intellectual labour prevailing in the GNP, some necessary conditions are required. To start with, 40 to 60 per cent of adults should have higher education, and the number of scholars and scientists in the nation should be sufficient enough to amount to 2-5 % of the total population.

Feasibility of the above indices is based on the fact that Russia now has an adequate number of highly qualified and skilled personnel and has accumulated an enormous intellectual product.

Recent transformations in the sphere of science and education have bolstered the argument that, as long as knowledge is of a universal nature, its acquiring, in-depth learning and dissemination is basically achievable through assistance and stimulated collective efforts of the international scientific community. Accentuation of internationalisation of education's content along with its functional variety, on the one hand, and increase in mobility of both students and teachers - on the other, becomes ever more significant in the light of today's trends in the world commerce, economic and political integration and growing demands for intercultural mutual understanding. This positive trend is backed up by the increase in the number of students who study, work, live and communicate in the international environment being greatly assisted through new telecommunication technologies.

The system of education is the most reliable and civilised way of achieving progress and implementing reforms leading to the development of society. Realising this fact should result in ensuring the outstripping approach to education development against the background of other measures contributing to the process of Russia's revival.

V.KINELEV
DEPUTY CHAIRMAN OF THE GOVERNMENT OF THE RUSSIAN FEDERATION
CHAIRMAN OF GOSKOMVUZ OF RUSSIA

1. BRIEF CHARACTERISTIC OF RUSSIANS EDUCATIONAL SYSTEM

The right to education is one of the inalienable constitutional rights of Russian citizens. Education in the Russian Federation is carried out in accordance with the national legislation and international law (Appendix 1).

According to the Law on Education, the RF, the system of education in Russia is defined as an entity of:

- the system of successive educational programs and standards for various levels and purposes;
- the network of educational institutions of various organisational and legal forms, kinds and types that realise the above curricula;
- the system of educational management, including the bodies within the jurisdiction of the above.

The educational programs and curricula implemented in the Russian Federation are subdivided into:

- general educational: basic and supplementary;
- vocational (professional): basic and supplementary.

General educational programs and curricula include:

- those pertaining to pre-school education;
- primary general education;
- basic general education;
- secondary (complete) general education.

General educational programs are designed to settle the Tasks of forming general culture, intellectual, moral, emotional and physical development of the personality; working - out scientific world-outlook; adapting individuals to life in a society creating the basis for a thought-over choice and mastery of vocational training programs (Appendix 2).

Vocational educational programs include:

- Those of primary vocational education;
- Those of secondary vocational education;
- Those of higher-school professional education;
- Those of post-graduate professional education and corresponding supplementary training.

Vocational educational programs are oriented toward further development of the personality in the process of acquiring a profession, speciality and qualification by students in conformity with their interests, abilities as well as the social order of the society and state.

The mandatory minimum of the content for each basic general-education and vocational program (for a specific profession or speciality) is determined by the corresponding state educational standard.

Interconnection between basic and supplementary educational programs are realised through the system of educational institutions (chart 1.).

According to their organisational and legal forms educational institutions may be state, municipal (community), non-State (private) ones, as well as those run by various public and religious organisations (movements).

According to their designation and objectives pre-school establishments in Russia fall into general child-developing ones, health-compensating (for children in need of certain correction of their psychological or physical development), those for child care, physical conditioning, and combined types.

The system of general secondary education in Russia includes:

- General secondary schools;
- Schools with in-depth studies of separate subjects;
- Gymnasia;
- Lycees;
- Educational institutions of the boarding school type;
- Special schools for physically or mentally handicapped children;
- Educational institutions for supplementary education;

The Russian Federation is populated by around 130 nations and nationalities. The Non-Russian population share is about 19 %. To avail that category of students of an opportunity to upgrade their knowledge of native languages, special native language schools are organised.

Primary and Secondary vocational education is provided through the network of professional technical and secondary special schools, including technical ("technicums"), humanities, medical, art and other establishments. These establishments ensure students every opportunity for acquiring general (complete) secondary education.

The higher-school professional education system includes:

- Universities
- Academies
- Institutes
- Colleges

Higher educational institutions (VUZ) train specialists and provide upgrading (refresher) courses for the like of them on the professional curricula leading to B.A. or M.A., along with a traditional higher education diploma as well as training the highest qualification scholars and scientists earning such degrees as a candidate of sciences or doctor of sciences.

Supplementary educational programs are realised in general educational or vocational institutions and in specialised supplementary institutions: at upgrading (refresher) institutes and courses, professional orientation centres, musical and art schools, at palaces and centres of child and youth creative activities and the like. The major objective of adult supplementary education is to provide a continuous upgrading of qualifications for workers, employees and specialists. The system of continuous education boasts the participation of 40 % of the nation's adult population.

Russia's system of education is one of the world's biggest. Nearly 20 million children of Russia go to school. Most of them (about 70 %) attend pre-school establishments before school. In 1994 they numbered about 73,000 such establishments with over 500,000 teachers and instructors.

The general educational schools of Russia (in 1994 - 69,000, including 2,000 national, native language schools) employ over 1,6 million teachers (75 % of them with higher school diplomas).

The primary vocational training (in 1994 - 4200 schools) employs about 160000 teachers and instructors, there are about I million students mastering the skills of 250 specialities and trades. Today, higher school professional education in Russia comprises 568 state and 211 non-state (licensed) higher educational institutions with a 3 million student body and 240,000 professors and teachers, including 18,300 DSc and 114,600 candidates of science. In addition, there are 1051 institutions providing upgrading courses, where 2 million people study annually, there are also over 100 military higher educational institutions.

The student body of 2600 state and 70 non-state secondary specialised schools amounts to over 2 million.

The higher school of Russia has a highly-developed academic, research and production infrastructure which includes over 600 libraries, about 700 scientific bodies, with 92 scientific-research institutes, 57 experimental design centres, 84 experimental production shops.

All in all, the secondary and higher professional school in Russia has about 6 million teachers, staff workers, postgraduates and students. The total number of people in the system of education in Russia amounts to 40 million, which determines its exceptionally important role in cultural, social and economic development of the nation.

No economic or social reforms are destined to triumph without an accelerating development of the system of education. Priority consideration to the problem of producing specialists that understand the gist of economic and social reforms and are capable to realise them through new economic mechanisms of management, through creating new progressive technologies and forming new social relations - will help Russia to preserve the role of the World's leading power and to successfully overcome difficulties on the road of grandiose socio-economic and political transformations.

2. PRINCIPLES, STRATEGY AND REALISATION OF RUSSIA'S NATIONAL POLICY IN EDUCATION

The territory and army can be sacrificed but the literati cannot.
(From Confucius' address to Ancient China's rulers)

The main principles of Russia's national education policy are set forth in the federal law «On Education» (Appendix 3).

The strategic aims of Russia's national education policy are consequently as follows:

• effort is to be made to provide citizens with the necessary facilities to exercise their constitutional right to education, with more self-determination, self-development and possibility for every individual to find a place for himself in life;

• Russian mentality is to develop on the basis of universal values, with respect for the rights of the individual as well as for public, territorial and ethical interests promoted in Russia's public consciousness;

• a system of education is to be formed, adaptable to men's conditions and standards and also to the new theory/practice interaction;

• principles of developing education and activity-oriented techniques are to be introduced, with education becoming a field for mastering thinking and acting procedure;

• Russia's educational system is to be integrated into the world system of general education.

Russia's national education policy is organisationally based on the Federal education program adopted by the country's supreme legislative body. The Program specifies particular ways and means to achieve the strategic aims set.

The main mechanisms of the major educational reform in Russia are diversification and regionalisation of education ensuring its continuity, overhaul of its administration system, as well as raising the quality of educational programs by basing them on a thorough scientific knowledge, and making them comprehensive and individual-oriented. One of the major mechanisms having to do with all the main trends in Russia's educational reform is informatisation viewed as a sine qua non and, at the same time, as an important stage in the informatisation of Russia as a whole. The basis for transition from the industrial society to the informational one lies in new information technologies (NIT).

Informatisation of education will ultimately make it possible to enjoy the essential NIT advantages, which are as follows:

• an open education system can be devised, with every individual choosing an education route of his own.

• the process of cognition can be radically altered by adopting system thinking on a larger scale.

• the students' cognitive activity during instruction can be better organised.

• certain specific computer characteristics can be used. The most important of these are:

- The process of cognition can be so organised that an activity approach is maintained throughout;
- instruction involving need, motives, goals, conditions, means, actions, and operations. Instruction can be individual and, at the same time, comprehensive, with automated teaching programs programmed and dynamically adapted. Finally, radically new cognitive means can be used and organised.

Informatisation of education is looked upon as an important means of realising a new national educational paradigm designed to change the existing orientation. Generalised knowledge is to have preference over pragmatic highly specialised aims. Likewise, primacy of knowledge will make way for general culture and scientific thinking, while focus will be on the up-to-date concept of the structure and all-round content of science rather than the historic context of scientific knowledge.

The new educational paradigm will give preference to

• a thorough scientific knowledge, which implies emphasis on establishing deep-seated essential foundations and interconnection between all kinds of processes in the world around us;

• a comprehensive approach, which means introduction of comprehensive series of scientific subjects with a single aim in view and focus on links between them;

• the development of the individual.

It will help to enhance the social importance of education due to its enormously rich content as well as its cognitive and world outlook potential. But new educational tasks call for new technological solutions.

3. NEW INFORMATION TECHNOLOGIES IN EDUCATION - PECULIARITIES OF THE NATIONAL PRACTICE AND PROSPECTS

Bare hand and brain itself are of little if any power. Actions are performed with both instruments and auxiliaries, which are of more need to brain than to hand.
Francis Bacon

3.1 .BRIEF HISTORY

Development of computer technologies in education in the USSR started in the middle of the 70s and reached the peak of its mass application circa the 80s. At this stage informatisation of education developed mainly at higher school. Automated teaching systems, developed on the basis of common programming and methodological means, such as AOS VUZ, RAKURS and others, were then widely practised.

Within the framework of science and technological programs for the USSR and the other Warsaw Treaty countries from 1979 to 1990 a series of projects was carried out on developing and introducing computer technologies into the practice of educational institutions of all levels. As a result, there appeared:

- concepts of designing and applying computer teaching technologies;
- a complex of instrumental program facilities:
  - author languages, aimed at constructing dialogue teaching programs;
  - author systems (automated systems for constructing teaching programs);
  - experimental expert and consulting systems (program systems for instrumental and methodological support of knowledge bases for teaching purposes);
- sets of applied program and methodological means, aimed at studying different subjects.

The newly formed means became an effective instrument for accumulating, testing and specifying new teaching methods and forms at all the levels of the educational system.

Expansion of new information teaching technologies brought about some structural changes in the most frequently used professional terminology. The new term *NEW INFORMATION TECHNOLOGIES IN EDUCATION (NITE)* came into use.

In Russia, the so-called Technology of Education means realisation of educational contents, envisaged by educational programs and by a system of forms, methods and means of education to reach didactic goals.

Distinctive signs of new information technologies of education are specific environment, in which they are applied, and some components, such as:

- technical (technical facilities in use);
- program and technological (programming means to support the applied technology of the education);
- organisational and methodological (instructions to both teachers and students, organisation of the educational process);
- the problem area of knowledge.

In Russia, automated educational courses with computer program support, aiming at reaching one or more targets, are widely practised. Automated educational courses include programs, methodological and educational materials (slides, printed material, audio and videotapes etc.), necessary for teaching activities at any level.

In Russia, works in the sphere of didactic programming got considerable elaboration. In the pedagogical literature this term is used in connection with tasks and problems of selecting and structuring educational material, as well as optimal organisation of the educational process. One of the most important tasks of the didactic programming is synthesis of target systems for optimal monitoring of educational activities, when the level of knowledge and skills of any student reaches the required one.

At present, a new tendency comes to the surface. It is aimed at developing and using the author's integrated medium, supporting different informational components: texts, dialogues, schemes, patterns. It also includes analytical and simulation models of the objects and phenomena under study, data and expert knowledge banks, support systems for certain professional activities: scientific, engineering and technical calculations and studies, automatically controlled screen display and planning.

At present the system of education has accumulated some several thousand computer programs for educational purposes, developed at educational institutions of Russia. Certification, testing and distribution of these programs are carried out by branch foundations, being in close contacts with regional, higher institutional and other centres of new information technologies. These centres actively participate in realisation of state scientific and technical programs of informatisation in education, provide education and training for teachers, render all kinds of assistance to educational institutions in applying new information technologies of education.

3.2. INFORMATION TECHNOLOGIES IN EDUCATION - NEW PROSPECTS FOR STUDENTS AND TEACHERS

Modern information technologies provide students with an access to non-traditional sources of information, raise effectiveness of independent studies, lay the foundation for creative activities, gaining and securing all kinds of professional skills, and help put into life principally new forms and methods of education with the use of means for conceptual and mathematical modelling of different phenomena and processes.

Modelling in classes provides graphic or visual image of a studied object and stimulates students' interest to this type of education; as well as studying dynamic processes results in a more profound study of the teaching material.

Since modelling itself becomes a target for a number of subjects, they are developing new instrumental program means in Russia, enabling both teachers and students to work out and modify teaching models in the interactive regime without any further programming.

Additional didactic opportunities are provided by such kinds of models as playing tasks.

Communication as a result of playing comes here as one of the forms of a personality's self-expression in the process of information interaction with colleagues and a computer. According to Russian specialists the most effective playing games are those oriented to obtaining the best results in solving difficult typical tasks by competing student groups.

Information technologies in education provide any teacher with a possibility to apply both certain kinds of class work and their combinations, in other words to project teaching medium. Instrumental means, oriented to a teacher, allow him/her to quickly renovate the content of automated educational and control programs in conformity with knowledge and technologies.

The teacher gets more opportunities for supporting and developing the personality of any student, for creative efforts and organisation of their mutual work, development and choice of the best program-variants. The teacher becomes the main supplier of educational subject targets with the account of subjects diversity and importance - humanitarian, economic, natural science subjects, etc. - at a given educational institution. By providing a teacher with intellectual forms of labour, we give him/her a possibility to put aside and get free from routine teaching methods, typical for traditional education. Information technologies free a teacher from explaining to auditorium a considerable part of the studied material and routine operations, connected with acquiring skills and abilities.

Introduction of new hypertext technologies into a teaching process provided both students and teachers with principally new possibilities to work with text documents. Multimedia technologies turned the computer not only into a worthy interlocutor, but enabled students, without leaving classrooms or homes, to listen to the lectures of eminent scholars and professors, become witnesses of historic events of the past and present, visit the most famous museums and centres of world culture, most interesting and geographically remote places on the planet.

Completely new possibilities for students and teachers have been opened by telecommunication technologies. As studies of specialists showed, being involved in the computer network activises students' need to become a member of a social community. A considerable increase in children's literacy and development of their speech habits, growth of their interest toward studies and, consequently, growth of progress in studies have been noted. International telecommunication projects become more and more common. Inter-regional and international competitions using new information technologies are held regularly. Russian school children, participating in them, traditionally show high results.

Getting an access to professional data banks, Schoolchildren get acquainted with scientific problems that are yet under study, form and work in small research groups, share their results with other researchers in the same field. Use of well-structured information, stored in data banks, serves as an instrument of testing hypotheses of their own, helps learners to remember information, facilitates to form habits for executing logic operations of analysis, comparison etc.

With an access to the telecommunication network, teachers not only increase their informational competence, considerably but get a unique opportunity to communicate with their colleagues practically all over the world. This creates ideal conditions for professional communication, for carrying out joint teaching, methodological and scientific activities, and exchanging teaching aids, computer programs, data etc.

In recent years Russia is expanding the sphere of computer application pre-school educational establishments. Different methods, aimed at children's individual development with the account of their age and individual capabilities, at organisation of their communication, are under development. Special attention is given to the use of modern information technologies in solving problems of integrating children with limited capabilities into the nowadays society. For this group of children new information technologies are the only instrument to get a full-scale education, competitive profession and simple communication.

3.3. EFFECTIVENESS OF TEACHING PROCESSES INVOLVING NEW INFORMATION TECHNOLOGIES

Estimation of the effectiveness of any method or educational technology includes evaluation of reached results, material and time expenditure involved. Academic progress is measured either by test paper results in points or percent of solved testing problems. Usually two groups of students are compared: those with a computer support and those without it.

Effectiveness of computer teaching methods is usually estimated against that of the so-called traditional methods, with academic progress being the only parameter measured. Sometimes the time spent by students is also taken into consideration. Application of such an approach to estimation of information technologies implies that the latter bring nothing new to educational goals and tasks. In reality, introduction of such information technologies changes the education itself dramatically, transforming it in conformity with general principles of society informatisation developing an into informational society. And this is one of the most important aspects of introducing new information technologies into education.

Nevertheless, the question of comparing effectiveness of traditional and new educational technologies is of much interest to specialists. Russia constantly hosts scientific and pragmatic conferences on increasing effectiveness of new information technologies in education, this subject being actively discussed by specialists in scientific publications, methods for estimating the effectiveness of new information technologies in education are being developed and tested.

According to Russian specialists, new information technologies in education will increase effectiveness of practical and laboratory classes in natural science subjects not less than by 30 %, and objectivity in testing students' knowledge - by 20-25 %. Academic progress in test groups using new information technologies, as a rule, is 0,5 point (with a 5-point scale of evaluation) higher. The vocabulary accumulation rate in groups studying foreign languages with a computer support increases by 2-3 times.

New information technologies allow us to settle a number of principally new didactic tasks:

- study of phenomena and processes in micro and macro environment, inside complex technical and biological systems on the basis of modelling;
- use of a suitable for studies time-scale for representing different physical, chemical, biological and social processes that, in reality proceed with too high or too low speed.

This enables us to introduce into the teaching process classes and laboratory works using computer models of a very expensive, sometimes unique equipment, which many educational institutions can not afford to acquire. In such cases we can speak about direct economic effectiveness of NIT introduction, but, as a rule, it is an effectiveness of a hypothetical nature, since in reality there is nothing to compare with - without NIT applications it would be impossible implement laboratory works of that kind in the educational practice.

4. RUSSIA'S STATE POLICY IN THE FIELD OF INFORMATIZATION OF EDUCATION, MAIN PRIORITIES

There are rules to choose a decision but there are no rules to choose these rules
Anon

It is common knowledge nowadays that information and knowledge, its ultimate form, create a decisive factor of development in a society as a whole. To effectively use gigantic volumes of information and knowledge brought up by the modem information revolution in order to solve real problems and overcome actual difficulties, Russia has to carry out intensive, co-ordinated and feasible informatisation of the society in practical terms:

• create legislative, economic, technical, social, professional and educational conditions to make available information, necessary to settle social and personal problems, anytime, anywhere, for any potential user;

• create technical conditions, hardware and software, telecommunication systems to ensure fulfilment of the previous item;

• provide an industrial and technical base for the production of competitive national information technologies and resources within the framework of the international labour division.

• ensure the primary development of structures, institutes and mechanisms, first of all in science and education, that guarantee an outdistanced (as compared to other spheres -political, economic and social) production of information and knowledge;

• train qualified personnel;

• implement a complex introduction of information technologies into the sphere of production, management, education, culture, transport, power engineering and etc.

Implementation of society informatisation requires a special information policy whose main principles with reference to Russia's educational system are conceptually recognised and formulated. A series of state, interbranch scientific and technical programs envisaging realisation of large-scale projects of education informatisation have been developed and are being implemented. They cover the following main directions:

• improvement of students' basic training in informatics and NIT;

• improvement of the system of teaching staff training and retraining in NIT;

• informatisation of the teaching and education process;

• equipping the system of education with technical means of informatisation;

• creation of a modern national information space and its integration of educational institutions;

• creation of a united system of distance education in Russia on the NIT basis;

• Russia's participation in international programs on NIT in education.

4.1 .BASIC TRAINING IN INFORMATICS AS A BASIS FOR INFORMATISATION OF THE SOCIETY AND A NEW QUALITY OF EDUCATION

Historically basic training in informatics in Russia underwent three periods: before 1985, 1985-1990 and 1991 till present.

Before 1985 training in basic informatics took place only in higher educational institutions, where future engineers, economists, physicists and mathematicians were taught the following topical subjects in: «Computing facilities in engineering and economic calculations», «Principles of computing technology and programming», "Algorithm languages and programming" etc. These programs were developed by methodical committees under the Ministry of Education. The programs were standard and obligatory for all higher educational institutions except several dozens considered to be of an advanced level and allowed to teach under non-standard programs.

Informatics classes in Russia's secondary schools were optional and were held in newly formed school education informatisation centres in Moscow, Novosibirsk, Ekaterinburg and Saint-Petersburg.

The first manual for the school course "Principles of informatics and computing" was prepared by a group of authors headed by academician A.P. Eshov in 1986.

To ensure proper informatics training at schools and universities sets of manuals on basic informatics, computer-aided control and design systems, microprocessing technology were published in 1985-1988. The best specialists and teaches of the professional education were involved in preparing these manuals.

Mass training of teachers and professors all over Russia in the field of computer knowledge was organised in 1986-1988.

The concept of teaching basic informatics covering all levels of education was developed in 1985. This helped to correlate contents of training and secure succession and continuity of studies at all levels of education. Training programs and plans oriented at specific level of education were substituted by new ones to achieve these key principles. The goal was to elaborate a content structure for continuous training in informatics, independent of institutions and levels of education: from methods of calculations with micro-calculators to the highest levels of computer application implying skills to program, develop microprocessors and insert them into equipment and electronic devices, develop systems of computer-aided design in one's professional field etc. The program of training in informatics was structured with reference to age stages that to be completely covered on finishing secondary school and other levels that were, as a rule, achieved on graduating from higher or secondary professional educational establishments. Figure 2 shows the structural composition and interaction of age stages and levels of training in computer science.

Computer science training was divided into basic and special-purpose training. The goal of **basic training** was to provide students with basic knowledge in computer science and computing facilities principles that will be needed to get **special training** in such fields of computer applications as design of information-processing and microprocessor systems, management and design automation, and etc.

One of the main elements of the system developed was a handbook of qualification requirements for computer science training of higher and special professional school students (fig. 3 gives a fragment of the handbook line). For each speciality of the professional education system, the handbook outlines the recommended levels of basic and special training in:

- microprocessor equipment (MPT);
- computer-aided design systems (CADS);
- computer-aided systems of industrial processes management (CASIPM);
- computer-aided research systems (CARS).

For each level of basic and special training, the following elements were developed:

- a fragment of activity description (a list of skills and abilities, and the level of knowledge the student should acquire in basic or special training at the relevant level);
- names and syllabuses of disciplines studied, the hours allocated to these disciplines, recommendations on the composition and volume of practical studies involving the use of computers and work in specialised laboratories;
- theoretical and practical teaching aids;
- recommendations on technical equipping of computer classes and specialised computing technology laboratories.

The scheme of formation of a program for computer training of students, using a developed complex of teaching and methodical documents is given in fig. 3.

The concept of outlining the content of computer training in Russia's educational system that was worked out and introduced in the late 1980s featured competence and adaptability to perspective requirements to students' skills and abilities, as well as completeness provided by teaching and methodical materials. The aforesaid makes it, in main aspects, relevant up to now.

The late 1980s saw significant changes in the content of courses in basic computer science for all levels of education. As a result, the number of hours allocated to studying programming decreases. More emphasis is made on studying new information technologies. When the new, modern, concept of teaching basic computer science in Russia's educational institutions was under development, the main principles embodied were as follows: priority to studying information technologies while taking basic computer science courses; and acknowledgement of high, ever-growing, computer science potential and its specific role in the formation of the modern informational society.

The distinguishing features of teaching computer science in Russian educational institutions are:

- acknowledgement of high ever- growing potential of computer science and granting it the status of fundamental natural-science discipline;
- modern- outlook comprehension of the computer science subject domain;
- modular presentation of the studied subject domain, instead of discipline one used before;
- use of modern information technologies for system modular formation of training content based on the activity approach. These technologies supported by state educational standards help to form a program with students' professional activity orientation and consideration of their personal interests and peculiarities;
- orientation to new information technologies of training.

Courses in computer science at schools are being modified substantially to follow the modem concept.

Training is split into three stages:

- general educational stage (I - VI grades) envisages introduction of schoolchildren to the computer world, formation of basic elements of the informational culture in the process of using educational game programs, the simplest computer simulators, etc.;
- the second stage (VII-IX grades), the main course is taught. Here students acquire methods and means of information technologies for solving problems, develop skills of conscious and rational use of computers for educational purposes;
- the third stage (grades X-XI) provides continuation of computer science studies, varying in the volume and content according to students' interests and their pre-professional training orientation.

To provide school computer science courses with teaching aids work is under way to prepare programming and methodical materials for the experimental course "Informational Culture" (running through all grades, X-XI). There were made such teaching aids as, "Algorithmics" (V -VII grades), "Computer Science" (XII-IX grades) and "Principles of computer science and computing facilities" (X-XI grades).

A specific feature of the modern concept is an upgrading mechanism that is being developed to update the content of training, for it to the catch up with rates of progress in informatisation means and technologies. Educational standards are revised every 5 years, which is too long a period for such a dynamic sphere of knowledge as information technologies. The solution is that standards regulate requirements to basic knowledge in computer science and determine only the list of information technologies students should master. At the same time, teaching modules providing the study and mastering of technologies can be chosen from a wide enough spectrum, with the account of institution technical bases and teaching staff proficiency. On the other hand, each recommended teaching module is characterised by its actuality. So, different curricula developed for these teaching modules can meet the requirements of the standard, but have different actuality ratings, which, in it's turn, will influence the rating of an educational institution.

4.2. INFORMATISATION OF THE EDUCATIONAL PROCESS

Development and introduction of educational information technologies into the teaching process are done in accordance with state research programs which are carried out by educational institutions, regional computer centres and research organisations dealing with educational problems and new information technologies.

Under conditions of sharp deficiency of resources and funds, scientific and technical programs for introducing new information technologies in education are being developed with the following priorities taken into consideration:

- development and introduction of information technologies of educational orientation;
- development of works widely used in the teaching process with their orientation to courses, taking a major part of time for studying: disciplines of base educational cycles, such as natural sciences, humanitarian, socio-economic, general technical cycles;
- projects envisaging creation of programming and methodical centres, which is of a particular importance for subjects enduring changes in scientific and methodical bases;
- research works aimed at scientific support and development of scientific and methodical bases of the process of education informatisation.

An extremely important component of Russia's information policy in education is development, as well as introduction, of complementary educational standards for state information technologies of testing acquired knowledge at all levels of the educational system.

4.3. NEW INFORMATION TECHNOLOGIES IN EDUCATION MANAGEMENT

Along with the reform of Russia's educational system, there goes a reform process in the system management. The aim of the reforms is to find the most rational and, in the perspective, the optimum correlation between centralisation and decentralisation principles of management that should justify strategic goals of education, on the one hand, and management democratisation with larger independence of regions and educational institutions, on the other hand.

Now in Russia many practical studies in the field of management automation are carried out, but , most of them are aimed at creating single automated working places for employees or, at best, at automating separate functions of administrative establishments. To ensure effective functioning of the administrative sector, it is necessary to develop an informational infrastructure for the organisational and administrative sphere on the NIT basis.

For this purpose, informational banks of data and knowledge are formed, they accumulate standard, instructive, and factual information. Means for analysing business and other information are created, and they are connected with educational institutions activities.

Within the directions mentioned interacted computer systems are being developed. They provide automation of control functions for the educational process, which allows us to reduce overhead costs in organising educational process control at educational institutions. In this field, they envisage the development of a computerised access to the library and inquiry information, calculation of the rating of every student and educational institution. To control the quality of the educational process, information systems for monitoring state educational standards including federal and national-regional aspects are being created.

In the field of the development of scientific principles for educational process control models of territorial and regional location of educational institutions and changes in their activities with the account of changes in the market are being developed.

The most important principles for providing informatisation of the educational system in Russia are: a system character, planning and conceptual bases and step-by-step realisation of work covering main directions of activities in the educational system:

- education and teaching;
- scientific research;
- system management.

Education informatisation can give the necessary social and economic effect in case the information technologies created and introduced into the traditional system of education will become its integral elements, combining with traditional methods in education.

Education informatisation requires great material and financial resources equal to the national annual income of the country. Therefore in Russia, the so called "Island" computerisation takes place, which means:

- singling out key organisational, educational, social and administrative structures in the educational system that lend themselves to informatisation. They are the "Islands", the basis for the beginning of global informatisation of the educational system;
- organising introduction and support for system integration of information technologies in these sub structures;
- creating and ensuring conditions necessary for «the chain reaction» expansion of developed and used information technologies from the "Islands" onto the entire system of education.

4.4. CREATION OF MODERN INFORMATION MEDIUM IS A CRUCIAL CONDITION FOR EDUCATION INFORMATISATION

It is impossible to create a modern information medium without Russia's integration into the world information system and an access to modern informational «thoroughfares», international data banks on education, science, industry, culture, health care and etc.

The quickest way to integrate into the world educational system is to give Russia's educational institutions an opportunity to use global computer network Internet.

At present Russia has the RELCOM network. It is linked to Internet and consists of about 100 regional stations connected with each other through the central station in Moscow. These stations use mainly commuted telephone lines and a specialised telephone network. Through RELCOM it is possible to exchange postal messages with such networks as Internet, UUNET, BITnet, COMPUSERVE and others.

About 3000 different organisations in more than 250 CIS countries have RELCOM user stations. The total number of the network users is over 10,000.

In addition to RELCOM, the RELARN subnet was created within the latter. This subnet is used for research and educational purposes (any commercial activities are prohibited) and is state-financed. The speed of information transmission through RELCOM is sufficiently high: within a few hours information reaches any part of the world. The created federal university computer network RUNNET is one of the greatest projects in education informatisation in Russia. Satellite communication was chosen as a transmission medium. This makes it possible to cover the entire territory of Russia, with receiving and transmitting stations set up in all federal centres. Moscow and St.-Petersburg form the RUNNET distributed centre. Moscow's centre is the centre of co-operation with other Russian networks, while St.-Petersburg's centre provides an exit into Internet through optic fibre cables and Scandinavian nets Funet/Nordunet.

Besides the above main types of networks. Russia creates and uses other networks. All of them are set up as parts of a single informational medium that unites information resources of different educational institutions and 150 centres of new information technologies underlying education informatisation. The centres are uniformly distributed over the country's territory.

Efforts aimed at economically acceptable variant of creating an informational medium showed that the most effective way is to allocate a part of information resources of a large network for educational purposes and to use it as a basis for setting up a virtual network of the educational system. With such an approach, the expenses of Russian educational structures will mainly boil down to expenses on buying and installing user stations.

And this, even with the account of the fact that Russian educational institutions are cash-strapped, is quite a feasible task.

The ground-based station Slavyanka developed at the design bureau of the Moscow Power Engineering Institute (a technical university) is used for these purposes. The main criterion for its development is a bottom low price combined with all operational characteristics necessary for the user.

At present, the information exchange in the interests of the educational system is executed through the two «Horizon» satellite-retransmitters that cover the territory of Europe and Asia, North Africa and North America, and with more efficient aerial facilities, the eastern part of the USA.

Thus, with present development activity results and the accumulated experience in exploitation of space information systems working through Russia geostationary satellite-transmitters, it is quite possible to start operating the Russian space network of distance education that is integrated into international educational networks. Even with current financing difficulties, this problem can, in general, be solved within 2 or 3 years.

4.5. A PROGRAM FOR A UNITED SYSTEM OF DISTANCE EDUCATION IN RUSSIA

The federal program for a united system of distance education (SDE) in Russia has been under development since 1995. SDE supplements the full-time and correspondence (existing since 1927) tuition, perfecting and improving these forms. SDE promotes the integration of various educational structures and the development of a truly democratic system of continuous education for Russia's population that covers the entire territory of the country. If the existing system, to a certain extent, limits the access to professional secondary and, especially, higher education, a united system of distance education in Russia that is under development has no borders. This system is a system of education for everyone at any age.

The demand for Distance Education in Russia is considered as an adequate one to the requirements of full - time tuition, i.e. it makes up approximately 1,5 million students a year. Besides, according to the Federal Bureau of employment 2 million specialists need to be retrained in Russia annually. They have to change their job profile because of closing down and activity changing of enterprises, a forced migrations of population and other reasons. The major users of the system of Distance Education can be Russian - speaking people abroad and those for whom the Russian language is the second one. The demand for services of Russian SDE from foreigners is considered to be significant.

In contrast to the traditional systems distance education allows each student to have an individual scheme of education, master it by applying to a special informational medium created for this purpose, it gives an opportunity to satisfy the requirements in educational services in the most convenient and comfortable regime.

The most attractive features of the educational process in the system of distance education are its flexibility, adaptability, modularity, economic benefits, user orientation, application of advanced communication and information technologies. The system of distance education in Russia is set up as an entity system, meaning:

- the unity of organisational, teaching and methodical and other principles for setting up a system of distance education with the view to more fully implement the state's and citizens' interests;
- the setting up of state's regional and branch centres of distance education, ensuring implementation of the state policy on the system of distance education in industries and regions;
- the setting up of the federal bank of educational courses for the entire system of distance education, having a unified certification, author's and methodical notes, that is accessible by telecommunication networks of educational resources, i.e. banks, bases of knowledge and educational-purpose data;
- the setting up of the Russian University of distance education pooling resources of a large number of educational institutions of all forms of properties, included into the distance education system.

After finishing studies at educational institutions within the Russian University of DE, students get a diploma approved and recognised by the state.

The united system of distance education created in Russia must provide for:

• large-scale training and retraining and refresher training of specialists for providing employers with specialists in conversion, educational, regional and other government and public programs;

• radically new levels of students' academic mobility, giving them an opportunity to transfer from one educational program to another, from one educational establishment to another to continue education, and to simultaneously study at different educational establishments including foreign ones.

• an opportunity to get education for disabled people who cannot study using the traditional system;

• a high quality of education due to realisation of complex educational programs based on the best traditions in the national education and international experience of using advanced information technologies.

• an expanded influence of Russian higher degree establishments entering new markets of educational services in this country and abroad;

• an accessible higher education for foreigners (from the CIS countries and developing countries), overcoming the isolation of the national educational system from the world one, at the linguistic level, as well;

• reduction of big cities' social tension caused by the youth migration (including the underaged) in order to obtain education in leading universities of the country;

• an opportunity to get education where one lives that can help to settle social problems connected with today's disproportion in geographical distribution of educational institutions over Russia's territory.

• a possibility to get advanced education for the most talented of children and teen-agers in spite of their place of residence and remoteness of traditional academical and university centres.

The program for the creation of the DE system in Russia must be implemented by the year of 2000 it envisages the solution of the following priority problems:

• formation of organisational and administrative structures for the system of Distance education;

• working out of the scientific and methodical support of the system;

• development of the material and technical base;

• training of specialists;

• development of information technologies, media and communication infrastructure for realising educational technologies;

• working out of legal support;

• development of international ties in the sphere of Distance Education System.

The development of national DE systems will promote integration of educational systems into the world one that is an important sign of the world community evolution. The DE system will allow us to use education as an instrument to settle geopolitical problems and, first of all, the problems of the Russian population living outside Russia. The process of interaction with foreign educational institutions and associations (such as open University UK, ICDE (International council for Distance Education), EDEN (European Distance Education Net-work), EADTU (European Association of Distance Teaching Universities) is intensified. In this case, there appears an opportunity of fruitful co-operation in working out program and methodical materials and the joint use of the sophisticated technical facilities of didactical communication.

The united system of distance education in Russia is created as an open system. Russia presents its industrial, technical and educational potential to the entire world community and invites all countries to equal-right co-operation, one of the most interesting results of which will be accumulation of mankind's knowledge.

4.6. PARTICIPATION OF RUSSIA IN INTERNATIONAL PROGRAMS ON NEW INFORMATION TECHNOLOGIES IN EDUCATION

Today Russia maintains international educational ties with 126 countries. The Russian higher school works out and takes part in realisation of numerous joint projects. And the significant part of these is carried out with the participation of UNESCO and UNIDO and is oriented to the integration of national DE systems. The global international program «An open educational system of the 21" century» is aimed at this.

This program includes 2 basic projects: «UNESCO-UNIDO-Russia: World Technological University» and «DESCOP» («Distance Education in New Informational Medium»). A memorandum on mutual understanding between UNESCO, UNIDO and GOSKOMVUZ of Russia, envisaging realisation of this program, was signed in Paris in November, 1995. All countries, organisations and establishments interested in forming new educational systems and having relative projects, can join this program.

The World Technological University UNESCO - UNIDO-RUSSIA will become an innovative educational institution to promote the principles of creating "world culture", a centre of business activity and joint efforts of technological universities, scientific and industrial organisations of world community countries in order to solve urgent problems of science, industry and education.

The World Technological University is a university of a "composite type", whose members will be classical technical and technological universities, academies, institutes, branch scientific-research institutes, cultural and scientific centres, international and regional associations and bodies providing engineering education, as well as governmental and public educational, scientific and industrial organisations.

One of the most significant activities of the World Technological University will be the working-out and putting into effect novel information technologies used in education. At the same time the University teaching staff will efficiently use some modern information technologies in the teaching process.

The aim of realisation of the international project «Distance Education in New Informational Medium»(DESCOP) is to create a common educational

- informational and space providing an access to computer information sources, as well as traditional and electronic libraries, video- and audiotheques for both learners and teachers who will communicate with each other through systems based on space technologies and other modern communication systems.

Both projects mentioned above and constituting the basis of the program "Open Educational System of the XXI Century" were adopted at the 28th session of the UNESCO General conference (Paris, Oct.-Nov., 1995) and approved by the 6th session of General conference of UNIDO (Vienna, Dec., 1995). The UNESCO 28th General Conference supported Russia's initiative and adopted a research project «Multimedia Technology and Personality Development». Realisation of the project will bring together Russia's research learns and their foreign colleagues in solving the most important problem, that of determining adequate psychological and ecological conditions for using novel means of information technologies in education and formation of students' world-outlook.

Russia intends to extend its participation in joint UNESCO-UNIDO programs on information and information technology exchange, necessary for creating a global educational system that can ensure any person a real access to any form or level of education, including professional training.

Optimism toward the future of these and other similar projects is based on real results reached in the course of Russia's implementation of a number of joint educational projects.

For example, vigorous efforts by Russia's Higher School in the field of "Distance Education" were backed up by a pilot project *TACIS* "Training managers in Russia on the basis of distance teaching methods".

In accordance with an agreement between Russia and the International Institute for Planning Higher Education (UNESCO/IIPHE), in 1995 they actively probed the possibility of using the Russian system of distance education for training students and teachers of 10 Russian Universities in the course «Higher Educational Institution Management».

Those universities were so selected as to represent different regions all over Russia: from Moscow and St.-Petersburg to Yakut Republic and the Far East. The course program was worked out by IIPHE - GOSKOMVUZ experts. The course is composed of 10 interactive classes 80 minutes each. At an agreed time GOSKOMVUZ ensures the use of satellite communication for the teaching process.

International educational projects using NIT are widely implemented in Russia's secondary educational institutions. Some of the most successful projects are ecological telecommunication ones in which schoolchildren monitor the ecological situation and exchange results by electronic mail. One of these is the project of the US National Geography society «Children's network KidNet». This project (telecommunication within its framework is carried out through the Sprint network) has been realised in Russia for 7 years, now it involves schools from 10 cities of Russia - Moscow, St.-Petersburg, Voronezh, Obninsk, N. Novgorod, Samara, Ekaterinburg, Novosibirsk, Yakutsk and Krasnoyarsk.

Another project - Global Lab, started jointly by Russian (INT) and American (TERC) scientists was used as a basis for the Glob project. An agreement on joint implementation of the project in both countries was signed by the commission Gore-Chernomyrdin.

The policy of the Russian Government aimed at integrating the Russian informational and - educational system into to the International informational medium will alleviate an access to the world's best educational programs and facilitate dissemination of Russian didactic materials through the international system of educational services.

The required conditions for integration of Russian education into the world informational medium include:

• creation of the communicational infrastructure core, ensuring effective exchange of information;

• use of international standards in informational networks;

• legalisation of the access to Western countries' computer networks for Russian users.

In its quest for effective ways of integrating into the world informational and educational medium, Russia actively participates in a variety of activities of international organisations, including:

• holding of conferences, seminars, schools, working meetings;

• exchange of information materials;

• working-out of international multi-language dictionaries and thesauruses;

• training of qualified personnel;

• working-out of international educational programs and systems;

• co-ordination of international projects.

* * *

Highly appreciating developing and effective use of new information technologies in education, Russia considers them not as per se, but rather as a means of forming the basis for the education of the 21[th] century which will prove to be education for everybody . It should be multivariant, adequate to cultural and ethnic diversity of the mankind and should satisfy various demands of socio-professional and confessional groups, as well as cultural demands of the individual.

APPENDIX I

THE STATE GUARANTY OF THE RIGHTS OF THE RUSSIAN FEDERATION CITIZENS IN THE FIELD OF EDUCATION

1. The citizens of the Russian Federation are guaranteed to get education irrespective of their sex, race, nationality, language, origin, residence, relation to religion, beliefs, belonging to public organisations (movements), age, health condition, social, property or position status, previous convictions. Infringements of the citizens rights to vocational training in relation to their sex, age, health condition and previous conviction may only be enforced on the basis of the law.

2. The state ensures its citizens the right to get

education through creation of an educational system and adequate socio-economic conditions.

3. The state guarantees its citizens accessible and free primary general, basic general, secondary (complete) general education; elementary vocational education. It also guarantees (on the competitive basis) free secondary vocational training along with higher educational vocational training, and post-graduate vocational training in state, municipal (community) colleges within the framework of state-approved standards provided that a citizen gets education of that level for the first time.

4. Citizens tuition fees in non-state paid state-accredited educational institutions using educational programs of general education are refunded in the amount determined on the basis of the State-approved standards for educating citizens in a state or municipal educational institution of the respective kind or type.

5. To ensure the right to education of the citizens who need social assistance, the state covers fully or in part their expenses for the period of studies. The categories of citizens entitled to the assistance, as well as the type, forms and sources of the latter are provided by the federal law.

6. The state creates conditions for getting education to handicapped citizens, providing opportunities for correcting their aberration and assisting their social adaptation on the basis of special pedagogical approaches.

7. The state stimulates persons with unusual abilities («whiz kids») to get education through awarding them special state stipends, including grants for studies abroad. Requirements and procedures for awarding such stipends are established by the Government of the Russian Federation.

Source: The Law on Education of Federation, Art. 5, The Russian Federation

APPENDIX 2

REQUIREMENTS TO EDUCATION CONTENT

1. The content of education is one of the factors of economic and social progress of society and it should be centred

around:

- ensuring self-determination of the personality and creating conditions for its self-realisation;
- strengthening and upgrading a law-abiding state;

2. The content of education must ensure:

- a world-adequate level of general and professional culture of the society;
- forming in students a picture of the world adequate to the contemporary level of knowledge as well as the level of the general educational program (tuition stage);
- integration of the individual into national and world culture;
- forming a personality and a citizen integrated into a society of his/her time and motivated (in improving that society;
- reproduction and development of manpower potential of the society.

3. The vocational (professional) education of any level should provide the student with acquiring professional skills and adequate qualifications.

4. The content of education should facilitate mutual understanding and co-operation between people irrespective of their race, nationality, ethnic, religious and social belonging; and take into account diversity of world-outlooks; enable realisation of the right of the student to freedom of opinions and beliefs.

5. The content of education in a given educational institution is determined by the educational program (curricula) worked out, approved and carried out on their own by this particular institution. The state educational management bodies ensure the working out of exemplary educational programs on the basis of state-approved educational standards.

6. In line with its charter's aims, an educational institution may implement supplementary educational programs and offer educational extras (on contractual basis) beyond the scope of its educational curricula, determining its status.

7. Military training in civilian educational institutions may be carried out only optionally with students' and/or their parents (legitimate representatives') consent at the expense of the interested Department and through the means of the latter.

8. While implementing educational programs, educational institutions make good use of cultural institution opportunities.

Source; Law on Education, RF, Art. 14.

APPENDIX 3

PRINCIPLES OF NATIONAL POLICY IN EDUCATION

1. Education is humanistic, with priority given to universal values, man's life and health and free development of the individual. One is to be brought up to respect one's civic duties and human rights, be diligent and love nature, one's country and family.

2. Federal cultural and educational space is indivisible. The educational system is to protect and foster ethical and regional cultures, cultural traditions and peculiarities under the existing multinational state conditions.

3. Education is to be available to all, with the system adaptable to the student's level and background.

4. State-owned and municipal educational institutions are to be secular.

5. Education is free of unnecessary restrictions and pluralistic.

6. Education in democratically governed both by the state and society, with educational institutions being autonomous.

Source: Russia's Federal Law «On Education», Article 2

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Fig. 1. The structure of Russia's system of education

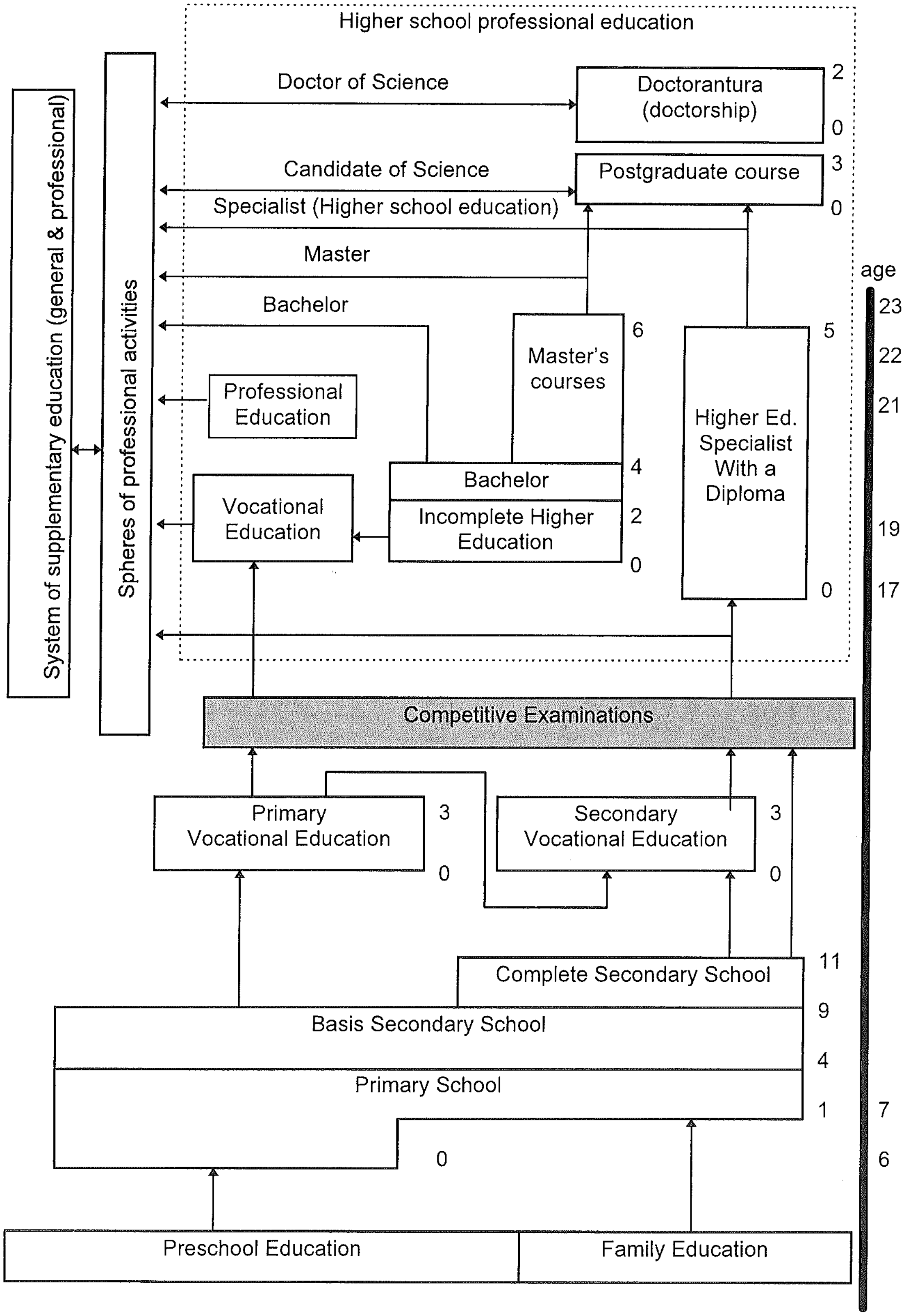

Fig. 2. A system of continuous training in informatics in education.

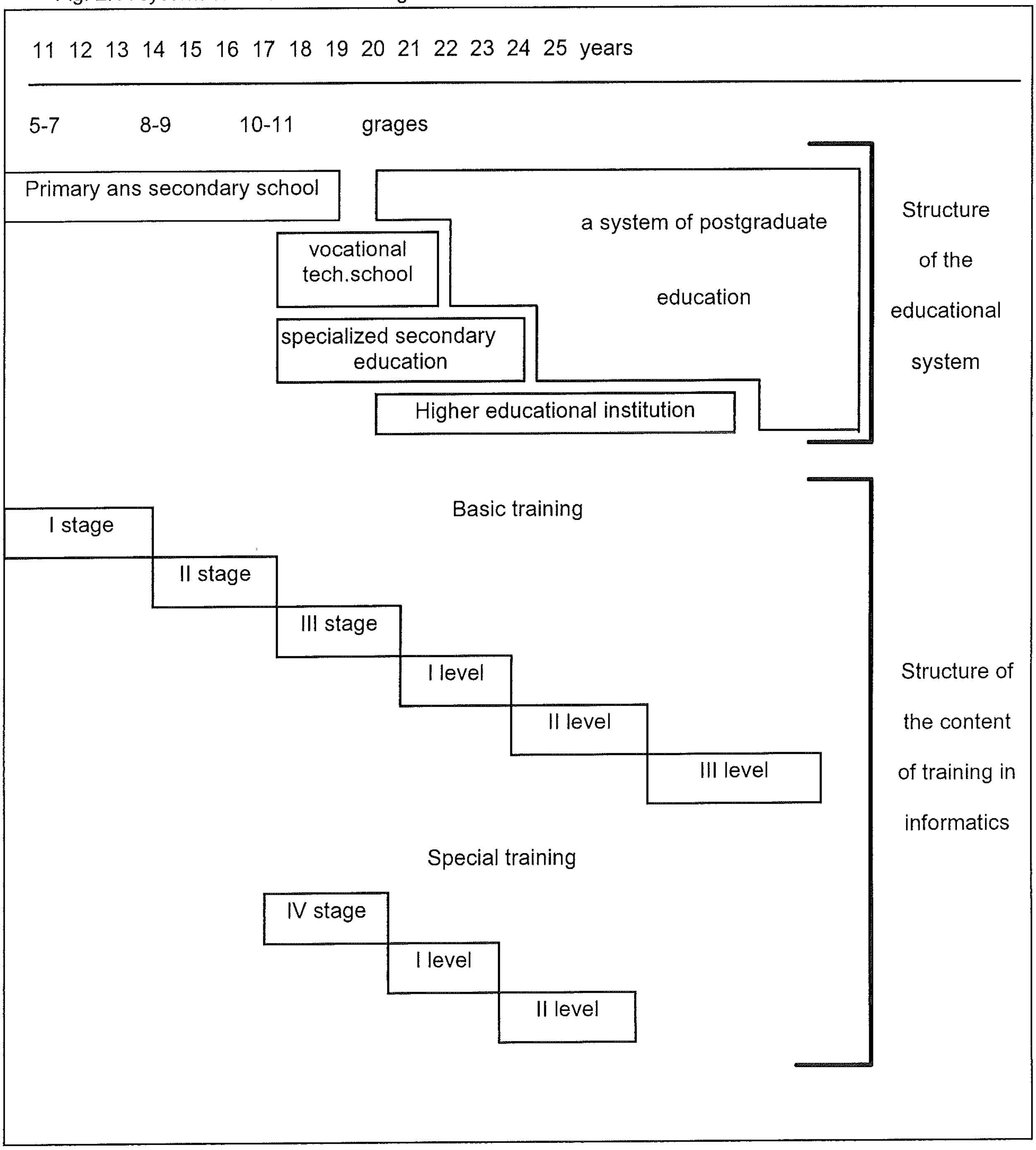

Fig. 3. Scheme of forming a program in informtics for students of the professional educational system.

Specialty code			Recommended levels of training				
№ group.	№ special.	Speciality name	Basic training	MPT	CADS	CASIPM	CARS
1	2	3	4	5	6	7	8
12	02	metal-cutting machines and tools	2	1	2	1	

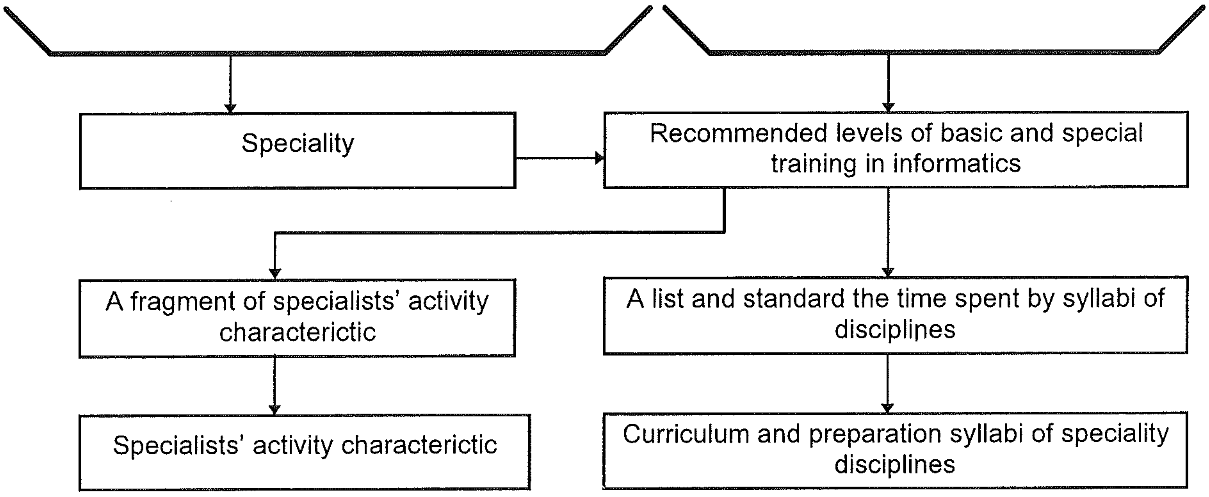

Fig.4. Structure of the subject area of informatics - a modern concept

Fundamentals of informatics

Theoretical informatics	Information as matter's semantic property. Information and evolution in living and non-living nature. Principles of general theory of information. Methods of information measuring. Macro- and microinformation. Mathematical and informational models. The Algorithm theory. Stochastic methods of knowledge. Semantic aspects of intellectual process and information systems. information systems of the artificial intellect. Methods of knowledge presentation. Cognition and creation as information processes. The theory and methods of developing and designing information systems and technologies.

<table>
<tr><th colspan="3">MEANS OF INFORMATIZATION</th><th></th></tr>
<tr><td>hardware</td><td colspan="2">for data processing, presentation and transmission</td><td>Personal computers. Working stations. Input/output unity and information display units.
Audio- and videosystems, multimedia systems.
Computer networks. Communication means and computer telecommunication systems.</td></tr>
<tr><td rowspan="3">software</td><td colspan="2">system means</td><td>Operating systems and media. Programming systems and languages. Service shells users' interface systems. Programming means of intercomputer communication (teleaccess systems), calculative and information media.</td></tr>
<tr><td rowspan="2">for technologies

realization</td><td>versatile</td><td>Word and graphic processors. Systems of data bases control. Electronic table processors.
Means of simulating objects, processes and systems.
Information languages and formats of presentation of data and knowledge, vocabularies, classifiers, thesauri.
Means of information protection against destruction and unauthorized access.</td></tr>
<tr><td>profession-oriented</td><td>Publishing systems.
Systems of realizing technologies of computer-aided calculations, design and data processing in the sphere of accounting, planning, management, analysis, statistics, etc.
Systems of artificial intellect (knowledge bases, expert systems, diagnostic, and teaching systems, etc.)</td></tr>
</table>

Information Technologies of social informtics	Input/output, accumulation, storage, transmission and processing of data. Preparation and word and graphic documentation. Integration and collective use of heterogeneous information resources. Information protection. Programming, designing, modelling, training, diagnostics and control (of objects, processes and systems). Information resources as a factor of socio-economic and cultural development of the society. The information society - rules and problems of formation and development. Information infrastructure of the society. Problems of information security. New opportunities for the personality development in the informational society. Problems of democratization in the informational society and ways of their solution. Informational culture and information security of the personality.

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NATIONAL REPORT OF SWAZILAND

THE SWAZILAND EXPERIENCE

INTRODUCTION

This paper is a product of years of observations measured by different researchers on science and technology education in Swaziland. Some of the observation are measured objectively while some are subjective estimates. The paper is developed as a national paper to contribute to UNESCO's efforts to bring about awareness on informatics among member countries. The paper will be presented at the Second International Congress on Education and Informatics to be held in Moscow, in July 1 - 5, 1996. The paper is divided into seven broad but related topics aimed at pointing successes and failures experienced in the effort to introduce information technology in our education. The author is responsible for erroneous observations reflected in the paper and does not in any way hold any institution, including government responsible for those failures. The author is convinced, however, that every stakeholder is responsible to do everything to give the Swazi child a better chance to face the future with confidence before it is too late. The first section of the report gives an overview on the country's education and industry infrastructure. The second and subsequent sections touch on different perspectives of new information technology in our education.

1. EDUCATION AND INDUSTRY OVERVIEW

Our education is structured sectored into six or more levels. The levels include the adult and non-formal education, preschools, formal schooling - which is further divided into: primary, secondary and high schools, tertiary and vocational education - and commercial schools, which are vendor-driven. The commercial schools concentrate in offering short courses in management, secretarial, legal, computing and few others. Identifying these different levels in our education at this point is an important factor for consideration as we aim to determine the layers at which new information technology can play an important role to enhance education quality as well as prepare students to be ready for future responsibilities in the learning careers as well as participating in society development strategies.

1.1. ADULT AND NON-FORMAL SCHOOLS

Because of intensive campaign to reduce illiteracy rate in the country the adult education was introduced to teach adults the two formal languages of siSwati and English, to the level of seventh year of normal schooling. As a result of introduction of adult education literacy rate has improved from 40% at independence in 1968 to almost 70% in 1986[1]. The adult education, which is instituted by SEBENTA, is distributed through out the country. It is supplemented by non-formal or special schools, whose main objective is to train young Swazis, especially females in crafts/skills including knitting, sawing, vegetable gardens management, handicraft, woodwork and other skills which serve as way-out to employment opportunities for people with low formal schooling qualification. The other area of contribution derived from the adult education is numeracy. Participants learn basic skills of arithmetic.

1.2. PRESCHOOLS EDUCATION

In 1994 over 460 schools were reported under this category. These schools share between them over 500 teachers and attend to over 16 000 pupils in enrolment per annum. Children enter this form of education from the age of two years and exit at the age of six years, just before they enter primary education. Primary schools receive graduates from preschools at the age of seven years. It is now almost a known fact of education policy (not formalised though) that children who enter the primary schools education should have preschool education as a prerequisite.

Most pre-schools are part of a primary-cum-secondary/high school, thus, sharing the same school management facilities. But some of these are independently run and located at strategic areas in the community they are serving. Preschools are most welcome by working parents who cannot afford the services of a domestic servant - which are at times not consistent in the caring for the child.

1.3. PRIMARY, SECONDARY AND HIGH SCHOOLS

Primary schools education admits children of the age of 7-years and upward. As already mentioned above these children would have graduated from preschools education. In olden days it was possible and prevalent to admit children of 12-years of age and above to commence primary education. The delay in entering the primary education was due to a number of factors. One cause of the delay was lack of awareness on the part of the parent how important is education[2]. The situation changed considerably after independence in 1968. Other reasons included lack of funding for clothing and school requisites, distance away from school, and environment surrounding the family such as: urban, rural, or farm settler/squatter. These conditions would not only delay entry into the primary education and thus delay period of exit to higher education but would also prevent many school age children from ever attending education.

During the year 1991 there were 516 primary schools (excluding pre-primary), and 150 secondary or high schools[3]. These schools were in the hands of, respectively, 5 347 primary-, and 2 430 secondary teachers. The primary schools had 173 000 pupils whilst the secondary schools had 44 000 students. Of the primary schools 70 were government schools, 411 were government aided schools, and 35 private schools. Of the secondary or high schools 70 were government schools, and SO being aided by government. There were no privately owned schools reported at this level.

1.4. POST-HIGH SCHOOL EDUCATION

There are six formal post secondary or high schools institutions in the country. Included in these institutes there is one university divided into two campuses. The six institutes constitute what is known as colleges and the University of Swaziland (Uniswa). These institutions share among them over 4 000 students and over 400 academic staff. The institutes are:

- University of Swaziland (Uniswa);
- Swaziland College of Technology (SCOT);
- Gwamile Vocational and Commercial Training Institute (VOCTIM);
- Ngwane Teacher Training College;
- Nazarene Teacher Training College;
- William Pitcher Teacher Training College;

There are other training institutes, which demand different qualifications than high school certificate or even lesser qualification as entry requirement. These include:

- Co-operative Development Centre (C.O.D.E.C);
- Good Shepherd Nursing College;
- Mananga Agricultural Management Institute;
- Manzini Industrial Training Centre (M.I.T.C) - distributed in three regions;
- Nazarene Bible College;
- Nazarene Nursing College;
- Swaziland Institute of Health Sciences;
- Swaziland Institute of Management and Public Administration (SIMPA) ;
- Institute of Development Management (IDM),

and other smaller institutions. We must mention shat the "other" institutions include the Police College and Prisons rehabilitation unit, both of which are large in terms of attendance.

1.5. INDUSTRY BACKGROUND

The structures of employment and establishments of government on one hand are complex, while the other sectors of the economy are characterized by subsistence farming on traditional land, small and large agriculture estates on freehold land (forestry, sugar, citrus, pineapple, cotton and cattle ranching), limited mining of asbestos, coal and diamonds; few agro industries, and manufacturing. The urban areas have diverse activities including wholesales, services, small industries, and a number of informal undertakings. The formal sector accounts for over 1 500 establishments (excluding the government sector), and employ over 93 000 persons (including the government sector).

In the next sections we focus on education technologies with special reference to the education and industry structures defined above.

2. NEW INFORMATION TECHNOLOGIES (NITS IN SWAZILAND EDUCATION SYSTEM)

The economy of Swaziland demands liar services, distribution, production and communications be efficient for ease of source and marketing raw materials internally and abroad. The volume of international trade, for an example, amounted to approximately E6.2 billion in 1994[4], of this trade export accounted for about E2.6 billion while import accounted for the rest. In addition to the external trade figures, local trade, including construction amounted to over E400 million[5].

These trade trends are clear indication that information and information processing are vital both to the traders and to the government. We have already indicated that the number of employees, from both public and the private sector is about 93 500 in 1993 statistical figures. The employees fall under the following closes: professionals, administrators, clerical, skilled, semi-skilled and unskilled labourers. Moreover Swaziland is part of the Southern African Development Community (SADC) region which is driving towards inter-country trade and development. Matters under discussion for the region include the sharing of transport, telecommunications and other facilities across the border lines for betterment of lives of the communities. These trade and strategic development issues depend highly, right now, on the regions capability to produce timely information for rationalisation and optimisation purposes. Each country will depend and rely on information concerning a set of select issues on social, economic, scientific and cultural competitiveness. A country's competitiveness will be achieved if the country advances itself competitively in technologies, including information technology. The countries which delay in advancing in the field of IT stand to loose in the race to compete for the scarce resources, and even experience higher deficits in their balance of trade.

2.1. DEVELOPMENTS IN INFORMATION TECHNOLOGY EDUCATION

It is a well-known ancient fact that man slaved off his development and advancement by hunting in the wilderness and in jungles for his daily needs. The hunt is still going on up to this very moment. There is a hunt for food, for clothing, for knowledge and for the unknown such as hunting for elements and friends in outer space. All countries participate in the hunt. In the developing countries such as Swaziland the hunt is concentrated mainly on acquisition of food, health, clothing, wealth and knowledge. The hunt for knowledge is urgent and a priority for boosting efficiency and effectiveness in the management and distribution of scarce resources. Because of the high level[6] of unemployment, (over 66%) which contributes to present dissatisfaction among the work force in general, there is an urgent need to explore areas which have not yet been developed and at the same time strive to increase production capacities on already existing production institutions. The type of education responsible for the supply of well-trained workers is under criticism from both government and society. The curriculum in particular, is viewed to having a greater room for improvement in order to produce the workforce capable of fitting in different work demands including, especially, versatile teachers. The observed deficiency in the curriculum is probably due to a slower growth curve and a weaker curriculum institution within the Teaching Services Commission. This fact will be discussed in detail in section 6.

THE CURRENT STATUS OF INFORMATION TECHNOLOGY IN EDUCATION IS AS FOLLOWS:

In tertiary education

The qualitative situation in tertiary education displays the following global characteristics:

Table 1.

Qualitative Computing Situation in Institutions

TERTIARY INSTITUTION	WITH COMPUTERS FOR TRAINING		
	TRAINING	ADMINISTRATION	RESEARCH
NAZ. TEACHER T.C.	NO	YES	NO
VOCTIM	YES	YES	NO
NGWANE TEACHER T. COLLEGE	NO	YES	NO
SCOT	YES	YES	NO
UNISWA	YES	YES	NO
WILLIAM PITCHER TEACHER T. C.	NO	YES	YES

SOURCE: Telephone interviews

For the moment we look at tertiary education how information technology education is conducted. Of the six institutions of higher learning listed above, three report the presence of at least one computer lab used for training. SCOT has three computer laboratories each of about 10 personal computers, while UNISWA has four computer laboratories each averaging over fifteen personal computers. In both institutions the computer labs are undergoing upgrading of the PCs from 80286 processors to 386 and even better processors. While the labs at SCOT are of stand alone PCs, all the labs at the university are connected on local area networks (LANs).

One of the university LANs is situated in a campus which is over 20 kilometers away from the main campus. The other three LAN's are linked together via a fibre optic backbone controlled from the university Computer Centre. There are about seven other related institutions, which report the presence of computing facility used for administration purposes. These were interviewed separately, and are listed below in Table 2. While most of the institutes make use of IT in administration reports, letters, and simple records, there is less effort made towards writing programmes dedicated mainly to word processing. The university has specialised systems for students record keeping, accounts, and other support systems, though. Some of the systems are built in house while others are acquired off-shelf.

Both the university and the technical college SCOT are in a process of linking to international highways to make it possible to research from shareable bibliographic databases through electronic data transfers. There are few other smaller institutions which exist whose details of performance and possession of computing facilities are not known. Of the major institutions, SCOT and Uniswa are the only ones engaged in formal and structured computing studies. SCOT offers computing literacy to the college students in general, and a 3-year diploma programme in computer science. Uniswa, on the other hand, offers a computer foundation course to three faculties: Science, Agriculture, and Commerce. The course is expected to reach all faculties in due time. In addition to the computer foundation course, the university Faculty of Science is also offering a degree programme in computer science as one of the majors, while the Faculty of Commerce offers Information Systems courses to first-, third-, and fifth-year students.

The least reported utilisation of computing in the institutions is research. The Social Science Research Unit (SSRU) of the university did report the utilisation of computing for its research activities, but this unit has since been dismantled in the process of restructuring of research activities at the university. Hopefully some form of research will immerge.

Table 2.

Other Related Institutions

TERTIARY INSTITUTION	WITH COMPUTERS FOR		
	TRAINING	ADMINISTR ATION	RESEARCH
COOP DEV CENTRE	NO	NO	NO
GOOD SHEPHERD	NO	NO	NO
NURSING			
MANANGA MNG	YES	YES	NO
N.A.S.C.	NO	YES	NO
MITC	NO	YES	NO
NAZ. BIBLE C.	NO	YES	NO
S.I. HEALTH SC.	NO	YES	NO
SIMPA	YES	NO	NO
IDM	YES	YES	NO

In the Primary, Secondary and High schools

Private schools are the ones reporting the presence of computers more than public or government related schools. But as already alluded, even in these schools, the use of computers by students can be explained as being for the enthusiastic student - it is not universal. It is encouraging to note that the Cambridge Syndicate O-level, overseas education which sets end-of-year examination papers and issues Form V or high school certificate, has already included the subject of Computer Science as one of its examining subjects. Students do already have an option to choose computing as examination subject. But we shall see there are too few schools with computer facility to make computer education become significant.

In a study conducted in 1991 by V.L. Kelly and L.K. Manana[7] the following primary schools were found to possess computer laboratories. The laboratories were found in different spaces of the schools including used libraries, offices, and other congested offices: Primary schools found with computer laboratories are:

- Mananga
- Simunye
- Ubombo
- Usuthu forest
- Sifundzani
- Enjabulweni

Only two secondary/high schools reported computer laboratories. These are Sisekelo, and Waterford. All these schools, primary and secondary, belong to private companies. They service staff members' children, but they are open to outsiders as well. Public or government run schools are being sensitised by the sciences campaign aimed at schools head teachers to start using computers in the administration. It is expected that before the end of1996, more than 48 schools will benefit from this campaign.

3. PRIORITIES AND POLICY IN NITS EDUCATION

It has been observed that the introduction of computing in the schools mentioned above is an idea which originates from the companies. It is also observed that the teaching of computer study of any form, e.g., computer aided instruction (CAI), computer based instruction (CBI), or computer managed instruction (CMI), or any form of computer education for that matter, is dependant on an individual teacher with or without computer skills who is just enthusiastic on the use of computers.

Currently the government is putting together a national development strategy for the different sectors of development. The strategy is a development plan which covers a longer period of up to twenty five years. The component of science and technology is delineated as well. It is hoped that the strategy will help the government to make appropriate decision for intervention in the development of the economy, especially in the development of human resources. The recommendations[8] made by the Science and Technology Committee are that the government will establish and support a National Research, Science and Technology Council (NRSTC) which is to be serviced by a permanent Secretariat. The secretariat will operate as an inferential engine for all realisable technology advisory committees (TACs).

Among these TACs there is a science and technology education or specifically an Informatics and Biotechnology Education Committee. The latter committee will liaise with the secretariat's appropriate representative in matters of S&T education. It is the duty of the NRSTC to popularize S&T through all structures of the society, especially education. On the other hand a shot in the arm is being provided by the Ministry of Education which is currently engaged in the process of restructuring and strengthening the Curriculum Unit of the Teaching Service's Commission.

As other researchers have observed, introduction of NITs in a school is a costly process. It is, however, the rightful duty of the experts in IT to explain in simple language to the lay education community that the use of computers and communication is not only for betterment of running the affairs of industry but it is also most appropriate for pedagogical purposes as well. The uses of computers in education include[9] the following:

- computation - simple data processing
- conceptualizing - helping children to grasp concepts quickly
- problem-solving - solve complex problems quickly
- simulation - instilling excitement and enthusiasm in learning
- skill and practice
- teacher utility
- information management
- tutorial

Each one of the areas of computer uses listed above is a subject of its own. It is capable of generating a full paper for presentation. These are the areas that education in developing countries should consider explicating and infusing into the education systems at appropriate levels. As already highlighted, the Ministry of Education is campaigning to introduce a computing use to few schools in the near-future for purposes of information management. The areas of conceptualizing and simulation can be introduced to preschools up to including high schools, whilst the areas of computation, problem-solving, skill and practice, and tutorial can start at the level where children can read and write. All these areas can be infused into our education through the curriculum according to the rationales and paradigms, which are considered to be national priority. We should also emphasise the benefits derived when using IT education to the disabled pupils. IT education is reported to be making great impact in interactive distance learning with the use of multimedia. There is greater economy derived from conferencing as different groups of students could be scattered all over the country but listening at and asking questions from the same teacher. Swaziland, as a country with fewer resources could explore this innovative area in education. Another sector of IT and telecommunication education to be synchronized in the country is streamlining of vendor-based computer schools to teach in a way that will quickly close the gap of IT illiteracy in the country. These commercial schools, as often referred to, have a potential to play an important role in helping students during holidays and spare times to come in and have hands-on practice. They can serve as student centres. Already there are university students who attend classes in these schools on voluntary bases. The main interest among these students is to be able to learn a wordprocessor for producing own school project documents.

In 1995, the University of Swaziland, under the auspices of UNESCO and the Ministry of Education, did organise and conduct the "Training the Trainers Course in Informatics" for Teacher Training Colleges participants. The course concentrated on five areas of computing; viz., the operating system, word processing, spreadsheet, databases, and programming languages. The programme[10], which ran for two full weeks, was designed to teach participants on the importance of the computer and how to use the computer in the classroom - especially to motivate students in the conceptualizing process.

4. PROVISION OF COMPUTER HARDWARE AND SOFTWARE IN SCHOOLS

Informal discussions show that the level of awareness on the use of computers is still low in the country. Computing is still regarded as a tool for big companies. It is considered costly to be introduced in the education system, especially when there are schools without desks and chairs, without classrooms, electricity or telephone lines. Some schools are built by communities at inaccessible areas even by means of a vehicle. Thus, talking computing to these communities is like talking prestige. Kelly and Manana point out that education software is expensive for the schools to obtain. By 1996 standard the computing equipment which includes Atari, Apple and other two-disk (floppy) machines are way out of fashion.

They no longer can run current flexible software which run under windows and requiring bigger working memories.

The computer laboratories at the university, for example, are being upgraded to accommodate software, which requires 16 or better megabytes working memory. A limited number of the machines are equipped with CD-ROM, speakers and sound blusters. Although the use of multi-media has not yet been fully demonstrated, their potentials are being conceived. Over 90 per cent of computing equipment at the university are based on DOS operating system. DOS is said to be fast running out of life especially with the introduction of Windows'95. Users are still happy with DOS-based systems developed with user-friendly menu lines. The antiquatedness of equipment comes different ways. At times the equipment in place runs out of spare parts. When manufacturers no longer support the model, repairs to the equipment becomes impossible. The other cause for concern is when an application software has been upgraded by the developers on a higher model development system or processor. Few examples associated with the latter constraint include the requirements to run WordPerfect 6.1 and *dBASE IV* version 2.0.

Both applications require a working memory size of minimum 4-million bytes (Mb). The wordprocessor requires this much memory size because it runs on windows and it incorporates more features such as graphics than its predecessors. The database management system developers on the other hand have upgraded some features of the system such as array manager to handle a larger matrix of over 300 rows by over 5 columns, say. These applications are popular and have tied many companies into their use. The upgrades, however, signal that future acquisitions of hardware should be way over 8-Mb. The applications running on Windows have even a larger memory requirements. The Windows'95 requires a memory size of at least 16-Mb. Windows'95 has another feature -Internet connection which is an advantage to have. While it sounds like the future is shaky in terms of hardware, the good news is that the new bigger and faster memory machines cost relatively cheaper than the older versions when comparing the price per performance. The University of Swaziland is currently experiencing these hardware-software changes. Both local area networks running the administration records face memory constrains as explained above.

5. POLICIES AND STANDARDIZATION

At UNISWA the select Coordinating Committee set in 1987 and clearly stated that all equipment purchased or donated towards the university should be DOS-based machines. This stipulation is most useful, as it has served the university community over the past ten years or more positively. There are exceptions, however. Lecturers coming from overseas with equipment of different operating systems, mostly AppleDOS, have found themselves without support from the majority users. The university has two UNIX-based file servers used for teaching and electronic mailing. These UNIX machines are operated and managed by not more than two Unix experts on campus.

One other area of careful thought is the network architecture or topology. After a careful study of possible network operating systems to be implemented, the university decided to implement a simple Ethernet architecture running Novell on copper or coaxial cables. These networks are reliable and work fine so far. The backbone or broadband (fibre optic) based network has a star module at the Computer Centre which manages all networks connected to the backbone or campus wide network. A test of linking the two campuses separated by at least 20 kilometres is going on right now. It is conducted by Post and Telecommunications technicians. The test is towards implementing a leased line to link the two campuses.

Recently an association of information technology professionals in the country has been formed and officially registered. Some of the objectives listed as commitments of the association include the following:

- to help in setting standards and code of ethics for practicing IT professionals
- to help in setting standards for training provided by computer schools ....
- to enhance the body of knowledge in the field ... and create public awareness on IT ...

Already the association has managed to run two forums; one on "systems implementation and the future" and the other on "Networking and Data Communication; Present and future Prospects in Swaziland". In both forums the Post and Telecommunications Corporation has featured prominently. The executive council of the association is currently on a campaign to bring together government, industry', and private practitioners of IT to a discussion of training in IT. It is expected that such efforts organised and managed by IT professionals, should yield forward looking results in the country's progress towards stimulating literacy as well as setting standards in computing.

6. FACTORS LIMITING PROGRESS IN THE ADOPTION OF NEW TECHNOLOGIES IN EDUCATION

Computing in education is lagging behind in the country because of several reasons. We shall list just few but very important factors which can make a difference. In section 3 of the report we have hinted already on what Kelly and Manana observed as obstacles in introducing IT education in schools. In another study conducted by a University research fellow[11] it is observed that constraints include:

- power supply coverage
- telecommunication infrastructure
- trained IT teachers
- hardware and software availability
- IT in education curricula
- use of local IT professionals both in government and industry

6.1. POWER SUPPLY COVERAGE

The supply of electricity is generally good in Swaziland, but because of resettlement nature of homesteads being scattered over the surface of the country instead of forming compact villages, it is costly to lay powerlines to individual families. At present moment the Swaziland Electricity Board, the sole supplier of electricity in the country, would charge anything up to E16.000[12] per transformer. If one homestead is interested in connecting to the power line, then the homestead must foot the bill alone. In addition to the connection charges, the homestead must pay monthly utilisation bills in excess of E200 if not using the power for cooking or double this amount if cooking and other heavier utilisation other than light is contemplated.

In some areas some homestead groups, relatively uniformly structured, have emerged and bought electricity. The Khanyisa Kukhanyeni Group Scheme, for example, applied for the supply of power and the charge was E30.000, for a group of 15 homesteads. Another scheme of Jabulane community, near Nhlangano was charged E13.000, for a group of 5 homesteads. Both schemes source the power via a nearby school connection. In 1994 the Ministry of Education Information System unit reported 89 secondary/high schools connected to the power line and 82 schools with science laboratories out of a total of 165 schools. No details were available about the other lower level schools. Commercial and tertiary education are all expected to be connected since they are all located in the bigger cities.

6.2. TELECOMMUNICATION INFRASTRUCTURE

The problems of scattered rural homesteads, costs and shortages of telephones lines at PTC are but few problems to be mentioned in connection with supply of telephones. Current voice carriers can transmit at the capacity of 9.6 kilobits per second for most parts of the cities. Improvement of capacity has been made in connecting from Mbabane, capital city, to nearest point in the Republic of South Africa. A broadband carrier has been installed which can transmit voice and data at 64 KB/s. It is expected that a similar facility will be in place between Manzini, the commercial town, and Mbabane. Incidentally, the university is situated in the Manzini area where the line can transmit packets of up to 9.6 KB/s.

6.3. TRAINED IT TEACHERS

There is a shortage of IT experts in the country in general, and in the teaching community in particular. Kelly and Manana point out that the teachers who take the initiatives to introduce computing to the pupils are themselves not computer literate, but they are driven by interest. Some of these teachers go out to attend short courses provided by the commercial schools in the city. The university has already experimented with special computer course to teacher training colleges lecturers. If the course can be formalised and run over in a three or five year period-project, the deficiency of IT teachers can decline, and schools can take off, assuming that hardware and software becomes available.

6.4. HARDWARE AND SOFTWARE

This is the most sensitive component of introducing IT education in schools. The sensitivity is in two ways. In one way the developers of software don't like the idea that their software be spread around like mushrooms without payment for them. In Africa, unlike in Europe, or North America, university or school packages are not available from software developers. No company offers such discounts as 45 per cent on a brand name bought for educational purposes, for instance. On the other side of the story, planners in education consider the delivery of IT hardware as waste of scare resources. These conflicting scenarios require international intervention to resolve. As we have indicated, private schools IT education is established through the generosity of the company the schools are located in. One possible option out of this problem is to bring regional universities, and even schools to a pool of thought so that they develop their own software, and assemble the hardware for the purpose of supplying to schools. Unless a major step of this nature is taken, there is no visible way out.

6.5. INCLUSION OF IT EDUCATION IN CURRICULA

We claim that the stiffest door to open for IT education to come in to schools is the curriculum. Initially it looks there is no way one can force into the timetable a course in computing and let every child in the school have hands-on practice session. Some teachers may think this is overloading when in fact there are other technical subjects which have not yet reached the entire population of students. Technical subjects such as woodwork or carpentry, metal work, agriculture and home economics already have the teachers hands full.

These are problems foreseen by a layman outside the Teaching Services Commission, it is possible there is a lot more problems. We have mentioned in section 3, however, that IT use in education enhances the quality of education in various ways. Each level of education benefits to a greater degree. Moreover our economy is not a close one, we are part of a global village. Exposing pupils to high technologies at an earlier age gives them an advantage when they grow up and enter into employment environment. Some of us entered university education at an late age. We enjoyed benefits of experience in some areas but suffered technology shock in new technology subjects. While we were undergoing shocks we soon discovered that those pupils who grew up under technology environment pursued learning with ease. These are hard facts but they are true.

6.6. USE OF LOCAL IT PROFESSIONALS

Local IT professionals have started to have a share in the labour market. The graduates from computer science at UNISWA have been absorbed by the Teaching Services Commission in teaching mathematics and other science subjects, but not informatics. It is encouraging to see companies coming forward to the university and scout IT graduates from the university during speech and careers day. It is hoped that with the coming to age of the IT association now formerly registered, IT popularisation will increase to a significant notice of potential employers. This demand in turn will stimulate the supply, which, in turn, will stimulate intensification of IT education.

7. PARTICIPATION IN INTERNATIONAL PROGRAMMES

Under the UNESCO thrust to encourage informatics in member countries, the University of Swaziland has been designated the National Node under the Regional Informatics Network for Africa (RINAF). As such the university has established a link to UNINET-ZA - a university network in South Africa, which has full access to the World Wide Web networks and Internet. The project started in 1990. the first test run was accomplished during 1995. There are still problems surrounding the connection, but it is almost clear that the connection will finally stabilise and enable the university to take over its rightful functions to deliver local and international links to other institutes of learning and individual professional.

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NATIONAL REPORT OF SWEDEN

THE USE OF COMMUNICATION AND INFORMATION SERVICES IN SWEDISH SCHOOLS

"Describing the use of NIT services in Swedish schools is like describing a thawing river. We see the water rushing by but we also get a picture of the spring flood to follow "

PREFACE

SCHOOLS ENTERING THE AGE OF INFORMATION AND NEW TECHNOLOGY

Access to electronic information services and contact networks means new possibilities for obtaining knowledge and information on working methods.

How is the increasing availability of new sources of information and knowledge affecting education? Databases and statistics, obtainable on CD ROM or via the Internet, for instance, multimedia packages and access to ongoing reports from research projects are just some examples of what is on offer.

The Swedish Agency for Administrative Development has completed research in areas such as access to electronic information, as well as whether and, if so, how it has managed to influence teaching and working methods in Swedish schools. Around 40 "school computer pioneers", 50 headmasters of upper secondary schools, 100 headmasters of junior schools and 20 directors of schools were interviewed for the study. The study has been compiled in cooperation with the Swedish Association of Local Authorities and the Swedish National Agency for Education. It forms part of an analysis of the Swedish market for electronic information services (the IMPACT programme), financed by the EU.

A FEW CONCLUSIONS

Almost half of Sweden's schools (46%) have the technical criteria to enable them to access databases and information services. However, few schools utilise these in their daily work or have sufficient knowledge about information supplies and information quality.

Expanding technology, purchasing computers and getting links to the Internet to work, etc., are still the greatest priorities at most schools. The discussion on teaching methods being updated and how this is going to become reality often takes second place, and there are also critics of these new concepts, of course.

Having commissioned the study, we feel that the result emphasises the fact that the age of information and new technology is based on so much more than technology and that it takes longer to understand than people think. Many players should be involved. Whilst technology is expanding, there is also time to make other preparations.

MAKING USE OF TIME

As far as the *local authority* is concerned, it is perhaps a matter of supporting "teaching strategies" within the framework of a local school plan. This is important, since the opportunity for updated teaching and working methods is central to development. In a *school,* one important step may be appointing people responsible for education/obtaining knowledge to the same extent as appointing those for technology. The individual *teacher* faces such challenges as developing new teaching material and developing methods for using the Internet during teaching - finding a way of learning from others and sharing your own experiences with others.

Teacher training and research are influenced by the development. This may involve aspects such as updating basic education or how the Internet and other sources can be used for spreading methodology, ideas and the results of research, for example. *Producers of information and teaching materials* can also contribute towards increasing competence with regard to existing services and information supplies.

These matters are not new, but discussions and activities must be broadened and deepened in order for educational preparation to be able to keep in line with access to technology, the introduction of the Internet/the School Computer Network, etc. Responses to questionnaires and interviews also reflect apprehension concerning greater rifts *within* schools and local authorities, as well as *between* those local authorities which are well-off and those which have poor resources.

Those at the Agency for Administrative Development responsible for the study were Sören

Lindh and Ĺsa Finnström. A contact group, consisting of Göran Isberg and Lage Ĺström of the National Agency for Education, Hans Ekholm and Gunnar Hedborg of the Association of Local Authorities, and Sture Ströqvist of the Agency for Administrative Development, has monitored the work.

THE USE OF COMMUNICATION AND INFORMATION SERVICES IN SWEDISH SCHOOLS

Describing the use of IT services in Swedish schools during September 1995 is like describing a thawing river. We see the water rushing by but we also get a picture of the spring flood to follow.

SUMMARY

Swedish schools are currently experiencing a paradigm shift. The use of computers in schools is changing, and computer teaching is now more a matter of information than of technology. In a situation where local authorities have poor funding, some of them are investing substantial resources into creating a "local intellectual infrastructure" where a school plays an important part. Most of those we interviewed spoke of currently witnessing a breakthrough in information technology. However, there are sceptics who see IT investment as a non-event of the same type as the "computer breakthrough" in the middle of the 1980s. There are also old hands who carefully warn of "the disappointment for those expecting too much".

The analysis we carried out during September - October 1995 should be seen as describing a situation which can rapidly change. A corresponding analysis in a year will give a completely different impression, but will probably show that the trends we have noted will still remain. The results of the analysis may be summarised thus:

- a considerable technical breakthrough is taking place in the education system of many local authorities, since local networks are being expanded and schools are being given the opportunity to establish communication with external databases through fixed links and with other schools in other places and in other countries,

- this technical breakthrough is being followed by an educational breakthrough where schools are integrating IT strategies into their local school plans and where teachers are being trained to use IT as one of several teaching methods,

but

- the response to the question of how the increase in communication and information is being used in practice in schools is still based more on expectations rather than experience.

Computerisation of Swedish schools may be described in three stages.

The first stage was introduced more than ten years ago, which meant that schools purchased computers and set up computer rooms for computer training (technical computer training, programming, Word Processing).

The stage that followed is still going on in the majority of schools. Computers are also being spread out and placed in group rooms and classrooms. Local networks facilitate communication from each computer work place using CD ROM drives or external databases. Many schools can be contacted via modem or are permanently linked to the Internet. Technical criteria are being created for IT to become an integrated investment in teaching in schools.

The third stage is characterised by schools actually utilising the new communication and information services provided by new technology. Increasing information is becoming a vital part of teaching. Computers are being integrated into most subjects as tools and for teachers in their lesson planning.

This analysis shows that a number of pioneer schools have already introduced the third stage and that many schools are on the way to doing so. Factors which indicate that this trend will increase are:

- directors of schools and headmasters understanding that their schools must keep up with technological developments,
- pressure from pupils and parents,
- the objectives of many local authorities to create an IT infrastructure which also includes schools,
- the National Agency for Education's investment in the School Computer Network and in other forms of user support,
- support and, in certain cases, subsidies from Internet suppliers such as Telia, Tele2, Celsius Information System and France Telecom, and
- the increasing access to school-oriented information services.

Factors which could slow the trend include:

- the financial situation for the local authorities,
- the traditional working methods of schools,
- disinterest from some teachers and teacher trainers, and
- insufficient resources for training teachers in IT teaching.

THE SWEDISH EDUCATION SYSTEM

National frameworks and objectives for local authority schools

The Swedish education system has undergone considerable change over the last few years. Responsibility for schools has been completely transferred to the local authorities. The freedom of pupils/parents to choose which school to attend has increased, and approximately 1% of the pupils at junior school level and 1.5% of pupils at upper secondary school attend Swedish independent schools. New curricula have been established for both obligatory and voluntary schools.

At the same time as the School Act obliges all children and young people to have access to equal education, irrespective of sex, geographical location, social or economic circumstances, the resources and priorities of the schools vary from one local authority to another. There are particularly significant differences in costs for teaching materials, equipment and libraries per pupil.

The curricula for both (for the pupils) obligatory and voluntary schools emphasise that schools provide both knowledge, certain skills and a basis for making evaluations. Statements within the curricula which are of particular interest in relation to IT development include:

- "The headmaster of a junior school is responsible for...ensuring that the pupils have access to instruction, teaching materials of good quality and other support in order to be able to search for and develop their knowledge themselves. Such support may constitute libraries, computers and other tools" (Curriculum for junior school level/Curriculum for upper secondary school level).

- Teachers of all subjects will endeavour to balance and integrate different forms of knowledge in their teaching.

-The school will endeavour to ensure that each pupil...develops curiosity and the desire to learn, develops his/her own way of learning....

- The teacher will ... be able to ensure that girls and boys receive equal attention during teaching and that they have equal influence on teaching". (Curriculum for junior schools)

- "Pupils will be able to familiarise themselves with a complex reality with an enormous flow of information and a rapid rate of change. Their ability to find, apply themselves to and use new knowledge will therefore be important....".

- International contacts, educational exchange and work experience in other countries will be promoted". (Curriculum for upper secondary schools).

Swedish junior schools work to the same curriculum, where every subject has a definite number of teaching hours, but where approximately seven per cent of the teaching time may be used for the pupils' optional subjects. The upper secondary schools run national post-16 programmes which specialise in various different areas such as natural science, caring and social science. There are also some specially-designed or individual programmes available.

Computer science is not a subject as such on the Swedish curricula. On the other hand, Computer Science may be included in a number of subjects/programmes, and can also be chosen by pupils at junior school level as a "separate option". A number of schools included in this study have developed IT as a "specialist subject".

IT Commisson and schools

The IT Commission, set up in 1994 by the Government to promote broad usage of IT in Sweden, has emphasised in various contexts the importance of the role played by schools to strengthen Sweden's future international competitiveness:

- "All pupils at school will learn to use IT. This will mean that the teaching environment improves, education develops and learning improves. The creativity in both teachers and pupils will also be released, providing more opportunities for personal development and success careerwise...".

- IT will be an integrated tool in education in all courses and subjects, whether they are natural science-based and technically-based, humanities and the arts....

- Each local authority will draw up a strategy for IT use and development in schools. Head teachers of junior schools will have this same responsibility for their own schools.

- A national campaign is being implemented to stimulate all local authorities and schools to broaden their use of IT. The State, developers and suppliers of IT and educational publishers, etc., should cooperate in this campaign....

- A national Internet-linked information network (the School Computer Network) will be established. High-quality services linking all schools to one another and also to universities and colleges will be offered by the network. These services will be accessible from every classroom, even at junior level. It will be easier to make contact with libraries and various cultural institutions." (SOU 1994:118, Vingar ĺt människans förmĺga [roughly translated: Encouraging peoples' abilities].

Even before the IT Commission submitted its report, the National Education Agency had started work to develop a School Computer Network (see below). As a consequence of the Commission's report, the "Foundation for Knowledge and Skills Development" was also set up to support development projects in schools and colleges.

THE FOUNDATION FOR KNOWLEDGE AND SKILLS DEVELOPMENT

The Foundation for Knowledge and Skills Development is investing in several areas of the schools sector: Project support for local authorities and independent schools, where the local authority and the school try out new teaching methods using IT; Adult Education vouchers to teachers to support their skills development; support for universities and colleges which will meet a growing demand for suitable further teacher training, and project support to develop a new generation of IT-based teaching materials, where the Foundation will also attempt to work with journalists, directors and fictional authors - those who are experts on the media of young people.

Everybody benefits

Everybody can benefit from the Foundation's input. Those projects granted funds are given the opportunity to develop their ideas with support from the Foundation. Even those that have applied for funds but have not obtained them will be able to make use of the investment in schools. The Knowledge and Skills Foundation will invest substantial resources in spreading knowledge and exchanging experience - a project which will benefit everybody.

700 million

All in all, the investment in schools is worth approximately SEK 700 million (app. US 100 million) and will run over a period of three years.

In January 1995, a new IT Commission

received a renewed directive and will study aspects such as the way in which IT changes the role of the teacher, the development of IT-based teaching materials, the development/adjustment of teaching materials and tools for pupils with learning difficulties.

Among the proposals made in the Commission's interim report entitled "Communication without limits, the IT Commission's work programme 1995-96" (SOU 1995:68) is one for teaching materials to be supplemented in order to emphasise the possibilities of new technology helping to update working methods in schools. The IT Commission further emphasises the possibilities of IT to support pupils with learning difficulties and proposes that the National Agency for Education be commissioned to produce documentation for teachers in their work with pupils who have difficulties with reading, writing and communicating.

DEVELOPMENTS IN COMPUTER TECHNOLOGY IN SWEDISH SCHOOLS

The first decade

As early as the 1970s, a certain amount of development work was going on within what was then the Board of Education to produce official documents detailing a future strategy for computers as tools in education. In the middle of the 1980s, a Computer Program Group was formed at the Swedish Ministry of Education and Science, and computers were generally introduced throughout Swedish schools. A special Swedish school computer, "Kompis" [literally: Friend], was developed. As the current study shows, a large majority of upper secondary schools and higher education establishments have had computers for teaching purposes for more than five years.

Early computer teaching took place in specially-equipped computer rooms and included Computer Science, elementary programming and Word Processing.

The number of computers in schools increased dramatically between 1993 and 1995. This included computers used by teachers for their work and for teaching. The number of computers for use by teachers in junior schools, upper secondary schools and local authority adult education has more than doubled, and has increased by 70% in schools for mentally-handicapped children.

The number of computers for teaching in junior schools has also more than doubled. In upper secondary schools, the number has increased by approximately 50%, in schools for mentally-handicapped children by approximately 40%, and they have almost doubled in local authority adult education institutions.

Table I below shows how the number of computers and the number of pupils per computer varies between different types of school.

Table I.

Computers for teaching in different types of school

Computers for teaching	1993 No. of computers	No. of pupils per computer	1995 No. of computers	No. of pupils per computer
Local authority junior schools	21 143	38	45 013	19
Independent junior schools			1 526	12
Local authority upper secondary school	22 728*	10	38 053	8
County Council upper secondary schools	1 463	20	2 494	10
Independent upper secondary schools			974	6
Local authority adult education establishments	4 417	**	8 286	8
Local authority and County Council schools for mentally-handicapped children	1 294	8	1 821	6
Independent schools for mentally-handicapped children			48	5
Educational institutions for intellectually-handicapped adults			388	6
Special schools			196	4
Saami schools			16	8

** Probably underestimated due to lack of response*
*** Could not be reported*

Since 1993, more and more computers have been placed in classrooms. A good half of the computers for teaching in junior schools and three quarters of computers in schools for mentally-handicapped children are now in classrooms. However, in upper secondary schools and local authority institutions for adult education, three quarters of the computers are still in computer rooms.

The number of schools that have access to a modem and external data communication varies considerably, depending on the type of school; those with the most are upper secondary schools and those with the least are schools for mentally-handicapped children. The same applies to access to CD ROMs.

ENTERING A NEW EPOCH

In 1993, the Nordic Council of Ministers decided to found a Nordic School Computer Network, and in April 1994, the Swedish Government commissioned the National Agency for Education to develop and run the Swedish section of the School Computer Network The objective of the School Computer Network is to:

- provide schools, pupils and teachers with better opportunities to communicate with one another,
- provide schools, pupils and teachers with increased access to information sources,
- develop as one of several educational tools,
- stimulate local IT development, and
- act as "the schools' guide to the Internet".

The School Computer Network is not a physical network, but a logical information network through which a user should be able to access information which is physically stored and updated in various places in Sweden and throughout the rest of the world. Being linked to the Internet provides a school with access to the School Computer Network's four permanent functions:

- address system for electronic mail addresses (preliminary study) and a directory of schools with their own WWW information,
- electronic conferences and an electronic bulletin board,
- WWW server with links to information on the Internet connected to schools, and
- descriptive examples - a forum for spreading ideas.

The School Computer Network (www.skolverket.se/skolnet/) is completely open and may be accessed by everyone everywhere, irrespective of the Internet supplier and user tools. The School Computer Network was commissioned to develop the network, but head teachers are to decide for themselves whether and how they use the service. However, a good forty schools have been earmarked as pilot schools that will form a reference group for the School Computer Network and participate in the evaluation of the services being developed. The School Computer Network will also provide other types of support such as information on IT for interested teachers and other users.

In order to make it easier for users to find material of interest to their schools, the School Computer Network has established links to information which is sorted into lists of subject groups, Swedish and international information suppliers, search tools, electronic newspapers, education, schools, choices of studies and career, etc. At the request of the School Computer Network, Lund University Library for example is creating a "virtual school library" ("Länkskafferiet" [literally: "Link Inventory"]) within the framework of the School Computer Network.

A number of Swedish authorities and organisations are already offering information via the Internet and many intend to do so within the year.

Four Internet suppliers are participating in this development work: Celsius Information System, France Telecom, Tele2 and Telia.

On behalf of Swedish schools, the School Computer System has also reached an agreement with some commercial databases that now can be accessed via the Internet for a very low annual cost. These databases include:

- the "AffärsData" newspaper database,
- article search in the Library Service Agency,
- the Swedish Institute for Building Documentation, and
- the "Rixlex" of the Swedish Parliament, i.e. the parliamentary information service, (including members, proposals, motions, parliamentary committee reports, subject index, speeches, interpetations and questions).

USE OF INFORMATION SERVICES IN SWEDISH SCHOOLS

"IT in schools" will mean the following educational services in the future:

- information services such as computer programs for tasks such as Word Processing and calculations, multi-media programs as teaching materials for particular subjects, information databases, etc., and
- communication services, i.e. methods of contacting information services either via disk/CD ROM or via computer and telephone networks.

Current studies on the use of information services in schools

A number of studies on the use of IT services in certain schools have been published during the last year. These studies generally show particular aspects of the use of IT or its use in certain types of school. Studies which are more than one year old are not referred to in this document because they describe a reality that has already been achieved.

"IT i skolan" [IT in schools], Teldok Report 100 by Lars Bolander is not a systematic analysis of the use of IT, but a broad description based on interviews and study visits. The author believes that IT opens up great opportunities for schools - particularly for high and low performance pupils. However, he also believes that IT will require changes to the organisation of schools and to the role of the teacher, and he expresses surprise at "how passively and unenthusiastically teacher training and further teacher training often approaches the area of IT in schools.".

In a report, "Internet i skolan [Internet in schools]", produced by the Institution of Information Technology at Umeĺ University in June 1995, David Hällgren describes aspects such as school and educational projects on the Internet: the School Computer Network, KidLink, the Learning Bridge, KidsNet, the Canadian schools network, K12Net and WWWEDU/SchoolWeb. Mr. Hällgren has also studied the use of IT at Kĺgeskolan, which has developed a number of projects including its own language project, English Around the World.

Mr. Hallgren summarises teachers'

experiences of the use of IT as follows:

- communication may promote language skills
- communication may create greater tolerance among pupils taking part
- the pupils may become more active and creative
- the teacher's role changes
- the project includes other types of teaching materials.

In a report, "Attityder till datorstödd undervisning hos högstadielärare" [Attitudes of higher education teachers to teaching with computer support"], produced at Kalmar Högskola (the Programme for Media Production), Isabella Ĺkerlund describes the attitudes of 12 higher education teachers of different subjects to teaching with computer support.

This study generally shows a positive attitude to computers (3 teachers described their view of computers as 5 out of 5 and the others as 4 out of 5 on a scale of 1-5. All teachers of theoretical subjects would like to use computers in their preparation work, such as most teachers of music and (principally) Art and Home Economics. Only teachers of handicrafts did not really wish to use computers. 10 teachers were really keen to use computers in their teaching. The only doubt was among art and handicrafts teachers (attitude 3 on a scale of 1-5). At the same time, teachers with a positive attitude also indicated a few problems, mainly those of finding "time when the computer rooms were not being used", that there were not many programs suited to teaching and those that were available took too long to get used to. As far as actual use of computers in teaching is concerned, the picture is becoming more differentiated.

Teachers of Swedish and teachers of special subjects regularly use computers in their teaching (each week), and believe that computers provide excellent support for the process of learning to write, particularly for pupils with difficulties. One of the mathematics/physics/technology teachers often uses computers for mathematical skills training. Among the teachers of practical subjects, the home economics teacher has regularly used a computer, stating that she has "finally obtained a program which is suitable for her teaching".

The study's illustration of the position in Swedish schools

A good half of the directors of schools and 26 per cent of the headmasters who responded to the questionnaire believe that the local authority is extremely interested in IT. Seven per cent of directors of schools and sixteen per cent of headmasters believe that interest is either quite or extremely small.

Almost one in two schools has an IT strategy and one third have a school strategy which is part of the local authority's comprehensive IT strategy. Upper secondary schools have their own strategies to a considerably greater extent (62%) than junior schools (35%). Most schools incorporate IT matters into their educational development plans (71%). Almost three-quarters of all schools stated that there is a person at each school who is responsible for IT, and two thirds of schools have someone in charge of teaching.

Computers have existed in upper secondary schools and higher education establishments for a relatively long time, and in lower level schools for a few years. Only two head teachers of junior schools have indicated that their schools have no computers. Schools have mostly been using their computers for teaching Computer Science, Word Processing, etc. The majority of schools also have CD ROM drives.

A good half of the schools (61%) have to finance IT development on top of the ordinary school grant. 27 per cent of schools state that their local authority allots special funds to technological equipment (networking, computer equipment), which is substantiated by the heads. IT costs are not usually entered as a special cost in the schools' finances, and most head teachers of junior schools therefore have not responded to the question on costs for purchasing information services. Where costs are entered separately, they amounted to between SEK 5 000 and SEK: 20 000 in 1995 and are expected to be higher for 1996.

Schools, which received computers early on usually, located them in special computer rooms. Such rooms are still to be found in many schools, but the clear trend is now also to locate computers in study areas and group rooms (for pupils' individual work or for group work), and, more importantly, in classrooms. CD ROMs can often be accessed via local networks.

The response shows that barely half (46%) of all schools have the opportunity to search for information from external databases (79% of upper secondary schools, 27% of junior schools). Since connection is normally completely new (it has taken place over the last year), schools still have very limited experience and they find it difficult to judge how they will use communication and information services in the future. However, many said that they would become permanently linked to the Internet during the autumn term, and that they expect this to lead to rapid development. It was generally agreed, though, that IT use is set to change teaching and school work in many ways: "We are facing a paradigm shift."

The situation as regards users as described by the schools is that, until now, IT has been used to a great extent by:

- special subject teachers in junior schools (58%),
- teachers in technical and natural science subjects (45%),
- teachers in social science subjects (37%).

According to the assessment of the headmasters, IT is used to a lesser extent by:

- teachers of Swedish and humanities subjects (26%),
- languages (26%).

On the basis of this information, it is perhaps natural for the headmasters to name relatively few specific services in their responses and generally instead refer to IT as being important in social science-oriented subjects, etc. The named services included:

- training for pupils with reading and writing difficulties,
- possibility of searching for information on refugee pupils' home countries,
- distance learning,

- "company school".

Both headmasters and directors of schools said that "all" teaching categories should make use of IT in the future.

The headmasters said that 57 per cent of those responsible for IT at schools know "very well" or "quite well" which information services, such as public databases, are on offer. Teachers are judged to have relatively little IT knowledge. Several headmasters who commented on information services used said:

- that the services were not sufficiently well-suited to school use, or
- that they were difficult to find or sort out.

The headmasters have been asked to assess the rate at which IT development will grow at their institutions during the next two years. 60 per cent believe that it will grow rapidly (70% of upper secondary schools against 54% of junior schools), and 34 per cent believe that it will grow slowly. However, directors of schools in general said that it would grow rapidly (80%), as did representatives of pioneer schools (88%).

Most of those who said it would grow "rapidly" referred to their local authority's central investments and to the pressure from pupils and parents, but principally they referred to the need to "keep up". Several said that they would be installing local networks during autumn 1995, and would become permanently linked to the Internet. In so doing, they would then satisfy technological criteria for more systematic IT-based teaching.

Those who said that it would grow "fairly slowly" generally referred to the lack of funds within their local authority and school. One headmaster said with regret that it would grow rapidly: "over-confidence in computer technology on the school's junior level curriculum". Quite a lot headmasters (47%) of reception and intermediate levels said that external communication and possibilities of searching for information "were no more important than basic skills".

The majority of headmasters (60%) believe that they will want to have access to external databases and reference material in several ways: the Internet in combination with on-line databases and CD ROMs. Headmasters of junior schools at reception and intermediate levels have CD ROM as their priority and are less interested in the Internet ("too difficult for our pupils"), while all headmasters of upper secondary schools want access to the Internet.

The main obstacle to increasing the use of information services is a lack of funds according to 76% of the headmasters, which in turn leads to a shortfall of computers (39%). The headmasters then pointed out the lack of IT skills among teachers (63%). Technical difficulties were not seen as a particularly great problem (12%). Directors of schools largely agree with this assessment. However, representatives of pioneer schools said to a far lesser extent that a lack of funds was a great problem. On the other hand, 64% said that teachers' work load was an obstacle (compared with 41% of the headmasters and 27% of the directors of schools). Many representatives of pioneer schools commented that investment in IT would and must be allowed to take time.

All of those interviewed said that IT will influence education and internal work in schools. The pioneers, who do have the most experience of IT, said to a greater degree than the headmasters that schools would be influenced in several respects, including the effect of pupils on teaching and their ability to cooperate. The opinions of directors of schools were more similar to those of the pioneers than those of the headmasters.

Influence to a great or fair degree	Headmasters	Pioneers	Directors of schools
teachers' cooperation, spontaneous or in law	44%	63%	54%
teachers' choice of teaching materials	71%	66%	87%
pupils' effect on teaching	46%	75%	60%
pupils' subject knowledge	79%	84%	100%
pupils' ability to search for factual information themselves	92%	97%	100%
pupils' ability to analyse and solve problems for themselves	72%	81%	100%
pupils' involvement in the age of information and new technology	62%	60%	80%
pupils' ability to cooperate	44%	66%	53%
pupils' ability to work independently	87%	97%	93%
pupils' preparation for working life	87%	84%	94%

Both directors of schools, headmasters and pioneers were asked about how IT would influence their schools' objectives of giving all children equal access to education. The majority said that the differences between children with various learning abilities may increase, as may those between children with different amounts of study support at home and between children in different local authorities. There is, however, a unanimous belief that it is up to schools to provide IT as a tool and develop IT education, thereby compensating for these differences.

The differences between children	Agree to a great or a fair extent		
	Headmasters	Pioneers	Directors of schools
will increase with different study criteria	59%	57%	53%
will increase with different amounts of study support at home	77%	66%	74%
will increase in well-off/under-financed local authorities	83%	73%	80%

Pioneers

The study includes 33 interviews with people at schools that we assessed to be pioneers with regard to IT. Pioneer schools exist at all levels, in all types of local authorities and it is reasonable to assume that the pattern of usage being developed at pioneer schools will also be developed for other schools.

There is the question as to whether the differences between the pioneer schools and the other schools are type or level differences. The interviews show that a pioneer school is characterised by having an old hand (usually a teacher) who has support from his/her junior school head teacher. The schools are usually (but not always) in a local authority that encourages IT development. Pioneer schools make use of IT services to a much greater extent than other schools. However, half of them are still not permanently linked to the Internet.

Contacts are teachers or other school staff who have broad professional experience, hardly "young enthusiasts". They are personally extremely interested in information technology and "early adopters", half of whom have access to the Internet at home. However, for this reason they are not always enthusiasts in the sense of "missionaries". At the same time as believing in the potential that IT will bring to schools and believing that it will develop rapidly, there are some who emphasise that teaching must be developed, not just technology, that there is too much rubbish on the Internet, and that people must learn to sort out the required and useful information. Despite the fact that many of those interviewed teach technical subjects, they emphasise that people must adopt a humanities perspective when developing IT.

The pioneer schools have broader experience than other schools of working with communication and searching for information. Appendix 4 shows services named by contacts. The responses show that contacts are often made with schools/classes in other countries. Databases have still not been increased to any great extent. IT is used as a teaching material and is taught as a constituent part of some subjects (e.g. Swedish and other languages), while teachers of other subjects (such as mathematics) have not found equally applicable material.

The pioneer schools do not allow themselves to be held back by technical limitations. Telephone interviews gave several examples of schools where teachers and pupils had been building up data communication with other schools within and outside of Sweden simply by contacting "BBS systems" via modem, long before the Internet became a practical alternative. Schools with limited financial resources said how a functioning system had been created by collecting or purchasing second-hand equipment, getting local companies to sponsor WWW pages and allowing pupils to extract information from local networks.

The role of school libraries

Extensive school libraries exist largely in upper secondary schools. At the lower levels, library tasks are often taken care of by a teacher who, in return, will have his/her teaching responsibilities reduced. Responses to the questionnaire also show that headmasters of upper secondary schools believe the librarian to be the person at the school who uses IT most often (aside from teachers in technical and natural science subjects).

School libraries offer a double resource. In many cases, there are opportunities here to communicate with external databases, and there are usually CD ROMs available, as well as staff specially trained to search for information. There is an ongoing discussion among school librarians on the professional role of the library when teaching in schools changes. On one hand, the librarian has an important role in the team of adults organising teaching. On the other hand, the role of the teacher is becoming more like that of the librarian - to guide young people who are looking for information.

FACTORS WHICH MAY AFFECT THE DEVELOPMENT OF IT USAGE IN SCHOOLS

It is not possible at present to predict with any certainty the IT development that may take place in Swedish schools. A number of factors may, however, speed up the rate of development:

1. Technology/communication is becoming cheaper and more user-friendly

A large number of representatives from pioneer schools, who have had the opportunity to use technology for a while, said that systems have definitely become more user-friendly.

2. *Teachers are being offered training*

80 per cent of head teachers of upper secondary schools indicated that local authorities had organised IT training for teachers. At pioneer schools, contacts described how they themselves organise training for their colleagues. Internet suppliers such as Telia are offering starter or school packages with introductory training of contact teachers and those responsible for IT at each school.

3. *School Computer Network "being discovered" by more and more people*

The School Computer Network is still relatively new and by no means all pioneer schools have yet had the chance to make use of its services to any great extent. However, the School Computer Network received good marks from those who had used it, and it may play an important role for teachers and pupils who find it difficult to familiarise themselves with the Internet.

4. *Local authority IT strategies*

Many local authorities/schools have already accepted or are devising IT strategies. The Swedish Association of Local Authorities' and the National Agency for Education's joint manual (October 1995) on how to devise an IT strategy for a school should allow acceptable strategies to develop and new ones to be drawn up.

5. *Publishers of educational aids*

Until now, the supply of Swedish CD ROM teaching materials has been fairly limited, but several publishers have now announced a number of new products.

6. *Information on society and local information via IT*

The Swedish Parliament is now extending its service to schools by offering CD ROM teaching material (the history of the Swedish Parliament, working methods, members, information sources, etc.) and Rixlex at a low price on the Internet. It is possible for history teachers to teach about parliamentary history with support from multi-media, and for social science teachers to allow their pupils to follow the actions of their local MPs in Parliament (motions, questions, participation in debates and voting).

Correspondingly, some local authorities are planning to make their official authorised documents and other local authority information available via IT.

A national museum project (the National Museum and the History Museum) is making comprehensive collections available via the Internet, and local museums are extending their Internet information. This information may be useful both in general history teaching and for supplementary knowledge gained at home.

7. *IT in special teaching*

One of the categories of teachers who have tried out IT in teaching to a particularly large extent is special teachers who have had access to programs for children with reading and writing difficulties. Teaching materials are being developed for schools for mentally-handicapped children, supported by the Swedish Institute for Disabled Persons and organisations for disabled persons. Such schools are now being integrated into local authority schools, which may mean that the special skills of schools for mentally-handicapped children will become diluted. However, since September 1995, there has been a special information centre (the LISEN project) at the Teacher Training College in Stockholm, which provides an overview of the supply of teaching materials for schools for mentally-handicapped children and for special needs classes, and which has the task of distributing this information

Responsibility for communication which takes place in and between schools

Head teachers are those principally responsible for the way in which information available on the Internet is used in schools, in the way that the individual is responsible for information which he/she uses. Some schools that still do not have practical experience of the Internet, have expressed apprehension about pupils gaining access to undesirable material such as pornography or graphic violence via the Internet. There is research taking place into various possibilities for limiting pupils' access to "undesirable" parts of the Internet. Schools that have already had practical experience of the Internet do not judge the problem to be particularly serious.

Several schools have laid down ethical rules for the use of their Internet subscription, or are reaching " an agreement" with each pupil authorised to use the network about how the subscription is to be used.

SUMMARY OF ANALYSIS

Teaching in schools will be substantially affected by the growth in information technology. How rapidly and to what extent this will happen at each school firstly depends on a number of interconnected factors: the attitude of the heads, availability of "old hands" and the financial resources of local authorities. Now that IT-based education is becoming a reality in a number of schools in Sweden, it is, however, probable that IT will he used increasingly. This study shows requirements expressed by parents and pupils.

In practice, much of the external communication and information searching will lie linked to the Internet. National investments being made by the School Computer Network are based on the Internet, as are many local authority IT plans.

However, it should still be noted that the pioneers have built up a number of interesting early projects by using BBS systems.

We are thus of the opinion that the demand for services connected with IT will increase substantially during the next few years. Two types of service ought to be especially in demand: assistance with technological expansion and teacher training. It is impossible to predict how - to what extent and in what direction - the demand for purely educational tools will develop.

It should be noted that a large number of authorities and organisations are now in the process of or are planning to develop special school-oriented materials that will be offered to schools as CD ROM and/or via the Internet and the School Computer Network. Several publishing companies have announced new series of CD teaching materials.

The greatest obstacle to IT development in schools is the lack of finances in local authorities, followed by the lack of teachers' IT skills. The technical problems that some head teachers of junior schools referred to are described as minor by schools which are permanently linked to the Internet. Orientational difficulties "out on the net" are reduced for those who make use of the School Computer Network. Unanimous statements from the pioneer schools and from schools that have not even had much chance to try out the service show that the School Computer Network is very important in the use of IT in schools.

Information technology is particularly important for some "specialised" subjects where teachers must normally develop their own teaching materials. Here, IT is used both as an educational tool and for teachers to exchange experience.

IT may have major consequences for work within schools. Representatives of pioneer schools said (to a greater extent than headmasters and directors of schools) that cooperation between teachers will increase. The descriptions of how work is done at pioneer schools also show this to be the case: a team of teachers, cooperation with the school library, and "hours" which are transferred from one subject to another. The representatives of pioneer schools also said that IT would increase pupils' influence on teaching.

IT projects often demand longer working periods than the traditional lecturing system has allowed. This means that at the intermediate level, teachers have found it easier to develop working methods to make more efficient use of IT than those at the upper secondary level have.

NATIONAL REPORT OF THE SYRIAN ARAB REPUBLIC

INFORMATICS AT THE MINISTRIES OF EDUCATION AND HIGHER EDUCATION IN THE SYRIAN ARAB REPUBLIC

I. INFORMATICS AT THE MINISTRY OF EDUCATION

INFORMATICS AS AN INNOVATING TREND IN THE FIELD OF EDUCATION

Education is a continuing and renewing building operation devoted to Man, the cornerstone of progress, comprehensive development, and advancement of society. Being an effective medium in the formation of knowledge, acquirement of values and practical experiences, education prepares qualified cadres that are capable of utilizing science and technology in the numerous domains of life.

The process of developing and upgrading the level of education is clearly stated in the directives of Mr. President of State - Hafez Al-Assad, but this process will fall short of achieving the intended objectives unless it becomes associated with well-organized efforts, in order to exploit its fruitful results and make them serviceable for the advantages of tourism, economy, defense and other spheres of life.

Modern Syria is witnessing the use of informatics based on solid foundation, in addition to extending the application of information science in various areas of constructional development and cultural advancement.

The Ministry of Education has endeavored to promote the introduction of informatics in the fields of education and related activities. Moreover, the Ministry's endeavor is designed in accordance with an exhaustive scheme founded on a scientific methodology in expansion, application and rehabilitation of skilled personnel.

TRENDS AND FIELDS OF INTRODUCING INFORMATICS IN EDUCATION.

1. Area of Informatics Teaching.

The experiment of teaching a course at the school experimental centers for the secondary stage (second secondary classes), started in the academic year 1991-1992 in all the provinces (Muhafazat), according to a ministerial plan. The Ministry publicized the plan, specified the method of implementing and supervising it and provided the required experimental, theoretical and practical textbooks.

The aforementioned Centers are increasing gradually, year after year, in the provincial capitals, cities and the countryside. Their number has so far amounted to 67 centers which are equipped with computers and their requirements.

These Centers are received with great encouragement and desire by the students and their parents. In this respect, a new book has been published this year in two respective volumes-theoretical and practical. The book deals with the bases of informatics and the use of computer to be taught in the centers. It will be assessed and evaluated in cooperation with the specialists of the Syrian Scientific Association of Informatics and Damascus University. Pursuant to the new teaching plan which was carried out in 1995-96 regarding the secondary commercial schools, a course in informatics was introduced to be taught theoretically and practically for the three secondary classes. Special halls were set up at the commercial secondary schools and equipped with the required computers according to a gradual plan which has been applied starting from the school year 1995-96 to the first commercial secondary class.

2. Field of Educational Administration:

The computer has been employed in the system of general examinations since 1991-1992, to carry out the operation results of all general certificates at two centers. One of these centers is situated in the main building of the Ministry and the second is in the city of Homs. This experiment was developed vocationally and technically during the last five years. It has become a base in the system of examination , and reflected positively with regard to accuracy, saving time, cost and work mechanism of general examination. Consequently, all the results of the general certificates and related documents have been computerized.

Moreover, the computer is used in the accounting operation and the affairs of employees working in the central administration of the Ministry and the educational directorates. At present, a program of statistics and collecting data is being planned at the Ministry, in addition to preparing statistical educational tables and specifying educational and statistical indicators, pursuant to the accredited development plan.

3. Personnel training and rehabilitation

The expansion of introducing informatics in education is accompanied by parallel and comprehensive plans with regard to personnel training and rehabilitation for teaching and using informatics in educational administration. The Ministry has taken serious steps towards preparing trained national personnel and improving their qualification as the first necessary practical steps in introducing and upgrading informatics in educational administration and teaching.

Teachers are trained to provide teaching staff for the Training Educational Centers of Martyr Bassel Al - Assad. These centers were established by the Ministry in cooperation with UNESCO in Damascus, Homs. Lattakia and Aleppo. These centers offer a nine-month-training-course for teachers who hold Bachelor Degrees in Mathematics, Physics, Natural,

Science, Economics, and Commerce. Seventy teachers representing all Syrian provinces (Muhafazat) are trained each year. This year, the number of teachers has increased up to 102 trainees. This is due to the fact that these Centers are equipped with developed computers and modern software using both Arabic and English languages in cooperation with UNESCO. thus, the number of trained teachers will reach 422 by the end of 1996.
Furthermore, training of the employees in using computers concerning educational administration takes place at training centers established by the Ministry. This involves training of leading personnel and other employees working at the Central Administration and Educational Directorates belonging to all provinces (Muhafazat), each according to his or her field of specialization.

4. Setting up the Directorate of Informatics

In order to promote the expansion and development of informatics on the educational level, the Ministry established the Directorate of Informatics in 1994. In addition, the Ministry founded departments of informatics at the educational directorates of all provinces (Muhafazat) to implement the Ministry's plans in the area of informatics.
Moreover, the Ministry gives priority to programming and maintenance in view of their importance in developing work mechanism, local and national experiences.
The Ministry tries its best to overcome the difficulties through the following courses of action:
A. Developing the Department of Programming in the Directorate of Informatics and giving six-week training courses for the employees of the Department in cooperation with UNESCO in the summer of current year. UNESCO experts will undertake the responsibility of training. A specialist from the Informatics Directorate was sent to the Netherlands to attend a long training course pursuant to the informatics project which was agreed upon between the Ministry and UNESCO.
B. The experiences of the Maintenance Section employees are developed at the Informatics Directorate. A number of maintenance workshops which have been established in some provinces (Muhafazat) pay periodical visits to the informatics centers in schools and the directorates of education to maintain the computer devices.

5. Setting up a National Strategy to Introduce Informatics at Pre-university Educational Level

As a national strategy, the Ministry has worked in cooperation with UNESCO to introduce informatics into pre-university education. Thus, The Ministry has cooperated with the Syrian Association for Informatics in assessing and evaluating the afore-mentioned strategy which was accepted by the Regional Command in 1995.
Pursuant to the educational policy of the Syrian Arab Republic, the Ministry of Education tries to achieve the integration of mental, national and educational aspects. Moreover, the Ministry attempts to develop the practical experiences of the youth through expanding the informatics plan in cooperation and coordination with the concerned sides, especially with the Syrian Scientific Association of Informatics and Scientific Research Center.
The Ministry's main objective is to keep a balanced preparation of the coming generations whose future and welfare are the basic aim of the Nation.

II. INFORMATICS AT THE MINISTRY OF HIGHER EDUCATION

At present, The Ministry of Higher Education makes use of the Computer Center of the Faculty of Engineering regarding the distribution of students among various faculties and institutes of the four Universities, taking into consideration the student's desire and the capacity of each faculty.
Realizing the vital importance of science and knowledge in changing and developing the structure of society, the Ministry of Higher Education has drawn a plan with the aim of computerizing the Ministry's work and related bodies, including the Four Universities with their hospitals.
In order to accomplish a comprehensive informatics system, the Ministry tries to develop a local informatics network through introducing modern software system. Furthermore, the Ministry has established computer sections which eventually will be developed to become a directorate.

Introducing Modern Technologies Of Information In Higher Education

In view of the great importance of informatics and its vital role in scientific research, the Ministry has established a number of departments of informatics engineering at the Faculty of Electrical Engineering in Aleppo University. The Ministry has, furthermore, established a department for mathematics and informatics at the Faculty of Sciences in Damascus University. A course in informatics is also taught to students of higher studies at the University. In addition, the Ministry has accomplished the teaching plans and introduced them into the program of informatics and computer engineering departments of the Four Syrian Universities.
An intermediate computer institute has been established in Damascus. At Aleppo University, a department for specializing in computers has also been set up. Finally, the subject of informatics has formally been introduced into the teaching programs of all intermediate institutes.

NATIONAL REPORT OF THAILAND

STRATEGIES FOR THE DEVELOPMENT OF EDUCATION AND INFORMATICS

BACKGROUND

The development of information system and the utilization of information technologies in Thailand began about two decades ago or during our Fourth National Education Development Plan (1977-1981).There were series of meetings and conferences to initiate information networks which would facilitate the exchange of information for educational planning and administration. It was proposed that the Office of National Education Commission should serve as coordinating center for data collection and the utilization of data. Nevertheless, each individual agency had its own mandate and functionality to perform, therefore, the progress in terms of system development was mainly based on individual's needs. This caused the problem of non-uniformity which implies the inability to exchange information between different agencies. In addition the rigidity in budgetary and personnel administration impeded the development of information systems. The over-centralized administrative system required schools, district, and provincial officers to report annually in statistical forms which would be processed by the central administration. This long process of data collection explains why educational planners and administrators did not have information in time during the process of educational planning and administration.

Another dimension of utilizing information technology is in the teaching and learning process. The current movements indicate that more and more educational institutions in Thailand are trying to make an appropriate application in information technology (IT) in education. A wide variety of IT application includes tele-education via satellite, multimedia and computer-assisted instruction, and learning through the computer networks. In general, these alternatives possess good potential for education, but on the other hand, they are not equally effective in every circumstance. Therefore, the government and responsible bodies have to research and make a right decision to invest in order to get the greatest benefit out of each technology. The problem of this undertaking, however, is due to the lack of unified direction and coordination. Previously, there was no coordinating agency to develop national goals in utilizing IT for education, to monitor the standard of media, and to evaluate its impact.

STATE OF THE ART OF NITs IN EDUCATION IN THAILAND

Regarding the application of IT in education, there are two dimensions, namely, educational administration and pedagogy.

In educational administration, most educational organizations are in the period of transforming into computerized system. Hence, it is common for organization to have a mix between manual data collection system and a computerized database management system. This means most data collection system will require form-filling by local agencies at various levels, then the data are processed at the district or provincial level before sending to the central administration. This depends on the provision of computers. However, it is observed that sharing of information between departments is still limited, because information flow is mainly on a vertical line of administration. The question is how to promote the exchange of information in a horizontal plane. The solution is not to simple and requires a lot of efforts to fulfill many preconditions, such as:

- uniform data code and definition;
- software protocol and compatibility;
- availability of tele-communication services.

In pedagogy, it is quite clear that many educational institutions are trying to apply the new information technologies (NITs) in their delivery systems. Many forms of media being experimented, such as, tele-education via satellite, multimedia for computer-assisted instruction (CAI), and learning through Internet. Most applications are in initial stage which provides feedback especially in quality and standard of multimedia. Up to present there is central body to set a direction and monitor the development of multimedia for education. In addition, there is a severe shortage in personnel for its prediction. Moreover, the state should specify criteria for provision of micro-computers, so each department could plan to distribute them to schools accordingly.

Insofar, every department in education has already utilized some forms of NITs. It is not possible to present a comprehensive list of applications. However, some details on state-of-the-art of NITs in selected departments will be explained to reflect the overall developments.

EDUCATIONAL MANAGEMENT INFORMATION CENTER - OFFICE OF PERMANENT SECRETARY FOR THE MINISTRY OF EDUCATION (MOE)

The center is responsible for data collection, data processing and development of databases in educational, religious, and cultural affairs. This includes data analysis and dissemination to members within the MOE information networks. In addition, the center is a core of the development of management information systems, and computer related training programs for the Ministry of Education.

At present, the center is making effort to connect every concerned department under the administration of Ministry of Education into MOENET (Ministry of Education Information Network). At the same time all parties within the network will be connected to Internet. With regard to the provision of computers, every provincial education office is already equipped with a computer, and more than 400 district education offices, representing more than 50 per cent of the total number of districts in Thailand, are already utilizing computers in their work routines. It is expected that by 1998, every district will be equipped with a computer. This means general information covering personnel administration, budget allocation, management of programs and projects, material and equipment inventory, as well as basic data with regard to education, religion and culture will be processed at the district level. The center is currently developing a software for statistical report which will facilitate district and provincial offices in data entry, data processing and reporting. It is expected that a computerized statistical report will soon replace the manual system.

OFFICE OF INFORMATION TECHNOLOGY - RAJAMANGALA INSTITUTE OF TECHNOLOGY

The office was established to search for appropriate IT which can be applied to teaching and learning activities. Besides, the office is responsible for policy formulation, research, administration, and technology and academic services. There are four major programs underway.

1) The application of IT in teaching and learning.
2) Management Information system.
3) Research and IT services.
4) Development of Internet networks.

These programs are aimed to meet the following objectives.

1) To increase the efficiency of database management system and the services.
2) To improve teaching and learning activities and to promote distance education in order to expand the standard education all over the country.
3) To produce component and capable graduates to fulfill the future labor market demand.
4) To promote research and development projects to invent and improve in the area of IT.
5) To develop connectivity of computer networks.

THE DEPARTMENT OF VOCATIONAL EDUCATION (DOVE)

The Department of Vocational Education has established an information center to serve as a focal point in data collection and information dissemination to students and general public.

With regard to teaching and learning, the department now requires every student at certificate level (Por Vor Chor) and diploma level (Por Vor Sor) to take a compulsory basic course in computer. DOVE is trying to provide adequate computer facilities for teaching and learning. The target is to provide one computer set for two to three students. In addition, DOVE is supporting the computer-assisted instruction programs by means of acquiring authoring software and organizing teacher training in CAI courseware development.

THE DEPARTMENT OF CURRICULUM AND INSTRUCTION DEVELOPMENT

In 1990, there was a significant change in curriculum for primary, lower-secondary, and upper secondary education in Thailand. One of the objectives was to promote the use of modern technology and teaching media, especially the use of computer at the school level. However, in practice, the equipment and personnel were not readily available. It was not possible to put computer courses as a requirement in curriculum. Nevertheless, at the secondary level, there were electives on computer subject. Later on in 1995, when computers were more widely available, the department introduced a basic computer course for grades 5 and 6 at the primary level. This course offered under the work-oriented subjects, or the preparation towards jobs.

In reality, only large secondary schools and schools that are supported by the private sector can manage to teach a computer course. Meanwhile, most primary schools are not equipped with a computer for either educational administration or teaching and learning. However, the Ministry of Education is planning to provide at least one computer to every school as soon as possible.

THE DEPARTMENT OF NON-FORMAL EDUCATION

The Department of Non-Formal Education is responsible for providing educational opportunity to people outside of schooling system. There are several types of courses, namely, functional literacy, general education, occupational certificate (Por Or-abbreviation in Thai), vocational certificate (Por Vor Chor-distance education), short-course occupational training, and interest group training. In 1995, 3.6 million people registered in the non-formal education courses. In addition, the department offers informal education by means of public library, radio and television broadcasting, and exhibition organized by National Scientific Center. All together, more than 15 million people benefited from the informal education programs.

The department has utilized computer in two respects, namely, educational administration, and pedagogy.

In educational administration, the applications are mainly for database management system covering:

- general education statistics;
- encyclopedia for life-long learning;
- local resource persons.

In pedagogy, there are two dimensions in utilizing NITs, namely, computer-assisted instructions, and distance education.

1. Computer-assisted instruction by national science center. The center develops CAI multimedia programs to display science exhibitions. The content is related to basic science, natural science, environment, science and technology, astronomy, aero-space, and meteorology. The target groups are primarily and secondary students and the general public. The exhibitions are designed to facilitate self-

learning through computer multimedia.

2. Distance education via satellite. In 1995, the department of non-formal Education in cooperation with THAICOM Foundation, launched an experimental project of distance education via satellite. This educational program was transmitted with two systems, MMDS and DTH (direct to home). The signals were directed to 236 learning sites. There were approximately 126,800 people who received distance education via satellite in 1995. In 1996, the department is already in the process to facilitate learning centers in every province all over the country. The full expansion target, however, will have to reach 40,000 sets of receptors for all learning centers.

Moreover, the department is undertaking a project on electronic library which is intended to store textbooks, guidebooks, as well as CAI courseware modules in electronic medium. This documentation collection could be search and transferred to public libraries at provincial and district levels. It is planned that each library will be equipped with three sets of computers. The pilot project has been kicked off this year and the expansions will be made in the following years.

INFORMATIONAL CENTER - OFFICE OF PERMANENT SECRETARY FOR THE MINISTRY OF UNIVERSITY AFFAIRS (MUA)

The information center is responsible for the development of information systems for higher education policy formulation and planning, as well as providing information services to universities. Major tasks of the center could be summarized as follows:

1) Conduct a computer system analysis and operate computer services for the Office of Permanent Secretary for the Ministry of University Affairs, as well as development of computer systems for other agencies.

2) Develop higher education database for educational development planning.

3) Disseminate and exchange information with higher education institutes for educational administration.

There are six categories of information, namely: a) student enrolment; b) university faculty; c) budget; d) curriculum; e) job placement of graduates; and f) student entrance examination results.

With regard to pedagogy, the Ministry of University Affairs has already launched a project on education network and tele-education between universities. This movement is related to the fact that potential of personnel and graduates in the area of science and technology is getting worse. The porential has accumulated for many years and affected national development. The Thai government, thus, declared a policy to speed up the production of personnel in the area of shortage.

Many efforts have been asserted to build the capacity of teaching personnel and to improve the curriculum and teaching-learning process which are appropriate to the modern word. And most of all, to expand educational opportunity to people in every region of the country. Referring to a conventional approach, campus must be expanded to receive more students particularly in different regions. However, the conventional method is not feasible, because the existing universities already lack teaching personnel. Therefore, it is important to recruit adequate staff for the new campuses.

In order to alleviate these shortfalls, the MUA decided to utilize information technology to expand educational opportunity quickly and efficiently. The combination usage of computer technology and communication devices, offers a solution to the problem. This means students in remote campuses can benefit from master teachers through modern technology. This approach helps bridging the gap in terms of quality between different universities.

However, before the utilization of technology, the Government must invest into the infrastructure to create the educational information highway. This is like the road to the source of learning. If the basic structure is provided to every university, it will be open a new channel for a two-way distance education.

This is not a new concept. Many countries in this region, such as, Singapore, Malaysia, Japan, Taiwan, and Australia have already taken this advantage. In the United States, the North Carolina Information Highway (NCIH), was a significant example. NCIN was introduced in 1986 to connect 50 universities in North Carolina along with community colleges, secondary schools, and etc. into the information highway. The essence of this concept was to build a virtual classroom in a rural school or any place affected by teacher shortage.

To create the information highway, there are four layers of information network that have to be developed, namely, campus network. In addition, the preparation for distance education networks comprises three components:

1) Organizing a standard classroom for two-way communication by utilizing video-conferencing system.

2) Develop computer networks within a university to obtain campus networks.

3) Create high-speed computer networks between universities.

With this frame of development, the MUA proposed a three years development plan as follows:

*Year One (*1996) - To build educational informational Highway between universities in Bangkok and in other provinces. This includes the installation of equipment for distance education, and the development of campus-networks. (US $ 36 million).

Year Two (1997)-To expand the number of studio classrooms to meet the increasing demand, and improve inter-university networks by switching the mode of communication to optic fiber. (US $ 42 million).

Year Three (1998) To install the systems for video-on-demand to allow every university to review any educational programs any time. This operation will eventually extend to schools and educational institutes at every level to minimize the utility of educational information Highway. (US $ 42 million).

NATIONAL IT POLICY

It is clear that information has become more and more instrumental for development in terms of production and distribution of wealth. The Thai government recognized that advancement of information technology (IT), such as, computer, telephone, television, multimedia, on-line database, and a wide range of other related technologies which will significantly shape the way we live. Thus, it is an opportune time to declare a national IT policy and set a direction as well as strategies for the next decade.

Since IT offers a good opportunity to improve effectiveness in business, and social development, the government must plan to utilize appropriate technology to spread economic activity, democratic principle, and social benefit provision such as education and healthcare across every region of the country.

It is foreseen that effective use of IT would be instrumental for - more equitable distribution and job opportunity to rural inhabitants;

- promotion of democratic principle and national heritage;
- reducing labor migration and alleviating urban slums and pollution in the capitals and major cities;
- more fairness in public services such as education, and healthcare to individuals in every sector of society;
- conservation of natural resources and environment.

Even though there are many positive features we could expect from the use of ITT, but we must be reminded that if properly developed and applied, IT could exaggerate the existing problems. Instead of bridging the gaps between the rich and the poor, the rural inhabitants, it could be a discriminating factor on who will get the social benefits and who will lack them. Therefore, it is likely that in this situation the rural population and city-poor residents will be left further behind.

In transforming from vision to realty, three fundamental conditions must be addressed and put into agenda as follows:

- National Information Infrastructure (NII);
- well-educated population and adequate IT manpower;
- genuine commitment from the government.

Agenda #1: Invest in equitable information infrastructure

At the most fundamental level, the Government must put investments to build the physical infrastructure. The most basic building block for a NII is the telephone service at high-speed telecommunication backbone linking the entire nation. Particular attention must be given to the distribution observes. A widely available and affordable basic telephone service is one important condition to effective rural development.

Agenda #2: Expand basic education for the entire population and produce adequate IT manpower.

In order to spread the benefits of using IT to all segments of society, there must be a liberate and well-educated population to become part of the beneficiaries. Without that, the society as a whole could not be expected to be active generator and consumer of new knowledge and information. On the other side of the spectrum, there is a critical shortage of almost all types of technical and managerial manpower. The greatest shortfall is in software and telecommunications engineers and technicians.

Agenda #3: Invest for the good governance.

Every member in society should be aware and involved in the undertaking to develop IT. However, most importantly, the state must provide the prime moving force to encourage, promote, support, and coordinate the development. The state must make every effort to remove critical obstacles, and provide a role model to society. This means investment in IT facilities and personnel is only pre-condition. The state must design and introduce innovative ways of working to achieve the full benefits from using IT. In this process, a society whose members can clearly perceive the benefits of IT will turn them into active users themselves.

These three fundamental issues set the scenario of what needs to be done to prepare our country to meet the challenge to next decade. To be more specific, each issue must generate more concrete strategies as guidelines for preparing program and projects.

1. Build an equitable national information infrastructure.

1.1. Embark on a five year rural communication expansion and modernization program.

1.2 .Ensure a reasonable share of the benefits be given to the rural region in all future major communication projects.

1.3. Establish an independent telecommunication regulatory body.

1.4. Review and reform the existing telecommunications and other related acts.

2. Invest in people to eliminate critical storage of IT manpower and raise basic education of all citizens.

2.1. Implement a National School-Informatization Action Program.

2.2. Establish a National Interactive Multimedia Institute to oversee the development of educational courseware and application software.

2.3. Intensify IT manpower production at all levels.

3. Enhance government services to make fuller use of IT by all public agencies trough government reengineering and to provide full supports to all sizes of entrepreneur in the information industry.

3.1. Launch a Nationwide Government Informatization Program.

3.2. Make IT planning an integral part of the annual government budgeting exercise and IT policy research an on-going effort.

3.3. Support the development of a short local information industry.

3.4. Promise and support electronic means for citizens and business to interact or trade with government, or among themselves, or with the world community.

MASTER PLAN OF INFORMATION SYSTEM FOR EDUCATION

From the scope and strategies generated by national IT Policy, education sub-sector has to delineate its own details. The prospect is quite clear that education can benefit a great deal from appropriate use of IT. However, there are numerous institutions involved in educational provision. It is necessary to develop a master plan of information system for education. The Office of the National Education Commission, which is attached to the office of Prime Minister, serves as coordinating body to develop the master plan.

The objective of developing information system for education is to achieve an efficient information system which supports educational planning and management. The information must be interchangeable and the system must be accessible to educational institution at all levels. This includes information services which fulfill the aspirations of all citizens for life-long learning and skills upgrading without regards to age, profession, distance, geography, or physical disability. The desirable information system for education comprises two major components:

1) Information system for education administration.

2) Information system for teaching and learning.

INFORMATION SYSTEM FOR EDUCATIONAL ADMINISTRATION

This component actually covers statistical information and documentation information.

The system of statistical information comprises a wide range of agencies, both information producers and information consumers, from institutional and departmental levels to ministerial and national levels. It is expected than by the year 2001 the linkages between departments and between ministries will be completed, and the line of data communication will also be available for international cooperation.

The system of documentation information comprises libraries, academic clearing-houses, private agencies, and international organizations. There are two types of network. First, a network which the ONEC serves as a node where members can have an access to available databases, such as, a collection of cabinet's resolution, on education, educational laws, educational development plants, and education research abstracts. Second, a network where ONEC is an affiliated member connecting to other existing networks, such as, a national library network, university libraries networks, etc.

INFORMATION SYSTEM FOR TEACHING AND LEARNING

According to the national IT policy with regard to investing in human resources, there will be a national project on "School Informatization" This means schools will be equipped to benefit from the advancement of IT. A wide range of IT applications will be organized. Schools will be connected into a network and have access to a variety source of learning. There are two organizations which will be responsible for the development of information system for teaching and learning.

(1) National Electronics and Computer Technology Center (NECTEC). NECTEC will provide services to schools and universities to get connection to the Internet and other international networks.

ThaiSarn, the Internet of Thailand, was founded in 1992. Initially, the institute's operation was purely academic and aimed to serve research communities. Later on its operation was expanded to meet demand for nation's economic growth. By the end of 1994, more than 40 sites would have been on-line with ThaiSarn-Internet. ThaiSarn is growing at the rate of approximately 120% annually.

ThaiSarn's major goal is to establish an information structure for the academic and research communities in Thailand by means of computer networking and the information service therein. The short-term mission is to bring all universities, their libraries, colleges and leading schools on-line to the global village in a professional manner. The medium-term mission is to build up solid information-exchange foundation for ultra-organization communications and cross-database access for all participating parties. In this endeavor, Thaisarn must seek new forms and technologies to make this ambition a realty.

(2) National Interactive Multimedia Institute (MIMI). This institution will be a central body in monitoring, supervising, and developing standards of multimedia for education. The tasks also includes purchase of software, development of software applications, and distribution of multimedia to schools.

The establishment of National Interactive Multimedia Institute will respond to the intention of the government with regarding the distribution of Knowledge and information to the people through electronic media. This is especially true for education. In the United States and Europe, for instance, there are over 10,000 titles of learning topics recorded in the CD-ROM annually. Thus, in order to mobilize resources to build capacity in multimedia production, the establishment of the multimedia institute is indispensable. It is expected that the institute will be able to serve the domestic demand by building the capacity of personnel and monitor the quality standard of the medium in terms of educational psychology and presentation technique.

STRATEGIES FOR DEVELOPMENT

In order to achieve the objective of the master plan of information system for education, certain strategies must be specified to ensure support from the government. These strategies cover the development of infrastructure system for educational administration and information system for teaching and learning.

1. STRENGTHENING COOPERATION FROM ALL PARTIES

The state should encourage and provide incentives for the private sector to be involved in the development projects. There should be at last two levels of the coordinating committee,

1.1. National level. A sub-committee on educational information system development should play a role in proposing development policy and master plan of action. This includes a plan for producing and upgrading IT personnel/manpower, the mechanisms to coordinate among governmental agencies, and between governmental organizations and the private sector.

1.2. Regional level. There must be a committee at the provincial level to ensure appropriate operations according to national policy. This committee will promote lateral cooperation between different organizations, so that the sharing of resources and exchanging of information would be maximized.

2. IDENTIFYING COORDINATING AGENCIES FOR EDUCATIONAL INFORMATION SYSTEM DEVELOPMENT IN BOTH AREAS OF EDUCATIONAL ADMINISTRATION, AND TEACHING-LEARNING ASPECT.

2.1. Coordinating agency for MIS. The Information Center for Education (ICE) located in the Office of the National Education Commission should be the coordinating agency for MIS. The scope of work includes developing information criteria and standard software for database management system which will make possible the sharing of information between different agencies, and eventually will extend information service to the general public.

2.2. Coordinating agency for teaching and learning. The National Interactive Multimedia Institute should be immediately established to oversee/monitor the quality standard of teaching-learning media, and promote research and development projects to improve the efficiency of using multimedia for education.

3. ENCOURAGING ALL EDUCATIONAL AGENCIES TO PUT INFORMATION FOR ADMINISTRATION AND TEACHING-LEARNING ASPECTS INTO MACHINE READABLE FORM

3.1. With regard to information for educational administration, all concerned agencies should plan to conduct a data collection to fulfill the agreed upon list of educational indicators by the end of the 8th National Education Development Plan of the year 2001.

3.2. With regard to the production of media for teaching and learning, the coordinating agency should be responsible for:

1) monitoring the quality standard of educational media;

2) identifying appropriate technologies for certain type of education, this includes distance education via satellite, multimedia for computer-assisted instructions (CAI), and learning through Internet;

3) providing financial support for the production of teaching-learning media to governmental and private institutions;

4) conducting research and development projects for innovation in education;

5) organizing training courses to develop teaching personnel from educational institute at all levels to be able to use IT for education.

4. CREATING EDUCATIONAL INFORMATION HIGHWAY FOR ALL TYPES OF EDUCATIONAL INSTITUTION

4.1. Regarding information for educational administration, the state should support the development of LAN within an institution and data communication lines between central and regional administration.

4.2. Regarding information for teaching and learning:

1) at the institutional level, a school network or campus network should be developed to facilitate the sharing of resources;

2) infrastructure for tele-education should be immediately developed to connect various educational institutions into tele-education networks;

3) all levels of educational institution should be connected to the Internet to get access to resources of learning worldwide.

5. BUILDING THE CAPACITY OF IT PERSONNEL TO RESPOND TO THE NEED FOR THE DEVELOPMENT OF INFORMATION SYSTEM FOR EDUCATION

5.1. For educational administration, the IT personnel must be trained for the MIS and be able to operate data communication between different agencies.

5.2. Regarding IT for teaching and learning, teachers at all levels must be trained to utilize multimedia technology for education. In each school there should be a good proportion of teachers who are able to write a script to produce a software for computer-assisted instruction which would be a key factor in educational expansion and quality improvement.

6. THE GOVERNMENT SHOULD PROVIDE ALL NECESSARY SUPPORT AND MAKE THE DEVELOPMENT OF INFORMATION SYSTEM FOR EDUCATION A HIGH PRIORITY

6.1. At the national level, all ministries will be connected into Governmental Information Network: GINet, where the educational information highway will be a part of the governmental information network.

6.2. For teaching and learning purpose, two modes of delivery system must be supported:

1) learning from a computer, either stand alone or LAN, a school should have an electronic classroom;

2) infrastructure must be developed to facilitate all types of educational institutions to apply a two-way tele-education to their delivery system.

NATIONAL REPORT OF TOGO

THE REPORT ON EDUCATION AND INFORMATICS IN COLLEGES OF TOGO

Like all developing countries, Togo is accused of a considerable lag behind in industrialization and of lack of attention paid to the information revolution.

Such situation is caused by non-adequate relationship between education and world's evolution, on the one hand, and between education and the real needs of the country, on the other.

In order to reach a high level of development in all spheres of life by constant analysis of factors, affecting productivity, Togo does everything possible to form professional staff in its education institutions, which will be able to use all the known information technologies for the wealth of the country.

The newest findings in the spheres of informatics and communication technologies are looked at as a solid base for the rational and effective modelling and control of education systems and of other social and economic systems.

And with the majority of systems being interested mainly in micro-informatics, the education system is in a great need of this science in the fields of inner-control and planning.

1. THE INTRODUCTION OF INFORMATION TECHNOLOGIES IN THE UNIVERSITY OF BENIN

Many countries have already worked out their national informatization plans, which determine a state policy on the further information systems' development and on spreading new technologies in the education system.

The program of the informatics introduction into the education system of Togo has been already drawn up. It is only the first step of the elaboration of the expanded plan of the informatisation of education system. This plan plays a considerable role in the general plan of the country's economic and social development because informatics is able to have a great impact on the productivity growth.

A. THE ROLE OF NEW INFORMATION TECHNOLOGIES IN THE SYSTEM OF HIGHER EDUCATION

The program of the informatics introduction into the education system is carried out on the basis of inmpoving already existing information technologies in the University of Benin. In higher, secondary and primary schools informatics is supposed to assume the role of :

- an instrument of control, planning and management of educational process ;
- a means of getting access to information;
- an independent school discipline;
- a research instrument.

In higher school the changes of the existing information technologies of the Benin University are effected in the following directions:

- Informatics as an instrument of planning and control of educational process
- Informatics seems to be the most suitable way of coping with the complicated structure of management, caused by the constantly growing volume of information that has to be adjusted.

We are talking, first of all, about the Personnel Department, managing all the personnel of the Benin University. Earlier, the personnel management was carried out only by hand but now this style gradually leaves its place to informatics. This service has part of the data distributed among different sections at its disposal. The information control of managerial and teaching personnel is effected quite easily. Payments have become another important procedure that uses informatics widely. It is worth mentioning that the majority of programs run by this service have been worked out by the Informatics And Computer Center (ICC). The system of personnel and payments management is based on the local network of mini-computers.

Another system that requires computer-aided management - The Administration of School and Higher Education Affairs (AEHEA) - also formed the information program of school education management in 1989. The original information system has undergone considerable changes and now consists of ten management departments. The development of this system is performed by the ICC of the Benin University. In a month it is likely to form a new department that will operate the AEHEA's network. Carrying out this project will be the one more step toward the Campus' information network. AEHEA publishes its annual Bulletin, reflecting all novelties of informatics, taking place in Benin.

Information technologies as an access to the information through telecommunications

In Campus one can get an inquiry by inner-telephone. In the nearest future it will be possible to receive necessary information about the University's management structure and about the University 's scientific research.

This system of providing information also includes mail service that will allow a customer to send different messages with the help of special mail-boxes of E- mail. At this moment, the University doesn't have such network.

Informatics as an independent discipline

Informatics courses are being studied at different faculties of the Benin University and at schools. The contents of these courses depend on the University's financial resources. The course opens with the introduction into informatics as a science (students learn about information network, scientific programming and automated control). The studying of informatics is also required for book-keeping (editing texts ang making tables). Particular attention to the informatics studies is paid during the last years of the University, especially at Technics faculties.

ICC furnishes the faculties with material and technical supplies: provides rooms, computer facilities and sometimes it offers help of its own specialists. The provided facilities help to eliminate extra costs and delays in computer equipment adjustment. Nevertheless, some faculties and schools can afford to organize their own computer structures.

The great interest in informatics showed by students and the necessity of creating a new society contribute to the active use of information technologies by the officials of education institutions. For example , from the year of 1990 the African Center of Training and Maintenance of Micro-Informatics (ACTMMICRO) prepares highly qualified specialists in micro-informatics. The training course lasts a year and the graduates possess knowledge that can be applied not only to the Togo's computer system but to the up-to-date computer systems of the other African French-Speaking countries.

In 1995 new 2- year program of informatics training was set in the Center. The Benin University has also suggested that the High National Engineering School should organize a course devoted to industrial informatics. This faculty will probably open in 1996/97.

The highly qualified specialists training is also available from private institutions. But only the Control System of the Benin University povides state examinations.

The University invests regularly in the programs of informatics application to book-keeping in order to facilitate the work of managerial and teaching personnel .

Informatics as an instrument of research

Today any scientific work can hardly be effective without informatics. For supporting scientific research ACTMMICRO gives the University's professors engaged in research an opportunity to purchase computers at a prime cost and in credit. This program is financed by PII/UNESCO and by the University Teachers Mutual Aid Society. At present the scientists look for the way of using informatics in the creation of new computer technologies.

The efficiency limit in informatics

ICC makes out special information programs for different services and University research works. They cover the following subjects: programmed control of schools, programmed control of personnel and payments allocatins, organization of an inquiry service (providing information about different University structures), control of faculties' documentation, etc.

Since 1992 ACTMMICRO distributes computer facilities among the universities and institutions at a prime price, thus cutting expenses on computers' purchasing.

B. THE PRIORITY OF INTRODUCTION OF THE NEWEST INFORMATION TECHNOLOGIES, GRANTED OF THE UNIVERSITY

For achieving the planned objectives, the strategy of introduction of new information technologies has to follow the real political concepts. In Togo this strategy is based on:

- taking into account the advanced experience of world's technologies;
- finding new ways of development.

The usage of the advanced experience of world's technologies

One of the first applied advanced technologies has become a system of training, based on the various versions of access to the heterogenous database (equipment, operation systems, different programs). This method has to identify the institution's systems and call necessary information out of database.

The introduction of new technologies in all the systems of the Benin University will reduce costs of the local network running.

Finding new ways of development

The plan of the informatics studies introduction assumes two main directions of evolution:

- scientific research
- training qualified personnel.

Scientific research

First of all, the existing information systems should be mentioned: the Center of Computers and Informatics that expands the use of educational programs promotes different teachers' computer programs of educational control and planning. All the resources of this institution have to meet the requirements of the working information programs.

ICC plays the biggest part in the process of information exchange and in research control. It also has its own Department of Scientific Research.

A foundation has been set up with the aim to finance research, information programs in education and creation of new ones in the same field.

The training of qualified personnel

ICC arranges seminars, aimed at the broadening of knowledge in the sphere of informatics and computer system, and upgrading courses. The correspondence course scheme will be useful for the teaching and managerial personnel because of its information network. This project, developed by Togo, is included in the program of distant education development.

2. THE REVIEW OF INFORMATION INSTRUMENTS

A. TEACHING MATERIALS

The University possesses a wide variety of computer facilities, divided among different systems of training.

Though working with the same programs , SHIC and CALMIR are equipped with different hardware:

- 12 micro-computers PC 8088 EPSON without HDD disc for students;
- 12 micro-computers PC 8088 AMSTRAD with HDD 30 MO;
- 10 micro-computers PC 80386;
- 12 micro-computers PC 80486 COMPAQ , presented by Japan;
- 1 mini-computer PDP 11 together with the PC486, conducting the work of terminals, containing the scientific programs (FORTRAN).

The rest of the computers are represented by the models 8088 and 80386 which serve as an additional instrument of students' studies. The following software are used on these computers:

- Basic, Pascal, Fortran, C, C++;
- Database controlling programs - DBASE III and IV;
- Word Perfect 4.2 and 5.1;
- LOTUS 1, 2, 3.

B. HARD- AND SOFTWARE USED BY THE MANAGEMENT

The management of the University has at its disposal micro-computers, intended for the text work.

The Personnel Department which performs the functions of personnel management and payments, discharges its duties with the help of the micro -computers 386 and 486. The project of these computers' inclusion in the University's information network is being realized now.

The DASS service, responsible for the school system control, has a special school control program, drawn up by ICC. This program functions through the local Novel 3.11 network, which consists of 10 terminals and one server. This network has started the process of computerization of all University's structures.

As to system programming, several programs for text work (WordPerfect, Word and its DOS versions) are used in the University.

As for table editor, one can choose either Lotus 1,2,3 , DOS 0 or Excel IV and V. Some database programs - Dbase IV and V and statistic programs - SLM, SPSS and STATZTCF are used for the more effective control over University structures.

Today, the University adopts integrated information systems as they conclude all the above mentioned programs and therefore colleges prefer working with Microsoft Office and Works.

3. THE DIFFICULTIES OF THE PROCESS OF NEW TECHNOLOGIES INTRODUCTION

As informatization is an irreversible process, one can either put up with it or participate actively in learning new technologies. Nevertheless, this process faces a sufficient number of obstacles.

The main obstacle is the lack of the qualified personnel. Unfortunately, most of teachers are not specialists, and the rest of them constantly leave jobs in state colleges and move to private ones , and visa versa. Usually, they prefer to stay in private colleges because of higher salaries.

Then go financial obstacles. The lack of money for technical supplies delays considerably the new equipment purchasing. That is why the up-to-date computer facilities are not able to reach up the required level.

The limited University's financing of informatics together with the small budget investments can't improve the situation.

And finally , with the permanent growth of equipment cost and the impossibility to purchase new computers, the staff members are compelled to work with the old equipment that often breaks down.

4. FUTURE STRATEGY

The policy of action is the only way of achieving the set objectives. This strategy should be set up at all levels of education.. The Higher School of Togo, for example, carries on the informatization plan with the help of the Benin University.

This plan includes the following points:

- introduction of teaching staff training;
- improvement of already existing structures;
- participation to international seminars, devoted to the problem ;
- participation to different information projects, worked out by other organizations ;
- consolidation of technical supply;
- cooperation.

INTRODUCTION OF THE TEACHING STAFF TRAINING

This stage precedes the informatization plan. Specialists have to provide training courses for teachers and for managerial personnel. They act as technical advisers in the National commissions of informatics and participate in elaboration of new information technologies and their application to informatics.

IMPROVEMENT OF ALREADY EXISTING STRUCTURES

The finding and experience of the existing structures will be consolidated for the improvement of efficiency of work.

PARTICIPATION IN DIFFERENT INFORMATION PROJECTS, WORKED OUT BY OTHER ORGANIZATIONS

Togo has sighed an agreement on its participation in the international project of General Education (FAD). This project of setting up distant training through new information technologies and communications (e.g. network REFER) unites 5 countries: Benin, Bourkina Faso, Guinea, Mali and Togo. It is designed for the teachers of different levels of education and with different qualification and skills.

For the first several years, the teacher training courses will be offered as an experiment. Their curriculum won't differ from the University informatics courses.

Soon, the well-equipped information centers SIFED, in the University area, will be opened to students and teachers. At the beginning they will be used as an access to information but later the University will be looking for its own access to the information bank. It will give the University an opportunity to gather and distribute information by its own means and in a way it wishes to do it. In fact, the University has been already granted the permission to use the SIFED network as the base for this project.

PARTICIPATION IN THE INTERNATIONAL TRAINING PROGRAMS

Togo pays much attention to the creation of an information server in the colleges of Africa. The training programs will have to expand due to the new training centers, which will be interesting and helpful for the specialists and teachers of engineering schools, informatics and computer colleges. The policy of informatics introduction in the system of education stipulates that the teacher training courses will last several years in order to give the larger number of teachers a possibility to get to know the newest technologies. These programs will be guided by the conclusions of the following seminars and colloquiums:

The Seminar «InformAfric», that has been already held in Lome, Togo in December 3-7, 1995.

The Seminar « Electronic networks, information system and databases for scientific research, aimed at global changes in science», arranged by START and IGVP-DIS in the USA , July 17 - August 4, 1995.

The Conference «Informatics and the French-Speaking countries on the way to new comprehension of the essence of barter», held in Cotonu, Benin in November 13-14, 1995.

The conferences and seminars, planned in the nearest future:

The INET conference will be arranged by the Internet society in Montreal, Canada in June 1996. The purpose of this conference is to show the main principles of Internet, to present its networks and new technologies and to illustrate the world's success of Internet for expanding the Internet infrastructure. The Conference INET'96 will be very intensive and the problems of setting up, application and control of the Internet networks will be discussed during a week.

Two groups have been formed for this conference: group # 4- control of the national network (in English) and group #6 - management of local networks in campus or firm (in French).

The International Seminar AGIR will take place in Abidjan, Ivory Coast in July 1996.

The participation in seminars and conferences is very important to the specialists:

- there is a possibility to concentrate on the problems of infrastructure, utilization and control of information networks, expansion of the application of new technologies;
- they can enrich national information networks with the advanced world's technologies;
- they can strengthen the inter-countries cooperation by participation in joint projects. For example, some attempts were made to set database networks in the developing countries;
- the participants to these conferences acquire valuable experience and knowledge, that later can be used for the benefit of the country.

As the majority of the developing countries, Togo clearly realizes the significance of such programs and therefore welcomes the introduction of new information technologies into teaching process.

CONSOLIDATION OF TECHNICAL SUPPLY

As there are still enough problems in this sphere, the technical supply must arouse particular attention. The following measures can be taken:

- support of the joint African centers such as ACTMMICRO;
- establishment of similar centers in the country;
- setting up of close relationship with such specialized organizations as ENSI, that can provide technical support.

COOPERATION

Taking into consideration all the needs of the continent, the necessity of using local, national and international resources and the lack of joint activity in the sphere of information technologies, the introduction of informatics into the education system seems to be a solution of the problem. The following activities should be supported:

- backing of the effective cooperation South-South, concentrating on technical support;
- backing of the effective cooperation North-South in the state private sector and in non-government organizations of African countries. They have to develop education of the African continent by working in the world market of information and communication.

CONCLUSION

In conclusion of this Report we will give a short review of the most important aspects of the introduction of new technologies into colleges of Togo.

The use of the newest information technologies stimulates the creation of new working methods and the obtaining of new knowledge and skills.

Various fields of education will be satisfied after the introduction of 110 new information instruments, which will simplify and rationalize the work and increase its efficiency. Time savings will be spent on the data analysis and decision making.

The teaching personnel of this country reasonably feel a kind of fear to the growing interest towards informatics to the detriment of other disciplines: economics, social studies and culture.

But education, as a development factor, can't ignore the new information technologies because the future of the society is closely connected with informatics. The country should use the achievements of information science to the benefit and development of the whole society.

THE REPORT ON THE INFORMATICS STUDIES IN PRIMARY AN SECONDARY SCHOOLS OF TOGO

PRIMARY LEVEL

There is a lack of computer equipment and the Ministry of Education doesn't have enough funds for its purchasing.

None of the information technologies is used at this level, even by managerial staff.

Schools don't have either computers, or programs and thus it is impossible to arrange computer studies.

There are neither qualified teachers , nor access to computer network and therefore the introduction of new teaching methods will meet a lot of obstacles.

Not having qualified personnel and teaching programs, we have to postpone our participation in international projects for uncertain period of time.

SECONDARY LEVEL

The Directorate only is equipped with computers. They are:

- micro-computer Tandon Targe 40 - 286 (bought in 1988) ;
- micro-computer IPC 286 (bought in 1989, broken)
- micro-computer IPC 386 (bought in 1992)
- dot printer
- laser printer.

The following programs are used:

- Microsoft Word 5
- the program of the Personnel Department control.

Except printers, all the equipment is old and unable to work with new software. Within a short time the computer facilities will be renewed and the use of information instruments will be widened through making a new network for the effective control of information.

THIRD LEVEL

A. The role of new technologies on the third level of education of the state school of Togo

By now, the newest technologies don't play the due role in the education system. Informatics hasn't been included in the curriculum and computers are not used as a teaching tool. The long economic crisis cut the amount of investments in education system.

B. Prospects

In 1989 the plan of informatics introduction was divided into two stages: inclusion of informatics as a school discipline in Lycees - in the first, second and last grades and then providing classrooms with the necessary computer facilities.

The management will be also furnished with computers for gathering and distributing information. Today the elaboration of new projects FAS Togo and PAGED demands well-equipped offices, expansion and perfection of information network. Our desire is to make computer a handy tool for man through using state-of-the-art equipment and newest technologies.

PRESENTED

BY THE MINISTRY OF NATIONAL EDUCATION AND RESEARCH.
LOME - TOGO

NATIONAL REPORT OF TUNISIA

THE TRENDS OF THE SCHOOL'S INFORMATION SCIENCE DEVELOPMENT IN TUNISIA

INTRODUCTION

According to the 8-th Plan of country's development , covering the period from 1992/93 to 1996/97 school years, particular attention was paid to human resources, which determine the development of school information science.

The following main aims stand out:

1) The consolidation of the training system by increasing schools' capacity , strengthening of teaching staff , by introduction of postgraduate teaching education and setting up courses of professional upgrading and refresher courses.

2) Setting up the informatics sections in all engineering schools and management colleges;

3) Including the units on the informatics basics in all courses of school education and of the first years of higher education;

4) Setting up private schools (the problem of diploma recognition, the introduction of the government examinations, etc.)

The government strategy and the Tunisian experience in the introduction of school's informatics are presented in the following chapters of this Report. And in this case, the information science is looked at, on the one hand, as a school discipline and on the other, as a mean of the teaching methods renovation.

In the system of primary education they suppose to make a number of experiments of applying the informatics methodology into some other courses.

THE PROBLEMS OF THE INFORMATION SCIENCE INTRODUCTION IN THE SYSTEM OF SECONDARY EDUCATION

The introduction of the information science in Tunisian schools started in the school years of 1983/84 when the computer laboratories were opened in three colleges (Rades Lycee of Technics, Sadicky college and Sphacs Lycee for men). With the establishment of The Centre of Informatics (CMBI) in 1985, reorganized into The National Institution Of Informatics in 1990 (INMBI), the two experimental lycees and five control colleges were included in the program. In that case the information science course, considered to be the working tool, was to start from the first year. Along with this there were held experiments of making the computer the basic means of teaching with the help of the computer programs and according to the scheme « Studying with the computer».

Since the school year of 1990/91 under conditions of the education system reform the process of introduction of the school informatics was put in a form of a program. During its first phase it had to provide any student, leaving secondary school, with a possibility to obtain skills in using information technologies. During the second phase it has to settle more ambitious problems, connected with the obtaining of cognitive skills and the renovation of teaching.

During this school year this program has covered 34436 students, and in the last year of the target period (September, 1996) it will embrace 46000 students.

RESULTS EXPECTED

In the middle-term plan the steps of the school informatics introduction have to help every student, completing secondary education, to master information technologies. For settling this problem the special program has been worked out. It makes it possible to achieve the prescript aims by September 1999.

The informatics course in the 3-th and the 4-th grades (the 6-th and the 7-th in accordance with the previous system) is taught as an optional discipline. Step by step, all the students of the 3-d grades of the section «Economics», «Math and Sciences» (to the school year of 1999/2000) and «Humane Studies»(to the end of the IX-th planning period) are supposed to be involved in this course. Thus, informatics studies will become a compulsary subject for the 3-d grade, and will remain optional for the 4-th grades.

Together with this, students and teaching staff will acquaint themselves with the various ways of the informatics application in studying different school disciplines. This will promote the creation of new methods of teaching to which the program of the school education reform pays much attention.

SOME RESULTS

A) STUDENTS INVOLVED IN STUDYING THE INFORMATICS COURSES

The introduction of the informatics course provided an opportunity to cover by this discipline about 9000 students in the school year of 1992/93 (6-th and 7-th grades), 17000 students in 1993/94 and 25000 students in 1994/95.

In 1995/96 the school informatics course (2 hours per week) will be taken by 34500 students. This figure includes students of the 6-th grade - 19000 and students of the 7-th grade -15500. Besides , 3148 students will regularly study the informatics course in six experimental colleges.

The extent of involving students in the informatics studies in the 6-th grades will make 62%, 37% and 4% in the sections «Economics», «Math and Sciences» and «Humane Studies» correspondingly; in the 7-th grades - 59, 27 and 2% for the same sections.

In the section «Humane Studies» the course is not adapted to the specific profile of education and that is why it is studied as an experimental discipline in several colleges by only 4% of total number of students.

B) HUMAN RESOURCES

1. Teachers

Information science is taught by teachers with different diplomas: some have the diploma of informatics, others specialize in other school disciplines. The first group includes 110 teachers, the second - 178 (the latter is subdivided into two groups : 111 teachers work full day and 67 have a part-time job). Teachers, who didn't have special skills in informatics, as a rule had undergone training in The National Institution Of Informatics.

One should point out that the coordination of these two types of teachers provides for more successful development of information science as a school discipline and guarantees achieving the prescript aims in this field.

Actually, the work of informatics specialists allows to increase the scientific level of education. On the other hand, the teachers of other disciplines, being well paid and highly trained, assist in the process of amalgamation of informatics with other disciplines, and also promote wider and more successful usage of a computer as a method of teaching.

The requirements to the informatics teachers can be divided into two categories:

- in the short-term plan - the possession of knowledge and skills, necessary for teaching the existing course;
- in the middle-term and long-term plan - there will be a need in a special knowledge for the efficient work in accordance with the improved program , providing more profound knowledge of the information culture and obtaining of new skills in the practical application of informatics.

The program of teachers upgrading implies:

- supplementary general training , broadening the teachers' knowledge of new information technologies and of their impact on the economy and social development;
- training in the methods of teaching;
- supplementary special training in the information science (for the teachers, who don't specialize in this sphere);
- training in new applied information technologies, used in the educational process.

2. Specialists in recruiting teaching

Nowadays one inspector and five teachers-advisers are travelling around the country and recruiting relative teaching staff, while exercising control over the quality of education and training teachers of informatics. They organize show lessons, methodological and educational seminars. They also inform The National Institution Of Informatics about the results of their activity and recommend the ways of improving educational programs. These specialists take part in the working out of an informatics manual , containing both theoretical and practical portions.

3. Laboratory personnel

During the last years the absence of qualified laboratory assistants has limited the possibilities of practical work in computer laboratories and its use for studying other disciplines. This hampered the work of keeping everything in order in computer classes and, moreover, created difficulties with software. Today for providing the most effective use of computer laboratories the position of an operator will be gradually introduced into the staff of every lycee. First of all, this problem is vital for the lycees, which will be equipped with second computer laboratories.

C) INFORMATICS STUDYING PROGRAMS

The objectives of information science studying were stipulated in the Act #93-670 of March 29, 1993 (Articles 635-638). They were determined in the process of elaboration of new educational programs with the assistance of foreign specialists. The main objectives are:

1) The introduction of the information culture to the students by considering informatics as a dynamic developing discipline, applied in various spheres of life. Such approach makes students to comprehend the essence of changes in the information science and, therefore, to understand and to learn it better.

2) The development of students skills in settling problems with the help of definite system methods, using the appropriate instruments. The chosen problems usually deal with different school disciplines, because it develops the inter-discipline culture and gradually stimulates teachers and students to purchase a computer and to use it as a means of self - training.

3) Training of teachers and students for the future use of a computer as a teaching instrument.

D) COMPUTER LABORATORIES

The organization of 109 computer laboratories was the next step in the process of establishing of informatics as a school subject. This took place in the school year of 1991/92 under the Tunisian -

Italian cooperation program. During this school year the number of computer laboratories increased to 160. Each laboratory includes 10 (9+1) or 8(7+1) working areas with two plugged-in printers.

THE PROSPECTS

Thus, nowadays the scenario of informatics spreading in the education system of Tunisia has been worked out. It makes it possible to achieve the set aims by September 1998 for the section «Technology and Economics», by September 1999 for the section «Math and Sciences» and by 2001 for the section «Humane Studies».

The process of informatics spreading will cover the students of the 3-d grades of secondary school. It will be an optional discipline in the 4-th grades.

As a result about 81000 students will be involved in the information science studying program in 1998. This course will be taken by 100, 80, 35% of all the students of the 3-d grade of the sections «Technology and Economics», «Math and Sciences» and «Humane Studies» correspondingly and by the students of the 4-th grade in proportion of 45, 35, 5% correspondingly.

In September 2001, to the date of the completion of the program, the informatics studying will cover 100% of students of the 3-d grade from the sections «Technology and Economics», «Math and Sciences» and «Humane Studies» and 45, 40 and 10 % of students of the correspondent sections of the 4-th grade.

The following program of personnel and logistic support for the process of information science spreading in the education system has been worked out.

A) COMPUTER LABORATORIES

The detailed analysis of the program of informatics spreading in the education system made it possible to present a plan of furnishing new equipment to the lycees. It stipulates a once-in-six-years renovation of lycees' informatics facilities and organization of second computer laboratories according to the numberof students.

Experts say that in order to satisfy the needs the total number of laboratories has to be increased to 203 by September 1996, that means that 43 new laboratories are to appear and 34 laboratories have to be renovated. The number of micro -computers, needed for the program will make 770 and the number of laboratories to be equipped - 43.

During the 8-th plan period the computer purchases will cost 1540000 Tunisian Dinars and the financing of adjustment works - 172000 TD.

During the years of 9-th Development Plan it is supposed to establish 278 new laboratories and to renovate 340 laboratories. The total number of computers that will be needed for work makes 6180 and the number of laboratories for renovation - 278. During the 9-th Development Plan period the capital investments for these purposes will amount to 12360000 TD for equipment purchasing and 1112000 TD for adjustment works.

B) TEACHING STAFF

In order to satisfy the calculated needs for teachers of informatics their total number is to be 230 by September 1995 and 304 by September 1997.

During the 9-th Development Plan the number of teaching staff is estimated as 436 teachers by September 1997 and 720 - by September 2001.

The lack of academic hours will be covered by the overtime work of staff teachers of information science or by attracting teachers of other disciplines.

C) COMPUTER AS A TEACHING INSTRUMENT

1. During the last few years several applied computer teaching programs have been constantly improved and used in schools under total or partial control of inspectors or experienced teachers. Other applied programs are being worked out in the National Institution of Informatics by the inter-discipline group of specialists, including teachers and computer specialists. These process is proceeded by the scientific research works on the concept of educational environment , based on the main trends of the Tunisian educational process.

There also exist applied computer programs, created by the students of some lycees. Among them are:

- program for studying French (the beautiful world of inventions and discoveries);
- program on mathematics;
- program-guide for the National Museum BARDO (multimedia version) ;
- 16-th century in France (documentary database);
- book on Arabic rhetoric.

2. The introduction of a computer into the teaching process in technical education

In the framework of the education system reform, technical school disciplines were officially based on system, rather then on technical principles. Such approach rested on the concept of teaching with the help of a computer and programs of production process imitation and modelling , by using robotics and computer-aided design system.

Thus, all the students of technical classes had an opportunity to work with the resources of such computer design programs as «Autocad» and «Orcad» and to use computer-aided production equipment.

Now there are 2000 work places, equipped with the software for computer design and computer-aided facilities (a mini-lathe with programmed control, a robot, an «automated hand»).

D) INFORMATION

The distribution of the information about new findings in the sphere of informatics and about teachers' projects is one of the most important problems. That is the reason why the National Institution of Informatics publishes aquarterly bulletin since March 1993 and distributes it among different sectors of`population.

E) SOCIAL AND OCCUPATIONAL TRAINING

Besides the personnel of the Ministry of Education, officials and clerks of many other state and private organizations (the Ministry of Youth and Childhood Affairs, the State Property Ministry, the Central Bank, the Tobacco Industry Administration) could take the computer training courses by signing a contract.

128 staff members of secondary education lycees who master the applied computer program «SYGEL», 64 teachers willing to get a new profession and 540 working teachers having particular interest in informatics attended training courses in the Ministry of Education.

F) THE MAINTENANCE OF HARD- AND SOFTWARE

The working experience of three regional centers of the National Institution of Informatics in maintenance of all the lycees' equipment was large enough to solve the problem of keeping in order the great variety of involved facilities. Two times a year each computer laboratory was checked by a technical group, which carried on the inventory of equipment and then provided routine maintenance and repair. But the growing difficulties with the operating personnel movements worsen the situation. One should also consider that this kind of problems will be aggravated as the technical base of lycees expands and becomes older. This bring up the necessity of taking measures promptly .

From the moment of its foundation the Maintenance Department did its best in computer facilities repairing. Its activity was carried out in two main directions:

- the increasing of maintenance quality in order to reduce the number of fails. The computer centers visiting schedule is made up at the beginning of every half-year but its execution depends on transport available;
- recovering maintenance with the help of the National Institution of Informatics' facilities.

G) AUTOMATED CONTROL SYSTEM

In the framework of informatisation of administrative departments of the Ministry of Education one can see a fast development of the automated control system «SYGEL», which now covers 380 lycees and embraces such new kinds of activity as the end of a school year events and certain types of statistics.

Moreover, it will expand into new spheres of management in several lycees after checking the automated control system by the «IGEBI» budget.

The scheme of informatics spreading

	School year	Technics & Economics		Math and Science		Humane Studies	
		6-th	7-th	6-th	7-th	6-th	7-th
VIII Plan	1991-92	10%	0%	20%	0%	0%	0%
	1992-93	10%	10%	30%	20%	0%	0%
	1993-94	69%	24%	39%	18%	0%	0%
	1994-95	60%	30%	40%	25%	2%	0%
	1995-96	62%	59%	37%	27%	4%	2%
	1996-97	75%	45%	50%	30%	10%	3%
IX Plan	1997-98	85%	45%	65%	35%	25%	5%
	1999-99	100%	45%	80%	35%	35%	5%
	1999-00	100%	45%	100%	40%	60%	10%
	2000-01	100%	45%	100%	40%	80%	10%
	2001-02	100%	45%	100%	40%	100%	10%

The number of students, covered with informatics studies

	School year	Technics & Economics		Math & Science		Humane Studies		Total
		6-th	7-th	6-th	7-th	6-th	7-th	
	1991-92	943	0	2780	0	0	0	3723
VIII plan	1992-93	169	167	4495	3117	0	0	7947
	1993-94	6998	448	6725	3107	0	0	17278
	1994-95	8802	2260	8094	5311	292	0	24759
	1995-96	9724	8922	8598	6235	607	350	34436
	1996-97	14563	8286	12705	7561	1769	681	45565
IX Plan	1997-98	20097	9559	19633	9780	5161	1195	65425
	1999-99	25060	11344	24790	11350	7117	1331	80992
	1999-00	27889	12402	33479	13666	12780	2714	102930
	2000-01	25856	13640	30881	14560	15550	2787	103274
	2001-02	26471	13331	31641	13874	20090	2628	108035

NATIONAL REPORT OF TURKEY

A. COMPUTER ASSISTED INSTRUCTION AND COMPUTER EDUCATION IN TURKISH EDUCATIONAL SYSTEM

The educational systems worldwide have been trying to integrate the use of computers into their educational systems during this decade. Computer Assisted Instruction has become one of the most important issues in educational systems all over the world. The modern age requires individuals who not only know basic skills of writing, reading and arithmetic, it also needs individuals who can use computers. These individuals should be able to state a hypothesis, make observations, collect and analyze data and make conclusions. Therefore the new skills required from individuals became the knowledge and usage of computer technology in solving problems. Computer assisted instruction is the most important tool which provides technology society relationship. Therefore computer assisted instruction and computer education should be a major issue of our educational system to raise individuals who have knowledge of computer technology. In Turkey, the first studies using computer aided instruction and computer education started in 1984 when 1100 microcomputers for high schools, and 1111 computers, in 1985-86 where purchased. In this project each school had one teacher computer that is a server and 10 student computers which were clients. Two teachers from each school were selected and trained on computer literacy at in-service training courses.

The studies on the improvement of the computerisation rate of the schools have been performed with projects developed by the Ministry of National Education (MONE) With the signed agreement between the World Bank and our government, the General Directorate of Computer Education and Services (BILGEM) executes, the CES (Computer Experimental Schools) Project which is a part of the National Educational Improvement Project which started 1990. The main purpose of the CES project is the improvement and widespread use of the Computer Assisted Instruction and Computer Education. The other purposes of the project. are:

- To identify the role and appropriate usage of computers in our educational system;
- To develop the curriculum for computer education:
- To prepare teacher training plans and programs;
- To determine the educational software criteria;
- To evaluate all computer education and computer assisted instruction studies.

Firstly, the project has been executed at 9th grade of 53 high schools which selected according to criteria developed by MONE and the World Bank. While spreading the project across the country, Turkey will benefit by saving time and thereby helping economy. According to the project application, 53 CES laboratories were provided with furniture by the schools own resources according to the physical environment standards developed before. One of the most important items to apply the project continuously and periodically is to train course and formators teachers in computer literacy and computer assisted instruction. The course teachers, formators and administrators were trained in computer education and computer assisted instruction by BILGEM. According to the needs, new seminars and course programmes will continue in the future.

I . THE CURRENT CONDITIONS OF HARDWARE AND SOFTWARE

1. The Current Conditions of Hardware in School

According to the questionnaire which was made to assess the current conditions of schools on computer hardware, software and trained personnel at December 1996, the following was ascertained:

The total number of computers in Turkey

Number of computers	22.476
Number of Laboratories	1.769
Number of computers in laboratories	17.680
Number of computers outside of laboratories	4.796

The spread of the total numbers according to groups

Number of computers in primary schools	2.064
Number of computers in high schools	7.947
Number of computers in vocational high schools for boys	6.832
Number of computers in vocational high schools for girls	1.130
Number of computers in commerce and tourism vocational high high schools	3.152
Number of computers in religion high schools	767
Number of computers in non-formal educational schools	570
Number of computers in schools for handicapped	14

2. The Current Conditions of Courseware in Schools:

A considerable amount of courseware has been prepared by the Ministry of National, including 135 pieces of courseware which are destined for the vocational high schools. In addition to what was accorded to the National Educational Improvement Project agreement, signed between our government and the World Bank, the necessary computers and courseware were bought for 53 CES. These are courseware (science, mathematics, English, educational games, and electronic encyclopedia) and application software (word processor, spreadsheet, and database). These software are in English and an eventual translation of them into Turkish is being studied.

II . STANDARDISATION POLICIES

Studies about the hardware standardisation have been performed. The standard aims at computer laboratories which are 10+1 or 20+1 in schools with 400 students. 5+1 laboratory standard was determined for the primary schools with 200 students.

In establishing the courseware standards, the experience of other countries in computer assisted instruction have been followed. A variety of standards have been used according to the type of courseware and instructional design.

III. THE FACTORS THAT PREVENT THE USE OF NEW TECHNOLOGIES IN EDUCATION

1. Trained Personnel

According to a level assessment examination performed in schools, teachers are selected and trained in universities as formator teachers. These teachers are trained in computer literacy, computer programming and computer maintenance. There are 702 formator teachers existing in Turkey. The main aim is a formator teacher for each school that has a computer laboratory. In addition, to training the administrators on the new technologies used in education, in service training programme were conducted. Many courses and seminars at different levels on computer assisted instruction and computer education were conducted for school administrators, ministry inspectors, and primary school inspectors. There is a need for more trained personnel Also, there is a problem to keep these trained teachers at the places where they carry out their functions.

2. Hardware Condition

Since the number of students in schools is high, there is a need for more hardware to widespread the use of technology in education.

IV. THE INTERNATIONAL PARTICIPATION ON THE USE OF NEW INFORMATION TECHNOLOGIES AND THE ADVANTAGES GAINED BY THIS WAY

Every year, 2 or 3 persons from MONE participate in the MED-CAMPUS that is performed with the support of MONE. Knowledge learned there is explained to other personnel at MONE. By participating in this seminar, new technologies in the world are followed, new technologies and methods are gained on the appropriate use of information technology and development of thinking tools. There is no other participation excluding this one. The participation to this kind of international seminars on the use of technology will provide great benefits to MONE.

B. THE ACTIVITIES OF THE MINISTRY ON THE USE OF NEW INFORMATION TECHNOLOGIES AND THE ADVANTAGES GAINED IN THIS WAY

I. THE IDEA BEHIND THE DEVELOPMENT OF MEBSIS PROJECT

After the completion of the Ministry of National Education Integrated Management Information System (MEBSIS) and especially Provincial Directorates System (ILSIS) subsystem, the flow of the reliable and accurate information between Provincial Directorates and central units of the Ministry would be provided with exact time and in detail, in needed periods and in a financially feasible manner. As a result, the information provided by the system will play a major role on implementation of education policies and development of middle-run and long-run strategies of the Ministry.

II. EXISTING SITUATION WITH HARDWARE AND SOFTWARE

I. Existing hardware used in the MEBSIS project

There is a total of 7 servers which are operational and in use in BILGEM. These are the Two Data General MV9500 and MV1OOOO, two Data General Aviion 5500 and Aviion 8500 which are located in the central building of the Ministry, one Data General Aviion 4300 located in the Balgat Building of the Ministry. In addition to this hardware there are two-more servers, which are Data General SMP 4000, procured in 1995 and located in the central building.

Data general MV1OOOO system (having the following configuration: 8 MB main memory, four disk units each having 592 MB disk capacity, one line printer with a capacity of 1200 lpm and one tape drive) is being-used-in BUTSIS project with 15 dump terminals and 1 dot matrix printer.

Data general MV9500 system (having the following configuration: 33 MB main memory, four disk units each having 592 MB disk capacity, 1 line printer with a capacity of 1200 lpm and 1 tape drive) is being used by many of the directorates including personnel, research and planning directorates.

Data General Aviion 4300 system (having the following configuration: 32 MB main memory, 1 GB disk capacity, 2 terminals and 1 tape drive) is planned to be used as the development platform for the ORACLE based applications.

Data General Aviion 5500 system (having the following configuration: 32 MB main memory, 1 GB disk capacity, 1 CD-ROM drive, 12 dump terminals, 4 dot matrix printers and one 2 GB capacity tape drive) is being used in the YOSIS project.

Data General Aviion 8500 system (having the following configuration: dual M8810 processors. 250 MB main memory, 2x3 =6 GB disk capacity, 2 line printers with a capacity of 1200 lpm and two 2 GB capacity tape drives) is being used in PERSIS project with 7 dot matrix printers and 64 dump terminals. In 1995, the upgrade of this system was completed and 30 dump terminals was procured.

Two SMP 4000 servers and I line printer were procured in 1995 to run the BUTSIS and IMISIS software which were completed before. The transition of the BUTSIS and IMISIS software is about to be completed.

Besides, there are more than 100 486 based PC having different brand names and models. These computers are dedicated to be used in office automation, software development and training fields.

2. Existing software used in MEBSIS Project

Below are the modules of the MEBSIS project and the tools used to develop them.

- Personnel System (PERSIS) were developed using COBOL, SQL*Forms and SQL*Reportwriter and ORACLE RDBMS;
- Budget System (BUTSIS) was developed using COBOL and DG/SQL DBMS in AOS/VS operating system;
- DONERSIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS in MS-DOS operating system;
- Higher Education System (YOSIS) was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS;
- IMISIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS;
- SOISIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDEMS;
- DISIS software was developed using SQL*Forms, SQL*Reportwriter and ORACLE RDBMS.

3. Existing Operating Systems

The following are the operating systems of the various hardware platforms used in office automation, software development, running MEBSIS software and training:

-Unix-AOS/VS-DOS -

Besides, there are Windows based products such as Lotus Notes and other office automation tools being used in the Ministry.

4.Provincial Directorates System (ILSIS) activities which have been developing in the score of National Education Development Project (NEDP)

Our Ministries Integrated Management Information System (MEBSIS) takes part in the scope of National Education Development Project (NEDP) which came into effect after Loan Agreement signed between our Government and the World Bank. Ministries activities in the scope of the project have been carried out by Bilgi Islem Daire Baskanligi which is in the structure of Bilgisayar Egitimi ve Hizmetlen Genel Mьdьrlьgь in connection with the Management Information System (MIS) project. In this respect, the highest priority of the subsystems that is thought to be developed in the scope of MEBSIS is given to the ILSIS and the studies have been speeded up.

ILSIS is planned to be implemented basically in two phases. In, the first phase a pilot is carried out and after the examination of its results, ILSIS, of the pilot application, in the second phase will be expanded to whole country. Pilot application will be implemented in Ankara, Cankiri, Cankaya and Polath provincial directorates of our Ministry. These provincial directorates' interconnection is on center-city administrative district basis. The provincial directorates which will be connected to the existing computer systems in our Ministry for the integration of this system with MEBSIS and its subsystems.

III. STANDARDIZATION POLICIES RELATED TO MEBSIS

The computer systems that have been acquired in the scope of Ministry of National Education MEBSIS project are Unix based open systems. Spreadsheet and word processor applications are Windows based.

IV. THE FACTORS THAT PREVENTS USING NEW TECHNOLOGIES ON MEBSIS

Because of the characteristics of services provided, and costly projects carried out by our General Directorate, the needed high quality personnel cannot be employed. Also it is hard to have such high quality personnel available.

C. MEDIA AND OTHER TECHNOLOGIES IN TURKISH EDUCATIONAL SYSTEM

Use of media in education in Turkey has a special place in non-formal education, whereby the aim of the use of media is generally to support formal education and produce audio-visual instructional materials for the schools in Turkey.

Besides the production of video-cassettes to increase the effectiveness of teachers in the classrooms, there are also some distance education applications.

Developments in education technologies in the world has accelerated with regard to both classroom instruction and distance education. There has been a considerable awareness concerning interactive teleconference activities, multimedia programmes and other similar electronic instruction environments.

D. DISTANCE EDUCATION

Two major distance education applications in Turkey are that of The Anadolu University Open Faculty and The Open High School. In 1995, while the Open Faculty served 711.271 students at university level, the Open High School served 71.309 students at high school level.

Anadolu University Open Faculty provides instruction both through television broadcasts and face to face courses.

Programmes produced by the Anadolu University have been broadcast on TRT's Channel 4, and the evaluation made by the University. Also some written materials such as textbooks and guide books prepared for the Open Faculty students, are part of the instruction. The University also provides courses at undergraduate and pre-undergraduate levels to the Turkish citizens living in Western Europe and the Northern Cyprus Turkish Republic.

Open High School is another distance education institution which was established in 1992. High school curricula used in formal schooling are written in scenario formats for television and radio and are broadcast on TRT's Radio 1, channel TV 2 and TV 4. There are also textbooks and guide books prepared by the Open High School to support the schooling. General student evaluation is done by the Computer Education General Directorate (BILGEM).

The total number of students receiving instruction through distance education at high school and university level is about 60% of the total.

E. EDUCATIONAL PROGRAMMES IN VARIOUS AREAS

Film Radio Television Education Directorate (FRTED), one of the attached units of the Turkish Ministry of Education, provides educational films, video cassettes and slides to countryside schools. This kind of documentaries, cartoons and other programmes produced by The FRTED are broadcast by the TRT.

FRTED has a very rich collection of both television and radio programmes. Today, it is possible to perform an educational programme from the pre-school ages to adult levels using the productions of FRTED.

F. INTERACTIVITY IN DISTANCE EDUCATION AND EXISTING SITUATION IN TURKEY WITH RESPECT TO DEVELOPING TECHNOLOGIES

Neither of the distance education applications of the Anadolu University and the Open High School have an infrastructure for electronical interactivity. Students, in existing systems, can contribute to the educational process only by interacting through mailing.

The Ministry of Education sees interactive technologies as an effective tool to overcome the handicap of "passive students". The activities scheduled as a short term plans of the Open High School towards establishing an effective interactivity are as follows:

1. To establish telephone lines for students to ask questions and have contact with theteachers;
2. To design a question bank program and broadcast it on teletex system.

In the long term:

1. T o assign one or two schools as pilot studies for the electronical classroom project that has been studied for a while by the FRTED and start its application soon;
2. To connect FRTED with a fiber optic line to the TRT which is already connected to the TURKSAT (Turkish Satellite) to extend pilot school broadcasts to the periphery schools;
3. To make FRTED a broadcasting institution and to provide necessary teacher hardware to insert any supportive materials into his/her lecture during the broadcast.

G. THE BARRIERS IN FRONT OF THE EDUCATIONAL TECHNOLOGY IN TURKEY

1. LACK OF TRAINED PERSONNEL

Educational Technology has a tendency to spread out depending on the developments in communication technologies. Therefore, there is a need for an information transfer from the Universities to the institutions serving in the field. New systems should be developed for better transformation of audio-visual and written data, and the applications in the field should follow it simultaneously. Although our country is very close to the Western Countries with regard to the use of telecommunication technologies, it is hard to say the same thing for educational technologies.

The lack of production and investment in this branch of technology brings a lack of personnel in the same area. It is known that some educational technology courses are offered in the related departments of educational faculties. But yet they are not sufficient to meet the requirements of technologic reforms that the Turkish Educational System puts forward.

2. KNOWLEDGE AND SKILLS OF TEACHERS ON NEW TECHNOLOGIES

The developments in educational technologies have been pushing teachers to employ different materials in his/her lecture. This is so especially in the field of distance education. Today, a teacher in front of the camera, is sufficient to some extent simply because he is not on live broadcast and there is no any interactivity. However, with the integration of interactivity to the existing system, teachers will be teaching on live broadcast by using different equipment. This requires a new approach in teacher training. No concrete step about this issue has yet been achieved. Teacher in the formal education is yet far away from the new technologies.

The other problem is the distance between teacher and new technologies. Multimedia technology has not been used in country schools yet. And also there is no teacher training programmes towards multimedia literacy.

3. DIFFICULTY IN RECEIVING THE OPEN HIGH SCHOOL PROGRAMS

Open High School television programmes are broadcast on TRT's channel TV 4. The broadcast is sent through TURKSAT and received by the TV Receive. Only Receivers and further sent via the VHF/UEF TV transmitters to the homes. However, in existing systems, some parts of the country can not receive the programmes. There needs to be some technical innovations for a solution of the problem.

PRESENTED BY
THE MINISTRY OF NATIONAL EDUCATION OF TURKEY

NATIONAL REPORT OF UGANDA

1. INTRODUCTION

During 1992 the National IIP Committee implemented a UNESCO funded project "Sensitisation and Training in Informatics of Decision Makers, Informatics Specialists and Trainers". The project involved seminars that attracted participants from managers in private and public institutions, teachers in schools, colleges and universities.

It was a very successful project that led to a blossoming of interest in informatics and the use of computers. As a result there is now a fast growing acquisition of computers with several new firms having been set to market the new technologies of computer hardware and software. Parallel to the UNESCO project the Institute of Computer Science (ICS), Makerere University, which serves as the focal point for the UNESCO IIP, introduced e-mail into the country for the funded project, the first time through an IDRC (of Canada) funded project, the East and Southern African Network, ESANET that involved the five universities of Makerere University, Nairobi University, University of Zimbabwe, Gambia University and Malawi University. This was also a very successful project which gave birth to the use of e-mail leading to the present fast growing interest in e-mail with ICS serving as a node for many users. Firms have now been set up to provide international e-mail connections (INTERNET) to users. ICS itself is completing the installation of an INTERNET connection which is planned to serve tertiary colleges and national research centres.

2. NEW TECHNOLOGIES IN EDUCATION

Makerere University through its Institute of Computer Science has spearheaded the introduction of new technologies. Teachers in schools and colleges have been sensitised in the use of computers in workshops and seminars. There is an upward trend of computers being introduced in schools, colleges and universities. Although a recent education review commission highlights the importance of computer science in education there is yet no well articulated programme of curricula for introducing new technologies in informatics into the levels of primary, secondary, college and university education. Makerere University on its own has introduced training for a Postgraduate Diploma in computer Science and undergraduate courses in Computer Science. It is also planned that M.Sc. courses in Computer Science be established.

Apart from absence of a formal programme of curricula for informatics there is need to establish training of teachers and other staff that would engage in the teaching of the subject in schools and colleges. This should be done in the teacher training colleges and colleges of technology. However, there has been a modest beginning on this training at the Institute of Teacher Education, Kyambogo (ITEK) and at the Uganda Polytechnic, Kyambogo (UPK). The main constraints faced by these colleges is lack of adequate hardware and software to cope with the number of students they have.

Further when the products of these colleges go to schools they find them unprepared to offer courses in computer science for lack of equipment.

At ICS an attempt has been made to bridge the gaps in training by offering short-term course that have become popular to a wide cross-section of users ranging from school students to employees in public and private institutions. It should be noted that there are other private organisations which also offer similar short-term training.

In order to ensure protection to clients there is need to monitor what is being offered in these courses .This monitoring role could be taken up by the national IIP committee together with the education authorities and the Uganda Computer Society.

The present Uganda industrial sector does not yet have intensive use of computers although interest in this is growing. It is mainly banks and insurance companies that have gone ahead in involving computers in their operations. Some of these institutions have their own in-house training.

3. NATIONAL POLICY

After the initiatives by the Uganda Computer Society and the national IIP committee proposals for a national policy for informatics and computer science have been made. These were eventually incorporated into the proposals for a national Science and Technology (ST) policy and submitted by the Uganda National Council for Science and Technology (UNCST) to government for approval. UNCST is a legal body set up by government to oversee and promote research in and implementation of ST for development. It is therefore expected that the government will arrange to have an ST policy approved based on the submission by UNCST. The policy proposals for informatics encompass the issues of:

Taxation, where the taxes on computer equipment should be low enough to encourage acquisition of the equipment.

Training requiring the establishment of a formal introduction of teaching computer science at all levels of education with accompanying provision of curricula and arrangements for acquisition of equipment.

Standardisation with an establishment of a regulatory body to oversee the acquisition of equipment with the purpose of ensuring quality for customers and standardisation where possible.

Promoting the introduction of IT in industry, commerce and trade.

4. PARTICIPATION IN INTERNATIONAL PROGRAMME

The Institute of Computer Science being a focal point for UNESCO IIP is participating in the UNESCO Regional Informatics Network for Africa (RINAF). The aim of the project is to establish a national e-mail network which would be linked to a regional network and eventually provide an INTERNET connection.

This project is at an advanced stage with equipment acquired and training provided to users at selected points in the country. The value of RINAF is that African countries would be connected thereby offer an opportunity to benefit them from each others experiences in research and development which are at similar stages in these countries. The Institute of Computer Science (ICS) in collaboration with the University of Bergen Norway is to develop post-graduate training at M.Sc. and Ph.D. level in Computer Science. It is also envisaged that ICS should develop into a regional centre for training in Computer Science and telematics.

These programmes at ICS will greatly benefit in producing the manpower required to promote the New Technologies in the country and the region.

PRESENTED BY

PROF. P.E. MUGAMBI
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NATIONAL REPORT OF UKRAINE

EDUCATIONAL AND INFORMATICS IN UKRAINE: POLICY AND NEW TECHNOLOGIES

1. INTRODUCTION

Application of computers in education in Ukraine has deep traditions. As early as in 60s together with introduction of specialities "Programming" and "Computers" in universities of Ukraine, in Kiev Polytechnic Institute, Institute of Cybernetics of the Ukrainian Academy of Sciences, L'viv Polytechnic institute, Simferopol and Kiev Universities, in some military universities computers have been used for tutoring and student knowledge testing.

From 1986 informatics became an obligatory course for secondary schools and state programs of computers introduction in educational system of Ukraine, aimed at computer literacy achievement and education quality improvement. have been started. As well as in other countries, at the end of 80-s in many universities and secondary schools of Ukraine an activity aimed at creation and application of information technologies (IT) in education was held mostly by teachers-enthusiasts. A spectrum of these activities was quite wide, comprising nearly all levels of education, many subjects and didactic functions of tutoring programs. At the beginning of 90s tens and hundreds of thousands of specialists were involved in research, creation and application of IT in education due to decreasing of computers' cost. and some achievements in carrying out programs aimed at computerisation of education.

Above-mentioned steps allowed to achieve certain restricted goals in computerisation of education, including improvement of computer literacy, introduction of informatics in secondary schools, embedded training at. working places, which in its turn opened the way to solve such problems as:

- Individualisation of instruction as a technique for developing student's creative abilities.
- Training in cooperative skills using telecommunication means.
- Building interrelations between training, professional work and research activity.
- Humanitarisation of public and vocational education, etc.

What is going on in Ukraine now in the field of education and informatics? To answer this question, we suggest a short description of a genera] situation in Ukraine.

2. THE MAIN DIRECTIONS OF SOCIAL AND ECONOMIC REFORMS IN UKRAINE

It looks like a paradox, but together with a legal act of great historical importance - obtaining a state independence by Ukraine in August of 1991, the state found itself in a hard situation of economic disorder. As a result, the volume of gross revenue has been shortened in 2.3 times, industries output - twice, agricultural production - by one third. Income of citizens has been decreased up to 19% from the level of 1991 (Lukinov, 1996).

Despite difficult economic situation Ukraine still is a country with developed industrial and agricultural infrastructure (see Appendix 1) and rather qualified personnel, education and training of which is supported by powerful educational system (see Appendix 2). Programs aimed at going out of economical crisis are developed and carrying out now, which should support formation of unite a new market model, including (Lukinov, 199f); Marchuk, 1996):

- System of macroeconomics and economic control, financial and credit regulation in strict legal framework and free market conjuncture.
- Preservation of existent industrial and technological basis.
- Achievements of scientific and industrial progress and existing intelligent potential together with attraction of foreign technologies.
- Mutually profitable and parity relations in

world community with definition of own niche in the international markets.

- Social orientation of economic development.

With industrial and agricultural output in Ukrainian export, an important place must occupy an intelligent production as licenses on new techniques, technologies and materials. Import in its turn should be directed at acceleration of scientific and industrial progress and at accelerated increasing of production of own goods, food, home devices etc.

3. PECULIARITY OF INFORMATIZATION OF EDUCATION IN UKRAINE

In spite of the efforts of society and state executive authorities the system of education in Ukraine is at. present in deep crisis (Kuchma, 1995). Financing is extremely low. Withdrawal of teachers and educational specialists is taking place. Among students the intention to obtain fundamental education is going down, requirements to the level of training and common culture have decreased. Textbooks, manuals and didactic means supply is quite insufficient, the gap between leading educational establishments and peripheral ones are increasing. For example, in the last. 6 years the amount of new computers installed in secondary school per year has decreased (table 1).

Table 1

Dynamics of equipping Ukrainian secondary schools by computer classes

Year	Number of computer classes installed	Number of computers installed	Level of computerisation %
1991	148	1628	27,7
1992	464	5082	30,5
1993	141	1776	32,0
1994	92	1104	32,8
1995	68	882	33,1
1996 (01.04)	18	216	33,2

Today only one third of Ukrainian secondary schools are equipped with computer classes, and one computer workstation is shared by mere than 70 students (table 2).

Table 2

Computers in Ukrainian secondary schools

	Total	Including schools		Cities	Including schools		Villages	Including schools	
		I stage	II stage		I stage	II stage		I stage	II stage
Number of Schools equipped with Computer classes	7185	160	7025	3752	54	3698	3433	106	3327
Number of Schools equipped with Computer working places	94623	1461	93162	55206	1245	53961	39417	1004	38413

The situation in Ukraine as to equipment of higher educational institutions with computers and implementation of information technologies is shown in tables 3 and 4.

Table 3

Computers higher in educational institutions of Ukraine

	Total	Including those with processor				Including			
		286	386	486	Pentium	classic universities	technical and trade universities	academies	institutes
Number of computer working places	35527	10658	9592	2102	113	4456	13288	7424	10359

Table 4

The number of computers per 100 full-time students at Ukrainian higher educational institutions

Groups of educational institutions	classic univer-sities	technical univer-sities	machine building	metallurgy and mining	technolo-gical	trans-portation	economy	construction	pedago-gical
Number of PCs per 100 full-time students	6,45	9,05	10,32	7,22	6,02	7,09	8,48	7,46	3,23

Despite weak, in general, development of telecommunication and computer infrastructure of Ukraine, leading educational institutions successfully solve tasks of informatization of education (Dovgiallo, 1993; Bykov et al, 1993; Gritsenko et al, 1993; Gritsenko et al, 1995) that are typical for developed countries (see i.e. Levrat, 1992).

From previous analysis and information on Figure I we can derive that:

From the point of view of information technologies in education Ukraine is neither developing nor developed country: it is a country in transition that needs:

- to develop the infrastructure of communication and information technologies;
- to support and develop existing intellectual resources and to become integrated in world-wide educational and information society.

4. PRIORITIES OF IMPLEMENTING OF INFORMATION TECHNOLOGIES IN EDUCATION IN UKRAINE

The Ukrainian state needs the rapid evolution of content, methods and means of public and vocational education to the level of international standards (Zgurovsky, 1996). Ministry of Education of Ukraine and National academy of sciences of Ukraine have prepared a conception of implementing informational technologies in education that is a part of the National Programme for Informatisation of Ukraine. Let us describe main ideas of the conception:

Idea 1

"Education & Informatics" in Ukraine is considered as an important component of the general process of Ukrainian society informatisation. The Cabinet of Ministers of Ukraine approved main directions of National Programme of Informatisation of Ukraine that plan to create in near future competitive computer industry and to reach relevant telecommunication infrastructure in Ukraine.

Idea 2

The goal of informatization of education in Ukraine is to increase the effectiveness of teaching and learning processes by expanding volumes of information to be learned and improving methods of representing and transforming of this information both for professional, educational and home usage.

The process of informatization will require training of teachers and students to effectively use modern informational technologies and to understand corresponding international standards. For this purpose a system of individual education based on intelligent tutoring systems and distance learning technologies will be created.

Idea 3

Ukrainian informatization Programme (see Figure 2) is considered as a system of interrelated results, resources and jobs. Axes A and B represent infrastructure of Ukrainian "Education and Informatics" and axis C describes expected results.

As a general result, in the field of education the saturation of educational establishments with modern computer, communication and IT facilities will occur. These events will lead to deep changes and intensification of training in all subject areas. Networks of educational knowledge and data bases, local and international, as well as access facility to state and foreign academic data and knowledge bases will be disseminated; computer-based didactic laboratories for training teachers of new generation will be organized in many educational and research establishments.

5. TELECOMMUNICATION AND INFORMATION TECHNOLOGIES FOR EDUCATION

Today in Ukraine there are several distributed commercial networks such as FidoNet, Relcom, GlasNet connected to the Internet. There is a comparatively well developed UUPC network which provides e-mail services on the commercial basis. UUPC network is originally the part of Russian RELCOM network. It charges equally commercial, educational and academic users and provides the service which does not match the international standards due to long delivery time (up to 10 hours on average). The main drawback is the use of extremely unreliable public telephone network as the basis for communication. Ukrainian IP academic and research network (UarNet) was started in 1994 (Saban, 1994) due to urgent need of the research and academic community. It is intended to provide services to universities and other higher educational institutions, libraries, museums, non-government funds and organisations. The main objective of the initial development stage is to establish the wide area backbone connecting the main cites in different regions of Ukraine .

The governmental funding for UarNet is under discussion. The UarNet has to become self funding network and nodes will be charged according to the bandwidth they request. State Innovation Fund, Ministry of Education and Academy of Sciences are most important among government institutions able to provide internal funding for the network. The expenses for international connectivity and networking hardware cannot be covered at present, without international support. The initial development stage of UarNet has also been supported by international projects. International Renaissance Foundation has provided seed funding for international Lviv-Warsaw link. United Nation Project has provided some funding for a separate satellite link for Ukraine. International Soros Science Foundation funds a project aimed to develop modern telecommunication infrastructure for several leading academic centres of the former Soviet Union. Kiev Base Computer Network with the links to leading Kiev universities and research centres is Ukrainian part of this project.

The first experience with educational networking has been obtained during IBM "Pilot Schools" program for the Former Soviet Union countries, in which 150 Ukrainian Schools were participated. These schools took part in HELLO and RAINS projects which included exchange of letters and e-mail communications (through UUCP) between Ukrainian and European participants.

Since 1992 research group at Glushkov Institute of Cybernetics and Kiev Polytechnic Institute investigate the possibility to apply telecommunication networking for Ukrainian educational system needs. This research shows that in comparison with developed countries Ukraine has poorly developed telecommunication infrastructure. The most of computers in educational institutions arc IBM PCs running DOS operating system. The others computers like SUN, DEC, Mackintosh may be found only at leading universities. Analysis of necessary personnel skills points on the lack of UNIX and TCP/IP experience at many of Ukrainian schools and universities. Educational networking in Ukraine takes its the first steps. It is presented by leading schools and universities FTP and WWW sites: there are only few WWW sites serving mainly as informational tool and FTP sites serving for software exchange. In spite of above constraints Ukraine is *ready* to assimilate modern Western experience in educational networking. Still 82 of Ukrainian educational institutions had in 1995 full Internet access (table 5).

Table 5

The number of higher educational institutions with Internet connection

Universities	Academies	Colleges	Other institutions	Total
48	17	12	5	82

The main goals of Ukrainian educational telecommunication network are:

- Incorporating telecommunication technologies into educational system and Internet literacy for teachers and students.
- Exchange of software and other educational materials.
- Distance education support.
- Professional education in telecommunications.

Experiments show that telecommunication networks provide an excellent possibility for various new forms of education. Computer-based networking bring new learning possibilities in traditional education, either by providing learning to a wide audience at a distance, or by providing new ways of learning in a more flexible and open way. These technologies allow the passage of different media or combination of media (graphics, sound, hypertext) over a distance. Creating open learning environments is a challenge to traditional computer-based learning systems. Distance educational systems are open for participation, time and place independent.

The strategy of Ukrainian telecommunication education network includes:

- government support for main international links;
- developing of regional and local nodes at educational institutions and interconnecting them into overall network;
- development of informational resources for the network.

At present Glushkov Institute of Cybernetics with National Technical University "KPI" start joint project on developing of base node of national educational computer network with links to UarNet and auxiliary nodes at Charkov, Dnipropetrovsk and Sumy.

The next level of education networking is achieved during European Commissions funded Copernicus project: "Flexible and Distance Learning through Telematic Networks". The Project is aimed to developing the infrastructure for distance computer-based education in Ukraine by developing courseware for distance education, and providing Internet links to the leading European research and educational centres. During the project new methods for flexible and distance learning via Internet for individual and group modes will be investigated and applied within the national and international context. Besides Ukraine the participants of the Project are University of Twente, the Netherlands, the Coordinator; University of Exeter, United Kingdom; Kaunas University of Technology, Lithuania; University of Sofia, Bulgaria. The main practical result of the project will be the development and approbation of unique distance 4-monthly course "Using communication technologies in the Internet".

In 1996 International Research and Training Center of Cybernetics UNESCO/IIP at Glushkov Institute together with the Eurasia foundation started organisation of distance training classes in Ukraine. The fulfillment of this initiative will give a possibility for a wide Ukrainian audience to obtain necessary skills and knowledge in the field of communication technologies and will give them an opportunity of direct dialogue through Internet with world community, that will promote further democratisation and reformation of Ukrainian state.

6. INFORMATION TECHNOLOGIES AND TEACHERS TRAINING

The rapid development and implementation of information technologies made a paradox situation in the education: computer, audio and video means for delivering and presenting learning material became really open to general use, but. they couldn't be effectively applied in classrooms because teachers can't manage to master potential possibilities of IT and include them to their didactic repertoire. This situation is common for the most: countries of the world. The same is with the Ukraine.

To introduce computers and IT in schools and higher educational institutions it is necessary to organise appropriate and effective in-service and pro-service teachers training. Simple use of electronic study book and manuals prepared by computer manufactures can't solve the problem: any teacher as the representative of creative profession prefers to use self-made electronic training materials on his/her lessons rather than delivered unified ones. The good compromise here is to give teachers the possibility to adapt unified electronic material into their own version.

Table 6 contains the overview of educational software, being delivered to schools and universities by Ministry of Education of Ukraine.

Table 6

Educational software fund at Ministry of Education of Ukraine

	Total	From general amount, for		From general amount for training								Embedded training
		universities	schools lycees	informatics	chemistry	physics	math	foreign languages	tools	computer-based technologies	modelling	
The number of educational programs	412	214	198	80	58	87	76	22	30	19	18	17

In-service and pro-service teachers training is fulfilled by central and regional institutes and pedagogical universities on the level of initial computer literacy with the support of existing educational software (Table 6).

As to the training of teachers who want to be the authors of courseware there are some institutions, for example Kharkov State Pedagogical University (Kukharenko, 1995) which are involved in development and dissemination of special educational tools (Globus, Scenarium, Lesson, Adonis, Helena) for tutorial scenarium implementation and texts, graphics and multiplication import,. These tools also make analysis of student responses - multiple choice, numerical and textual. With the support of such tools it is possible to organise effective training of courseware authors using the strategy *"From teacher's own educational software to general purpose it".* The next level of teachers-authors training is represented with approach of International Research and Training Center UNESCO/IIP at Glushkov Institute of Cybernetics (Gritsenko et al, 1995). The essence of the approach is to use intelligent tools in support of learning & tutoring activity. Teachers are involved in such kinds of activity (to their choice) as: using an expert systems shell for support of student's learning (Dovgiallo, 1993; Bykov et al, 1993); creating an electronic handbook on computer technologies in education (Gritsenko et. al, 1992), using tools for creating natural language interfaces, hyper/multimedia information systems, learning environments, adaptive CAI systems, etc.

7. CONCLUSION

The implementation and dissemination of IT for the education in Ukraine depends on further World Community help for

- communication and information infrastructure development;
- existing intellectual resources, support.

Now Ukraine has such help from:

- European Communities - Copernicus, Tempus-Tasis, Intas programs.
- Eurasia Fund.
- Soros Science Foundation.
- Canadian, American and European sponsors.

What. kind of Ukrainian impact may be useful for World Community?

This impact include:

- Theory and "know-how" for educational software.
- Intelligent components and tools for educational technologies in traditional and distance case.
- Electronic didactic products.
- Knowledge bases for different subject domains.
- Implementation and delivery of distance education.

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APPENDIX I

UKRAINE

Situated in south-east part of Europe, Ukraine stretches from wide Donetsk virgin lands up to Carpathian mountains, from Polessie up to Black and Azov seas. Its area is 603,7 thousands sq. km. This is the second-largest country of Europe. Its population is close to that of France, and its volume of the gross product - to that of Italy. Population of Ukraine is 52,1 million, the urban population - 68 %, and agricultural - 32 %. Quantity of the inhabitants on 1 sq. km. is 86,3. 46 % of the population of Ukraine are males and 54 % females. The main population of country - Ukrainians - 72 %. In Ukraine live also Russian, Belorussian, Judish, Moldovan, Polish, Bulgarian and representatives of other nationalities. State language is Ukrainian.

In an administrative structure of Ukraine there are Autonomous Republic of Crimea, 24 regions, and two cities of a republican subordination - Kiev and Sevastopol.

Ukraine is president and parliament country. Independence Act was approved by Supreme Soviet of Ukraine on 24th of August 1991 On the 1st of December 1991, 90% of country's population approved their will of independence during national referendum The first President, of Ukraine was L. Kravchuk, the second and current president is L. Kuchma. In total 26 political parties are registered now and multi-parties formation is continuing.

More than 32 million of the citizens of the country have high and professional education (complete and partial).

More than half of population of Ukraine is engaged in a national economy, including in the field of material manufacture - 74 %, and in non-productive sphere - about 26%.

In total volume of manufacture of country the main part is occupied by metallurgy - 21,8%, mechanical engineering and metal-working industry - 19,5 %, fuel industry 14,3 %, food-processing industry - 15,1 %.

Ukraine has a lot of minerals, two large coal-fields, more than 40 oil, 110 gas, and 50 oil-and-gas fields, various metal deposits, etc.

The Ukrainian metallurgical base is represented by ore mining and processing enterprises. The machine-building centre are Kharkov, Lvov, Donetsk, Lugansk, Kramatorsk, Dnepropetrovsk etc. The output electric power station are Zaporozhskaya, Krivorozhskaya, Pridneprovskaya etc. The basis of Ukrainian hydro-electric resources is the Dniper cascade. The biggest nuclear power plants - Chernobylskaya, Rovenskaya, Ylizhno-Ukrainskaya etc. Ukraine has more than 30 % of world black earth supply. More than 30 million of hectares are used.

The agroindustrial complex plays the great role in Ukraine. Here almost all kinds of agriculture food-industry are collected. The main brand of food-industry are sugar industry, meat., milk, salt, canning industry etc. Ukraine has a nice climate and soils for growing various plants, such as wheat, corn, sunflower, flax, buckwheat, oats, etc. There are also a lot of gardens and vineyards. The leading branch is plant-growing. The leading role in stock-raising plays the meat and milk plants and pig-breeding. The sheep-breeding, poultry farmers, fish plants and others are extended.

National Academy of sciences of Ukraine is the supreme research establishment of the country, which organizes and conducts research in the main directions of modern science. 163 research organisations, as well as special design and research enterprises belong to the Academy of sciences. It has 6 research Centers in Ukraine, including South, West, Dniper, South-East, Donetsk and Crimea.

There are about 26 thousand of open libraries containing 420 million of information units.

National Ukrainian culture has deep roots and rich historical traditions, which are developing in modern theatre and cinema, literature, art and architecture.

Museums of Ukraine are world-famous. The most known among them are Kiev-Pechersk Lavra, Sofia Dom, national reservation at Hortitsa island, Perejaslav-Hmelnitsky, as well as Museum of historical treasures, central archive and museum of literature and art etc. Now one can count about 200 state historical, literature, art and local lore museums and more than 6000 amateur museums that are not supported by the state.

APPENDIX 2

THE SYSTEM OF EDUCATION IN UKRAINE

The system of education in Ukraine includes more than 50 thousands establishments - from pro-schools institutions up to establishments for post-graduate's training, with about 15 mln. students and than 1,0 mln. teachers.

In Ukraine there are 23,2 thousands pro-schools establishments, in which 1,9 mln. children are being brought up by 241 thousands educators. There are 21,3 thousands general schools, from them 121 gymnasiums and 124 lycees, where more than 7,0 mln. students are trained and 582 thousands teachers work. The vocational education is represented with 1176 establishments, where 637 thousands students are trained and 60,5 thousands engineers and pedagogues work.

The system of higher education of Ukraine consists of 163 universities, academies and institutes (14 classic universities, 44 technical and branch universities, 29 academies and 76 institutes), 746 technical schools and colleges, 546 establishments for post-graduate training and 123 private educational establishments. In a system of higher education of Ukraine 1,5 min. students are trained, among them 71 thousands students are trained in private bodies. There are 14 thousands post-graduate students and doctorates. In higher educational establishments of III-IV accreditation level there are 78 thousands teachers, among which 57% PhDs, and in schools, colleges and technical schools 51 thousands experienced teachers works.

In the system of Education of Ukraine more than half of research potential of country is concentrated. Tins system provides the education for 176 students on every 10 thousands population and enables to enter the high educational establishments for 35 % school graduates.

PRESENTED BY

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Fig.1. *Ukrainian position in "Education and Informatics"*

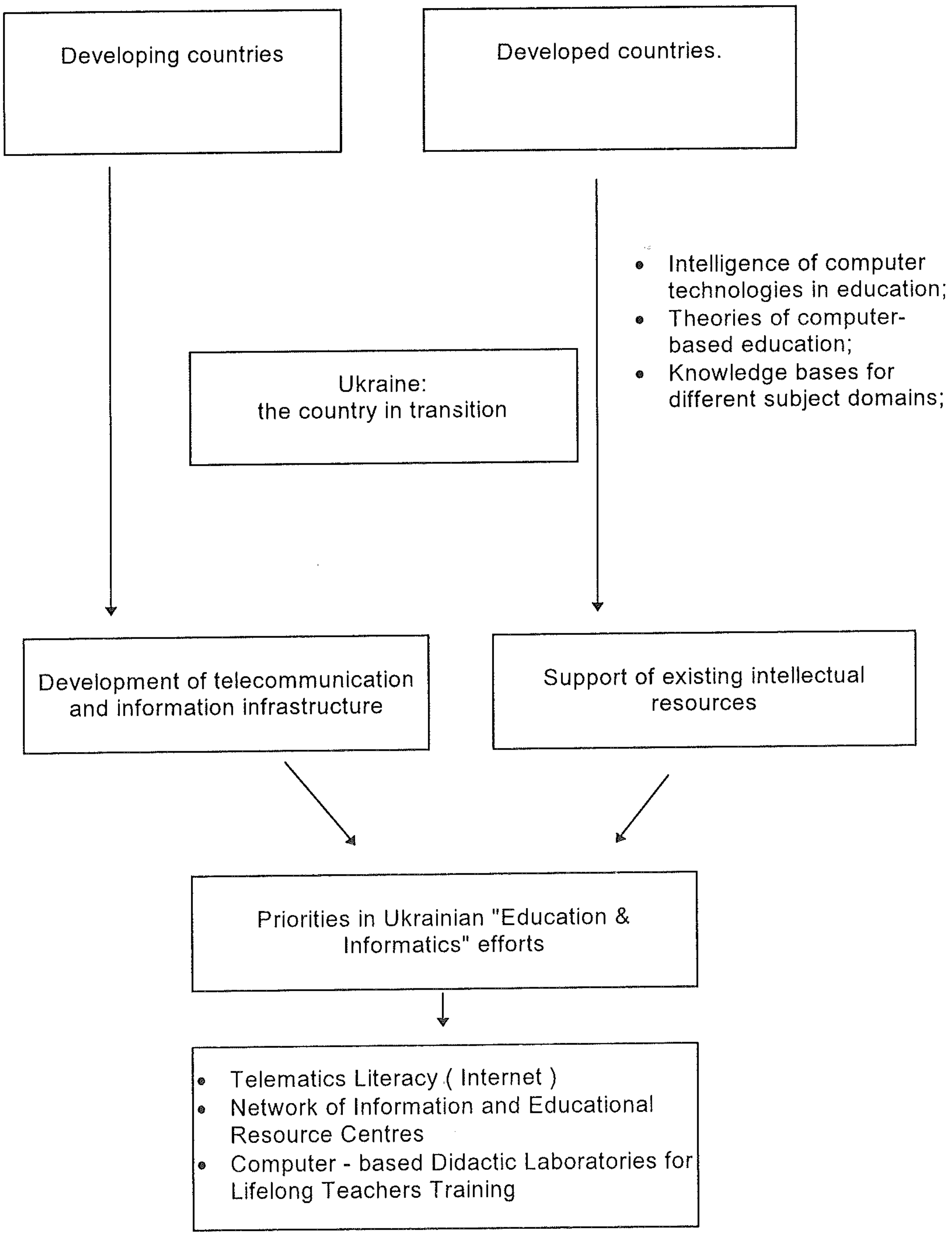
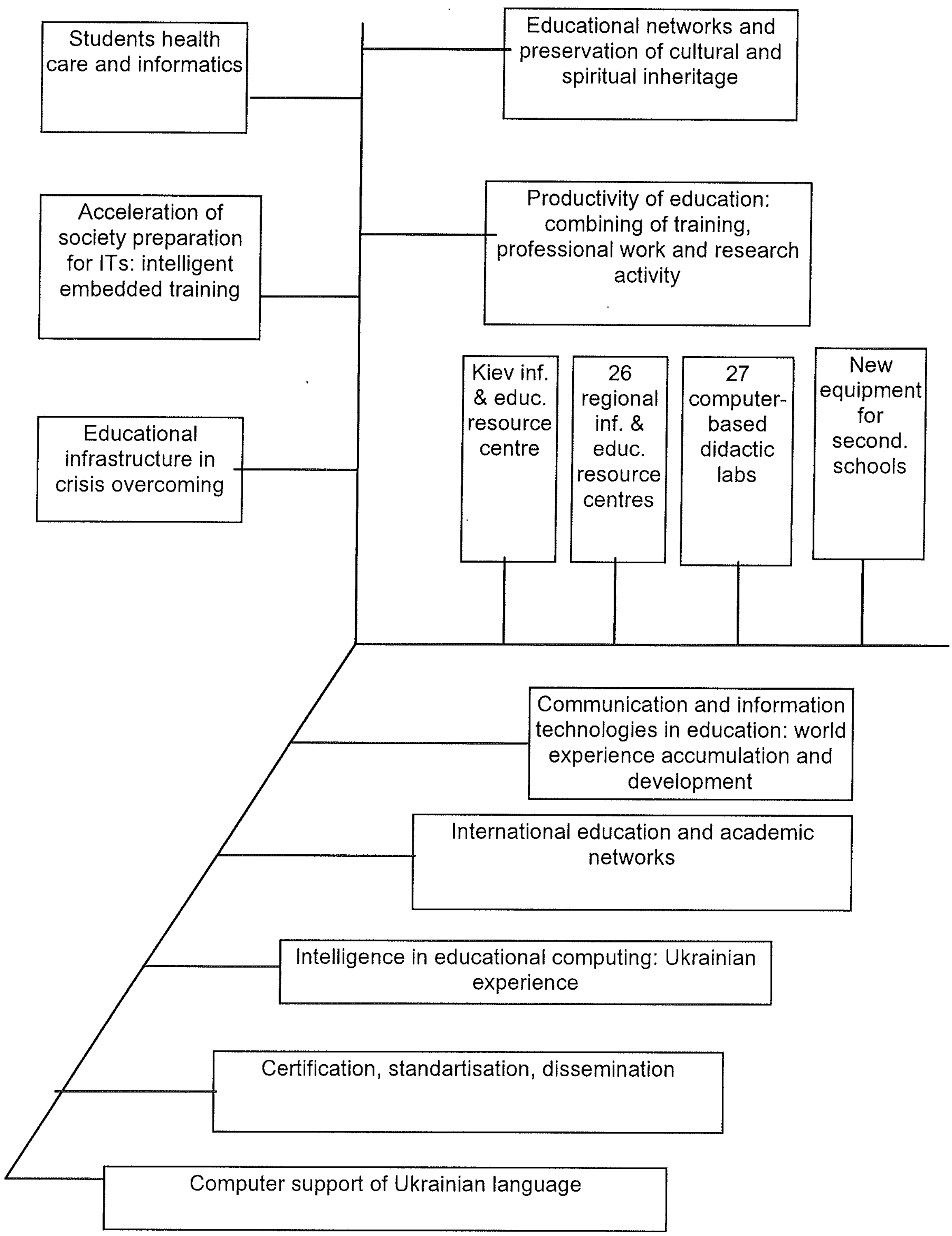


Fig.2. *Basic activities of education informatization in Ukraine*



NATIONAL REPORT OF UZBEKISTAN

DEVELOPMENT AND INTRODUCTION OF NEW INFORMATION TECHNOLOGIES IN EDUCATION

INTRODUCTION

The documents called "Informatization Concept for the Republic of Uzbekistan" and "Informatization Concept for the Ministry of Higher and Vocational Education of the Republic of Uzbekistan", which are based on the analysis of information society development among the leading nations, point out principal features outline main trends of development of informatics in our Republic. They also contain programs intended for step by step realization of these concepts.

Tashkent State Technical University (TGTU, formerly Tashkent Polytechnical College), which has such departments as "Software for Computers and Automated Systems", "Automated Systems for Information Processing and Control", "Computers", and "Radio Engineering and Radio Systems", is the leading college in the Republic to educate specialists in information technologies and telecommunications. TSTU participates in two of the above mentioned programs, i.e. "Mathematical Software" and "Personal computer".

A big team of experienced research scientists and professors works in TSTU and trains professionals in information technologies and telecommunications for all branches of human activity and economy of the Republic.

Graduates of the University have enough experience to use, develop, and introduce software of the following kinds:

- system software (databases, communication control systems, emulators, compilers and programming languages, security systems, operating systems and their extensions).
- general purpose applications (teaching and testing systems, text and word processors, computer graphics, financial programming and analysis, mathematical and statistical software, automating, desktop information systems etc.).
- special applications (banking, investment control, medicine, agriculture).

We are rather users than developers of software of the first group; however, software of the second and third groups created by our specialists can successfully compete in the world market provided that we abide by international standards.

One of the main aims of the program for informatization of education is to introduce new information technologies at all stages of continuous education. To that end, development of theoretical foundations for computer-aided education, automating of education, development of games and business educational programs, development of universal student grading systems are named as the main tasks of the program for informatization of education.

Further on we will speak about research and development of interactive computer systems for testing and grading of students' knowledge that has been done in Tashkent State Technical University for the last 2-3 years.

DEVELOPMENT OF INTERACTIVE TESTING COMPUTER SYSTEMS

The future of independent Uzbekistan depends to a far extent on its scientific potential, which is determined by the education level of university graduates. This is why college education needs further enhancement.

One of the directions of this enhancement is improvement of the student grading system. The government decreed to introduce a multilevel system for testing college students, which (the system) has the following aims:

1. Quick checking of the knowledge level of students.
2. Increasing impartiality of grading.
3. Controlling the educational process.
4. Gradual passage to the rating system.

By a decree by President I.Karimov, since 1993 all college entrance exams are based on multiple-choice testing with subsequent computer processing of the results. It is irrefutable that using multiple-choice tests, which are widely used in many economically developed countries, allows one to impartially check knowledge and professional skills of college students, schoolchildren, and school graduates.

Testing may be used not only in education, but in many other spheres where one has to evaluate skill levels of a person willing to occupy a certain position. Moreover, testing may be used both during the studies and at the exams, which allows to exclude the possible influence of personal factors upon the examination process.

All conventional forms of student grading require much effort and are very time-consuming, which may lead to loss of time required for study. This is why optimal organization of exams using computers is of great value in practice.

TESTING STUDENTS: METHODS AND FORMS

The problem of evaluation knowledge is difficult to formalize. This is why, when using a fully automated testing system, the system itself should be the examiner, while the teacher plays the role of an expert.

There are two directions of research on automated testing:

- development of methods of testing, tests for various subjects and computer processing of the results of test.
- development of automated testing systems to be used both at exams and during the studies.

Let us consider the second direction in more detail.

Earlier, tests used only as auxiliary means of education and knowledge evaluation. Moreover, due to small number of computers available and high price of computer time, the access to computers was quite restricted, so testing with templates had the highest currency. Further on, one started using computers to process template tests.

Nowadays that personal computers are more and more widely spread and the prices of hardware and computer time are continually falling, computer testing has begun to spread more and more widely.

Let us consider these two methods of testing separately.

TESTING WITH TEMPLATES

The test tasks which are handed to the students are written on special cards. Each task consists of questions or simple problems, to which the student should give answers during a definite period of time. When the test is finished, the cards are processed either manually or using a computer.

When using a computer, numbers corresponding to answers chosen may be either scanned by a scanner or entered in a computer manually; after that the computer does the grading and prints out the results. Processing of all the tests is simultaneous and centralized.

The main disadvantage to this method is that processing of the results, i.e. comparing with the pattern, takes much time. The time needed for entering the results of a test on a group of 20-25 students in the computer and subsequent processing of these results is much more than the time required for doing the test itself.

Another drawback of pattern testing is that it requires much effort to prepare cards with questions, and it requires much paper to print them. Summing up, let us list the main features of template testing:

- The testing is performed with the use of template cards with questions and answers.
- The results are processed either manually or with a computer.
- The student knows his/her results not immediately after the test, but only when all the tests have been entered into the computer and processed.

COMPUTER TESTING

When computer testing is used, the person being tested sees the task on the computer display. Together with the task, he/she receives an instruction for entering the answer (with keyboard or mouse). This method is more universal and flexible than the one described above. The task itself may be either a question with a set of answers to choose, or a simple problem. Hence, the testing is performed in the form of a dialogue with computer, with user friendly interface as a rule.

The results of a test may become known either immediately after the student has entered an answer for each task, or when the time for test is up.

Thus, computer testing has the following features:

- The test is performed in the form of a dialogue with computer.
- The dialogue may be realized in the form of a user-friendly interface or in the form of an order.
- The student learns his/her results immediately after the test is finished.
- Modern computers allow much more possibilities to present a task on a display than one has with template testing on cards.

FORMS OF TESTING

Tests give to all the persons being tested equal opportunity to show their psychological features and business or personal qualities. The results of tests are easy to evaluate and to process by computer.

According to the number of persons being tested, tests are divided into individual tests and group tests; according to the form of answers, tests are divided into oral and written; according to the character of mental action tests are divided into verbal and non-verbal.

In a verbal test one is suggested to choose a statement characterizing the extent to which a given property takes place. A variation of the above is possible, where one is suggested to numerically grade this property. Universality, simplicity and efficiency is an advantage of this kind of tests.

Non-verbal tests are used when testing understanding. There are three kinds of such tests:

- Tests for understanding pictures.
- Tests for understanding fictitious situations.
- Tests for understanding written text.

Such tests are used for evaluating individual psychological characteristics of a person.

Most popular are the so called "multiple-choice tests". In these tests one is suggested to choose the correct answer among those given. Sometimes there are only two alternatives: true or false, plus or minus, yes or no. More alternatives are often given, and one is to choose one of the answers (either the only correct one or the best approximation to the truth).

EXISTING AUTOMATED TESTING SYSTEMS: A SURVEY

For the time being, various automated testing systems are used in colleges. To name a few:

- "Autotest" (created at POVTDS department of Tashkent State University).
- "Test" (created in TashGEU)
- The system created in TGTU.

Most of these systems, while differing by presentation of text on the screen, video mode (text or graphics), structure of reports they create and data bases they use, have some common features and drawbacks:

- A unique subject matter is hardwired into the system. This prevents wide usage of a system, since creating tests in new subjects or making alterations in the existing tests require the expertise of a programmer.
- The system is oriented to only one kind of test: either final exams or tests performed during the studies.
- Poor user interface and low level of service.
- The system assumes that only one correct answer for each question is possible, and neither the questions nor the answers are weighted. This feature prevents complete and impartial grading.
- It is impossible to store results of the testing, which prevents statistical processing of the results.
- The set of output forms is restricted, and it is impossible to add new or change existing forms without making changes to the software.
- The system cannot work in both text and graphics mode.

If graphics mode is used, then the system often works only with EGA or VGA adapters, which prevents using CGA or Hercules monitors.

Let us compare testing in text and graphics video modes.

When using text mode, it is difficult to display graphic information, and it is almost impossible to use various fonts and special characters. If graphic information is present in the task, the student has to switch between graphics and text mode, which considerably hampers understanding of the task and complicates dialogue with the student. The advantage of this mode is high speed and simplicity of displaying information, as well as the possibility to quickly scroll the text in case it does not fit in the screen. All these features stem from the fact that text mode is the standard mode for IBM-compatible computers.

If the testing system uses only graphics mode, the information is displayed on the screen much slower (the factor may vary from 2 to 20), and more RAM is required for organization of complex dialogues (because graphics information consumes more memory than text information). The screen area occupied by a raster image depends on the graphics mode used, and the color palette may also change when changing graphics mode. An advantage of graphics mode is the possibility to use various fonts, vector fonts included, and to choose the most appropriate layout for displaying information on the screen.

Thus, there is a need in a new testing system, which would optimally use the advantages of modern hard- and software and would not have the disadvantages of the existing testing systems.

DIAGNOSTICS AND EVALUATION OF STUDENTS KNOWLEDGE

Diagnostics of students' knowledge, that is, evaluation of the results of education, is one of the main aims of tests and exams. It is based upon the information obtained at exams and tests that one gets the data necessary for improving the educational process.

The conventional methods of diagnostics are as follows: oral and written exams, tests, quizzes, questioning, work in laboratories, etc. Multiple choice tests pursue the same aims as the conventional methods.

METHODS OF GRADING

All present methods of evaluation of knowledge are based on rating the students. The conventional rating scale may contain either two ("passed" or "failed") or four ("excellent", "good", "satisfactory, and "bad") grades.

Simple and customary as they are, these conventional methods have some disadvantages.

First disadvantage is subjectivity of evaluation: each teacher evaluates the student according to his/her own criteria.

Second disadvantage of these scales is their low discriminating power: they are not fine enough for entrance exams or evaluation of professional skills.

Scales with at least 5 grades allow one to take into account many parameters determining the level and quality of the student's education. Such scales are most effective when using automated knowledge testing systems.

A classical approach to grading students with the aid of automated systems consists in assigning a definite number of points (a "weight") to each question and computing the total number of points. Two versions of this approach are possible:

Version 1. There is only one correct answer to each question. In this case the computation of the total number of points is very simple: one just adds the ratings (=weights) of individual correct answers; the resulting sum is the rating of the test (note that ratings of different questions may differ).

Version 2. Several correct answers to one question are possible, and one is allowed to choose several answers simultaneously. In this case one adds ratings of individual questions as well, but these ratings are computed as follows:

1. If an answer with zero weight is present among the answers chosen, then the rating of the question is zero.
2. If no zero weight answer is chosen and the total number of chosen answers does not exceed

the number of absolutely correct answers, then the rating of the question equals the sum of weights of the marked answers.

3. If no zero weight answer is marked, but the total number of marked answers is greater than the number of absolutely correct answers, then the rating of the question equals the arithmetic mean of ratings of the marked answers.

It is clear that the first version is a particular case of the second one.

The final grade may coincide with the total number of points, or else it may be obtained from this number by placing it on the grade scale and determining into which interval on this scale it fits.

Our testing system allows one to use all of the described above methods of grading.

FEATURES AND REQUIREMENTS FOR COMPOSING MULTIPLE CHOICE TESTS

The following requirements for composing tests are essential:

- Tests should be highly reliable, economical, easy for usage and computation of the results.
- Prior to testing, a list of qualifying requirements on the subject in question should be composed.
- Test questions should be concrete and unambiguous.
- Test questions may be divided into groups either in the order of increasing difficulty, or according to sections of the course program.
- It is recommended to give 4 or 5 versions of an answer to each question. The number of answers to a question should not exceed 7 so as not to make a task too difficult to understand.
- At least one correct answer should correspond to each question; it is possible to have several correct answers to the same question.
- Each question and each answer should be assigned a number (weight). The weight of a question should correspond to its difficulty, and the weight of an answer should correspond to its correctness. None of the weights of answers to a given question should exceed the weight of the question. All weights should be positive integers.
- Each correct answer is assigned a number of points (the more difficult the question and the more correct the answer, the more points are assigned).

THE UNIVERSAL SYSTEM FOR EVALUATION STUDENTS KNOWLEDGE (UNITEST)

Thus, a necessity in developing of a universal testing system for multistage control of students' knowledge has emerged. The system should be usable with any subject that allows formalization of the course.

The aim of the system is to promptly provide the faculty with reliable information on the knowledge level of students, relieving professors of such tedious and time-consuming work as preparing tests and processing their results.

The possibilities of the system "Unitest" are described below.

The system supports:
- Testing on various subjects.
- Data base of the students participating in the tests.
- Generation and printing of reports.

The system allows:
- To make testing both in text and graphics mode.
- To answer a question once or several times.
- To choose more than one answer to a question.
- To use weights of questions and answers (weight of a questions corresponds to its difficulty, weight of an answer corresponds to its correctness).
- To perform comparative analysis of results achieved during a given period of time (both individually and by a student group as a whole).
- To perform statistical analysis of the answers.
- To edit format of the existing output forms and to create new output forms.

The system has user-friendly interface, highly developed service, and a subsystem of context-oriented help. User interface requires use of a mouse.

The system is portable to a wide variety of MS DOS versions and IBM compatible computers. The system can work in a local network.

The system can work in the following modes, depending on the type of the test:
- Current testing: on finishing a topic or a group of topics.
- Testing at an intermediate stage: on finishing a large group of topics.
- Final testing: on finishing a course.

The lists of questions and the versions of answers are prepared by the faculty. These lists are entered only once, before the testing; later they are saved in the library of questions, which can be edited if necessary.

The lists of student groups are entered once a year, and the lists of students are entered once a semester. It is possible to edit these lists, too.

Main output forms of the test are:
- Test record, which contains results of students' groups at a given test.
- Student's record, which contains results of a given student in a set of tests.
- Statistics of answers.
- Exam sheet of a student.

It is possible to alter the existing output forms and to create new ones.

The system works in a dialogue mode. The structure of the dialogue is determined by a script, which contains menus of functions with comments upon their realization.

The system implies the following division of work among users (i.e. professors and students) and the system itself.

- The professor:
  - decides upon which topic, subject, or to make computer testing;
  - compiles the list of questions with answers (there may be several correct answers to one question);
  - develops the grading scale;
  - organizes and supports the data base.

- The student answers the questions in the "Testing" mode and gets his/her rating.

The system itself is responsible for:

- Input checking of the information entered into computer.
- Generation of files and writing them on disks.
- Arithmetical and logical processing of the information.
- Outputting the data to display and printer.

The system is written using database system FoxPro 2.0.

FUNCTIONAL SCHEME OF THE SYSTEM "UNITEST"

Both the system "Unitest" and its main subsystems have modular structure. This module branched structure adds to flexibility of the system, enlarges the lifetime of the system, and allows one to increase its functionality by adding new modules if necessary.

The system is oriented to testing with "question-answer" scheme.

The system "Unitest" consists of four subsystems:

- Initializing subsystem.
- Testing subsystem.
- Record generating subsystem.
- Administrative subsystem.

The functions of the initializing subsystem are as follows:

- Loading of initial settings of the system.
- Opening databases and checking their integrity.
- Refreshing index files.
- Setting the system date and time.
- Forming the system environment.

The functions of the testing subsystem are as follows:

- Choosing the test.
- Entering the biographical data of the person being tested.
- Testing.
- Processing the results of the test.
- Diagnostics.

Databases of the testing subsystem are created by the administrative subsystem. The module "Choice of a test" chooses the test that will be given to a student. The module "Biographical data input" reads the biographical data of a student from the groups and students databases and processes these data. The module "Testing" forms the tests, permutes questions and answers inside the test (this is done in order to lessen the probability of guessing the correct answer), and performs testing in the text mode. The module "Processing results of testing" computes the ratings according to the algorithms described in the section "Methods of grading" and saves the obtained results in the results database, to be processed further by the record generating subsystem. The module "Diagnostics" displays the results of the test in the screen.

The functions of the recording subsystem are as follows:

- Choice of the form of the record.
- Entering record parameters (the group, the test, date of testing, etc.)
- Generating the record and its output to the screen or printer.

The functions of the administrative subsystem are as follows:

- Creating databases in case they are absent.
- Reindexing databases.
- Supporting the information base of the system (working with students and groups databases, supporting the reference file of tests and the library of questions, forming questions for the text mode).
- Configuring the system environment.
- Copying and recovering databases.
- Encoding databases.
- Configuring, editing, and printing output forms.

INFORMATION PROVISION FOR THE SYSTEM

The system "Unitest" distinguishes three kinds of information: input information, output information, and reference information.

Input information consists of lists of questions and versions of answers to these questions; these are prepared by the faculty.

Output information consists of testing records and statistical information on answers to separate questions.

Reference information consists of students and groups databases.

USING "UNITEST"

The system "Unitest" is intended for multistage evaluation of students' knowledge (current, intermediate, and final testing). It can be used with any subject that allows formalization of the course.

"Unitest" supports:

- Testing on various subjects.
- Supporting database of the students participating in the tests.
- Generation and printing of reports.
- Multistage evaluation of knowledge.

"Unitest" allows:

- To choose both one and several answers to a question.
- To answer a question once or several times.
- To assign weights to answers and questions.
- To attach up to 7 versions of an answer to a single question.
- To place the versions of an answer in a random order.
- To keep an unlimited number of tests in the system.
- To choose at random any number of questions for a test form the library of questions. The number of sections of the library of questions from

which the questions are chosen should not exceed 100; however, the total number of sections in the library and the total number of questions in a test are unlimited.

- To perform a comparative analysis of progress of a student or a group as a whole during a given period of time.
- To print out questions and answers to them.
- To copy and restore data.
- To make testing both on separate computers and in a local network.
- To exchange data between different computers.
- To merge testing results obtained on different computers.
- To perform testing in the text mode.
- To use various mathematical symbols, Greek letters and pseudographics symbols in questions and answers of the test.
- To enter questions and answers of arbitrary size. If a task does not fit on the screen, it may be scrolled.
- To set up to 50 intervals in the grading scale.
- To enlarge the number and complexity of checking parameters without much difficulty.

"Unitest" has:

- A very user friendly interface and well developed service.
- The possibility of changing system settings (color palette, sounds, etc.) according to the needs of a user.
- A powerful context-oriented help subsystem, which will help you in any situation.
- A built-in calculator, which supports, besides standard arithmetical operations, such functions as square root, trigonometric functions, logarithms (decimal, binary, and natural), exponent, exponentiation to an arbitrary power, conversion from degrees to radians and back, operations with parentheses.
- An ASCII table, using which one can enter mathematical and pseudographic characters, as well as Greek letters.
- A built-in set of redefinable macros for line drawing with single or double stroke, which can be used to decorate tests.
- A built-in report generator, which allows the user to edit existing output forms, as well as create a new output form from scratch.

The system works in a dialogue mode. Prior to using the system a database, which contains lists of students and groups, the library of questions, and the descriptions of tests, should be created.

It is possible to enter questions on different subjects separately. Once entered, these questions can be edited.

After the system has finished working in the "Testing" mode, it displays the results of a test on the screen.

"Unitest" supports both keyboard and mouse, provided that a mouse driver is installed.

The system contains a built-in text editor, which allows you to enter and edit tasks for students. This editor supports all the functions you may need in your work with texts of questions and answers. The size of the edited text is practically unlimited. The editor supports such functions as:

- Cutting, copying and pasting fragments of text, as well as exchange of data between editing fields.
- Searching and replacing text strings.
- Hyphenation.
- Undoing and redoing (i.e., undoing of undoing) editing operations; these functions are useful if you change your mind about the editing operation you have just performed and decide to revert the text to its previous state.

USING "UNITEST" IN EDUCATIONAL PROCESS

The universal system "Unitest" consists of three subsystems:

- Testing subsystem.
- Record generating subsystem.
- Administrative subsystem.

In the administrative mode the reference information (lists of groups and students), as well as the questions, is entered and edited. Moreover, such operations as changing the system settings, changing colors, copying and restoring data, information checking and creation of databases, are also performed in this mode.

Prior to using the system a database, which contains lists of students and groups, as well as lists of tests, is created; sections of the library of questions are created, too, and the questions are entered into these sections.

Lists of groups are entered only once in the beginning of an academic year, but they may be edited later on.

Lists of students are entered and corrected once a semester. Before testing begins, a list of qualifying requirements should be composed.

When this list is ready, tests on a given subject are written and entered into the library of questions. One section of the library corresponds to one group of questions.

It is when composing a test that weights are attached to questions and answers, the rules for choosing answers are established, etc.

In order to organize testing, a list of tests to be used is made. For each test, a list of sections of the library of questions that will be used in this test, as well as the number of questions from each section that should be included in the test, are given.

Since the system stores large amounts of information, the administrative subsystem supports such functions as reindexing databases, data compression, copying/restoring data, and encryption/decryption.

Preferably, one should make a reserve copy of the data immediately after testing or editing the reference information. Reindexing and compression should be made after recovering from system errors or making substantial changes in databases. It is possible to configure the system so that it does reindexing and compression at the beginning of every job.

The encryption/decryption function is intended to protect database (texts of tasks included) from unauthorized access.

The data on the students that have passed the tests are written to a special file, which is subsequently used for generating output forms. System administrator (professor) should revise this file regularly and remove obsolete information from it.

The system can be configured according to the needs of a user. This function is accounted for by the "System configuration" mode.

The system can work in a local network; several users sharing one personal computer can use the system independently, for each user can have individual configuration and define paths to his/her personal databases.

Results of work on several independent computers may be merged.

When the lists of students and groups are entered and libraries of questions and the list of tests are created, one may begin testing.

First, the student should choose a test, then the title of the group and his/her name. The system generates a test of library questions. When generating tests, the system shuffles questions and answers in order to lessen the probability of guessing the right answer.

The student can choose more than one answer to a question; however, if the student chooses all the proposed answers, the rating of this test will be zero. It is possible to answer one question several times, to skip some questions and to return to others.

Each answer is evaluated, then the total number of points is computed, and the result of a test is displayed on the screen.

As we mentioned before, results of tests are stored in a special file of results. After each testing, the statistic on the answers to each question is added to the library of questions.

Printed record of the test can be obtained both immediately after testing and later on. The latter option allows one to analyze progress in the studies of a student of a group and to find out to what extent the students have digested what they had been taught.

The system "Unitest" has been successfully tested in exams at several departments of TSTU and is being introduced into other colleges in the Republic of Uzbekistan.

We believe that the universal system "Unitest" is a program product that will play, in conjunction with the modern hardware and pedagogical ideas, the leading role in the science-based organization of teaching.

INTRODUCING NEW INFORMATION TECHNOLOGIES INTO EDUCATIONAL SYSTEM OF THE REPUBLIC OF UZBEKISTAN: CURRENT STATE AND PROSPECTS

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Our epoch is marked by penetrating of computers and computer-based technologies into all branches of economy and into education, too. The Republican "Law on Education" stresses the importance of computerization of and introducing new information technologies into education.

An analysis shows that the rate of informatization in the Republic does not answer the demands of the moment. Informatics and its components should become object of planning, analysis, and control by the state. The information infrastructure of the Republic should be formed of scientific and industrial structures that process information, provide users with information service, develop and support automated information systems, prepare the and consult personnel in informatics.

The main objectives of computerization of education are:

- Intensifying of education and enhancing its quality throughout all educational structures.
- Automating of control over educational process with the aid of teaching and testing systems.
- Organizing continuous computer education.
- Organizing high quality pedagogical diagnostics and vocational orientation.

An objective of great importance is creating computer-based refresher courses, especially for state employees, and putting an end to computer illiteracy.

The development of science and technology in our independent country will have no prospects without computer literacy of the population and using new information technologies in practice.

The Republican law "On Informatization", whose objective is providing economical, legal, and administrative foundations for information infrastructure, shows clearly what a great importance is attached to informatization in our republic.

The mentioned law states that the main trends of state informatization policy are determined by the "Informatization Concept for the Republic of Uzbekistan".

This concept pursues three main purposes:

1. Development of modern information technologies, extension of information services to all subjects of the state.
2. Assistance in forming information systems in economy and social sphere.
3. Joining the Republic to worldwide information systems and networks.

The Republic has some experience in realizing these purposes. In particular, as early as in the end of sixties pupils in some of Tashkent schools were taught (at optional lessons) some notions about computers and work with them.

In order to create, investigate, and introduce computer-aided technologies, specialized departments of universities were founded, as well as the scientific and production union "Cybernetics" under the supervision of the Academy of Science. During this period a firm foundation of the future development of information technologies in Uzbekistan was created.

In the present report, the history of development new information technologies and of introduction them into the educational system of Uzbekistan will be regarded in its historical, hardware, software, and methodological aspects. We will also describe the prospects of development of these technologies, as well as problems pertaining to it and possible means of their solution.

PROVIDING EDUCATIONAL ORGANIZATIONS WITH COMPUTERS

In the second half of the eighties a new school subject, i.e. "Basic Informatics and Computer Equipment", was introduced, and computers began to be supplied in large numbers to schools. This triggered drastic changes in the process of fighting with computer illiteracy.

By the moment the Republic acquired her independence, about 2500 of 8000 schools were supplied with computers. For the most part these were Soviet-made computers DVK-1, DVK-2, KUVT-86, CORVET, AGAT-7, AGAT-9, UKNTs, and PRAVEC-8 (the latter was produced in cooperation with Bulgaria). At that time a few Japanese "Yamaha" computers were delivered to the Republic, but their number was negligible.

These were only the first steps. The industry of the former Soviet Union was developing and mastering the production of various kinds of computers. Unfortunately, they were incompatible with one another at both software and hardware levels; moreover, when a new model of the same computer was released, upwards compatibility was not maintained. Schools had computers of more than 10 different models by then.

Meanwhile, it was known that as early as 1981 the first IBM PC with a 8086 processor and the MS DOS operating system had been released. The experts knew when IBM PC/XT with a 8088 processor, and a bit later IBM PC/AT-286 and PS/2 with a 8086 processor appeared.

These and other computers of foreign make caused admiration not only by their performance but by the fact that they were compatible with earlier software, regardless of the width of data bus in the processor.

However, in spite of all this knowledge and enthusiasm, nothing could be done when all the decisions concerning education, allocation of computers to schools included, were made thousands of kilometers apart from Uzbekistan.

Since we have acquired independence, the Government of the Republic has been paying much attention to endowing schools with computer equipment. By 1995 the number of secondary schools equipped with computers had attained 4500, which is over 50% of the total number. 94% of these computers are the 8 bit computers mentioned above, and only 6% of computers in schools are modern IBM compatible computers.

Since 1991, IBM PS/2 computers have been shipped to schools. 96 schools received this equipment, and an extensive experiment according to the "Pilot Schools" program began.

The wide variety of models of computers has caused many problems with development of the software and adjusting it for each separate model of computers, with technical support and repairs, which requires great additional expense.

The Ministry of Education of Uzbekistan makes great effort to further supply schools with modern computer equipment (IBM compatible, for the most part), in which both software and hardware compatibility is maintained, which goes with many application programs, and which can work with various external devices. To that end, a special institution called "Uzbekuchavtomatika" was formed with the purpose to carry out, under the supervision of the Ministry, the computer policy in education. At present all the works having to do with shipment, installation, and support of computer equipment are performed by the personnel of this organization. "Uzbekuchavtomatika" has all possibilities to assemble local educational networks from ready modules. Thus, all proposals concerning joint production of modern computers will be considered thoroughly. It should be noted that there are really many things to be done with school computer equipment besides supplying computers to the schools that do not have them, namely, step by step upgrading and replacing physically and morally outdated equipment .

This is why it is noticed in the above mentioned "Informatization Concept for Republic of Uzbekistan" that mastering of production of computer equipment will attract modern technologies to the Republic, which will substantially raise the culture of production, train the personnel and enlarge the assortment of electronic devices. This should considerably lower the prices of computer equipment, which will make it more available and more attractive for an average customer, raise both the export potential of the Republic and the employment of the population. Personal computers owned by private persons should be widely used in education, science, and information service.

SOFTWARE

To overcome computer illiteracy, software is as important as hardware.

When supplied to schools, computers were, as a rule, endowed only with an operating system, a BASIC interpreter, and several game programs. The educational software, which could have aided the teacher in class, was as a rule lacking, and the available educational programs had serious disadvantages.

First, these programs were written by experts in computers, or sometimes physicists and mathematicians, but not by teachers in the subjects these programs were supposed to teach. As a result, the programs were of little use for giving lessons.

Second, most of these programs displayed too much text, which occupied almost all the screen. Poor graphic capabilities of the then existing computers made the use of pictures in educational software restricted or outright impossible.

Third, most of educational software was oriented to Russian speaking students, and it was for the most part impossible to translate the programs into the state language.

Fourth, about 90% of the existing educational software is intended to teach mathematics, physics, or informatics. Other subjects are still waiting for attention of the developers of educational computer programs.

The mentioned problems were seriously aggravated by the wide variety of computers the schools had. Due to the lack of compatibility, any educational computer program had to be ported to all existing models of computers (for example, programs for AGAT-7 were not suitable for its later modification, which was AGAT-9).

Before 1991 it had been the above mentioned "Uzbekuchavtomatika" who supplied educational software to schools. Later on it had to stop these activities, because the expense of porting software to various models of computers proved to be too high.

Since then the policy of the Ministry of Education has changed. Now it is the enthusiastic teachers themselves who create educational computer programs. These teachers, who have hardly mastered programming, try to realize their didactic ideas in the form of computer programs. To tell the truth, the quality of the resulting programs is not always high either. It turns out often that this software is impossible to use without its author and apart from the methods of teaching used by its author. However, this is the best one can attain if the educational software is created in school, because the didactic problems are posed and solved by the same people; it turned out that it is easier for a biology teacher to study a programming language, than to for a programmer to master biology.

What is left to the Ministry is to choose the best (by didactic characteristics, design or other parameters) educational programs, to polish them up with the aid of professional programmers, teaching instructors, and psychologists, and then to supply the resulting software to other schools.

According to this policy, Ministry of Education organizes an exhibition of best educational software or a contest of educational computer programs every two years. The winners, who are named by experts, are awarded. In 1994, 9 best educational programs were named, while in 1995 the number of these attained 46.

It goes without saying that this policy alone cannot solve all the problems pertaining to educational software, but the number of these problems is gradually decreasing. The tendency to further uniformization of school computer equipment should also make the problems less acute.

It is here that a new challenge for experts in new information technologies is in order: to create new utilities for creation of educational computer programs. Using these utilities, teachers would be able to create nice looking and didactically efficient programs.

It should be said that there are many people in the Republic whose duty is to create educational software, but at present their efforts are concentrated on mastering, adaptation, and selling foreign program products. The abundance of foreign program products lowers the level of national products and makes it more difficult to find areas in which chances for commercial success exist.

This is why it is necessary to give legal status to computer programs as information product, to monitor the development of the market of information products, to coordinate efforts of programmers and stimulate their activities. With this approach adopted, one can expect that even in the nearest future such products as numerical programs, artificial intelligence systems, data bases and data banks, expert and teaching systems, text processors oriented to the Republican standards of office work, Uzbek language drivers, bookkeeping and bank programs will appear on the market. Actually, such programs already exist; one should reveal them, legalize them, and provide for their standardization and sales.

DIDACTIC PROVISION

Soon after computers appeared in school and the new subject "Basic Informatics and Computer Equipment" (for the sake of brevity, further on we will call it "Informatics") was introduced, three questions began to emerge; "What to teach?", "How to teach", and "With what textbooks to teach?".

Such questions on the part of teachers and teaching instructors demanded for immediate answers. Thus, first sillabi appeared, as well as first experimental textbooks, which were used throughout all the former Soviet Union in the 9th and 10th grades of school.

Although all the textbooks were experimental, it seems that nobody analyzed results of this experiment. At least nobody was interested in the results of testing various textbooks, which came to the Republic one after another.

Unfortunately, neither national and territorial peculiarities of the Republic nor models of the computers available were accounted for in these textbooks. As a result, teachers were always in the state of search for sources necessary to prepare for the next lesson.

This is why, before the first textbook written by Uzbek authors appeared (this textbook is experimental, too), many various textbooks had been used in schools to teach informatics.

The objective of teaching informatics remained vague and unattainable in practice. It was understood that the main goal of the course was to give the schoolchildren an idea of informatics as science, of methods and means of solving problems on computers, of interplay between informatics and computer equipment. However, thanks to the shortage of computers in schools, in most schools informatics was taught without computers.

In the above mentioned "Informatization Concept for the Republic of Uzbekistan" informatization of education is called an urgent task. Taking into account this concept and modern requirements for education, in view of the imminent informatization and introducing information technologies into all fields of activity, the Ministry of Education issued a document called "Concepts of Teaching Informatics". This document names final and intermediate objectives of teaching informatics. It suggests also that the course of informatics be moved in the direction of earlier grades.

For example, according to this concept the study of informatics should begin in the 8th grade of the 11 year school. Basics of algorithms and programming in BASIC should be studied in the 8th and 9th grades (according to the syllabus of former Soviet school, this was to be done in 10th and 11th grades).

The 10th and 11th grades are devoted to studying new information technologies. Main system, instrumental and application programs, which are applied in various branches of economy, are studied in some detail.

The didactic provision for informatization of the education is performed by the Research Institute of Pedagogical Sciences and by the Republican Scientific and Didactic Educational Center. All educational and didactic material (textbooks, exercise books, teacher's books etc.) and educational program products are tested and approved prior to introducing them into schools.

A document called "State Educational Standard in Informatics" has been issued. In this document the main requirements for the course of informatics as a whole, as well as for separate stages of this course, are clearly indicated.

The main goals of the mentioned document are:

- Improving the quality of teaching informatics by stating mandatory requirements to the students' knowledge.
- Securing the kernel of the informatics course with various programs and types of textbooks, and various national and territorial models of education.
- Improving the school educational process by gradual diversifying of education.
- Aid in creating and testing educational and didactic materials in informatics that conform to the requirements for the students' level of knowledge at various stages of education.

The educational standard in informatics states two levels of requirements for the students' knowledge.

The first level corresponds to the maximal results of the students. One may say that this is the level of abilities. It may be achieved by using appropriate textbooks and didactic materials, as well as by quality of teaching. Thus, when determining the level of knowledge of a well performing student, this level of abilities is used.

The second level determines the obligatory minimum of knowledge in informatics. This is the lower bound for the results of teaching informatics.

Thus, the standard and the concept define a "corridor" which is to determine and direct development of educational processes in informatics and introducing information technologies into education.

Issuing of the standard had good effect upon both the level of students' knowledge and the system of training teachers in pedagogical colleges and refresher courses.

TEACHING IN PEDAGOGICAL COLLEGES AND REFRESHER COURSES

Informatics is a comparatively young but rapidly developing science. It is noteworthy that the domains of its study and application expand every day. Quite recently informatics was studied in the finishing grades of secondary school, and now this science is on the threshold of nursery school. At present more than 100 nursery schools are endowed with computers, and this number is incessantly growing.

Spreading of informatics and new information technology in the educational system has a great positive influence upon teaching other school subjects, but every innovation in the educational process requires taking appropriate administrative and didactic measures. This system of measures consists of the following steps:

- The concept and educational standards of a new subject are established.
- Basing on the above, programs of courses are created.
- Textbooks are written according to the programs.
- Finally, the teacher, who is responsible for introducing new subject, is trained.

These steps are taken in the indicated order every time a new subject is being introduced into school.

Not meaning to belittle the significance of any of these steps, we would like to stress the importance of training the pedagogical personnel. Indeed, suppose that standards and concepts are ready, programs and textbooks are written; if the teacher is not trained adequately, all these concepts and textbooks will not have the desired effect.

The validity of the above statement is corroborated by the present-day state of teaching informatics in the schools of the Republic. The most obvious problem is the diversity of levels of teaching in different schools, which leads to different levels of knowledge shown by graduates.

One of the reasons of this diversity is insufficient professional and didactic expertise of some informatics teachers. In order to prepare informatics teachers, special courses for teachers of mathematics, physics and some other subjects were organized in 1986-1990. Various organizations (universities, pedagogical colleges, teachers' refresher courses, etc.) were in charge of these courses, and the programs of the courses varied as well. As a result, different teachers achieved substantially different levels of training.

Another reason is that school informatics develops rapidly and pervades the educational process. Thanks to this rapid development, the above described order of introduction new subject into school education is not observed: before a concept of teaching has emerged, programs are written, before textbooks are written, teachers are trained. This also has bad effect on professional skills of informatics teachers.

The necessity of giving an adequate training to all informatics teachers brings to life the problem of raising the quality of teaching informatics in pedagogical colleges and refresher courses.

We do not mean to deny the role played by pedagogical colleges in preparing informatics teachers. However, we would like to stress the role of refresher courses. Indeed, college takes only five years of the teacher's life, while the rest 30-35 years of his work the teacher has need in regular brush-up of his skills. This is especially true for informatics, where knowledge becomes obsolete every 2-3 years.

Taking into account this peculiarity of informatics, the Ministry of Education gives much effort to enhancing forms and methods of teaching informatics at refresher courses. The Ministry created a centralized system of refresher courses, which is headed by Central Institute for Raising Teachers' Qualification (CIPKRNO) and comprises 14 regional Institutes for raising qualification. Each of these Institutes has a Department of Informatics, where teachers of Informatics have their refresher courses and teachers of other subjects and school administrative personnel are taught the course "Introducing Computers and Other Information Technologies into Educational Process".

State standards for teaching Informatics and New Information Technologies at teachers' refresher courses have been developed, and new programs for refresher courses in Informatics and New Information Technologies are written.

There are still same problems whose solution could raise the level of teaching in pedagogical colleges and refresher courses. The most serious of them is shortage of the necessary equipment. Most of the pedagogical institutes and institutes for raising qualification have no modern computers, which makes practical Informatics classes ineffective.

In spite of all the effort made in the Republic in order to solve this problem, the present state of economy prevents purchasing large stocks of modern computers and supplying them to educational organizations.

NEW INFORMATION TECHNOLOGIES IN EDUCATION: CURRENT STATE AND PROSPECTS

From the very beginning of teaching informatics in schools, a search for applications of computers to other school subjects has begun. At Informatics lessons the scope of teaching went beyond the syllabus. Teachers and gifted pupils wrote primitive programs for processing numerical and textual information, some teachers developed text and graphic editors in collaboration with their students.

The actual acquaintance of schoolchildren with New Information Technologies began in 1992, when first IBM PS/2 computers arrived to the Republican schools. Informatics classrooms with these computers were installed in 94 schools; all of these schools started an experiment according to the project "Pilot Schools".

Unlike the traditional course of Informatics, which is oriented at teaching programming to children, the concept underlying the project "Pilot Schools" has preparing users of computers as its objective. This is why many educational, demonstrational, and instrumental computer programs are involved with this concept. During their classes, the students gained experience in working with text and graphic editors, with various integrated program packages including databases, spreadsheets and editors.

Unfortunately, many of the computer programs that had been meant to be used in this project, were never shipped to the Republic. After disintegration of the Soviet Union the experiments were finished as well. Now all the schools that used to participate in the project, as well as other schools, teach children according to the unified program, in which all the aspects of teaching informatics, in particular those envisaged by the project "Pilot Schools", are included.

At present the Republic is going towards complete computerization of such branches as banking, taxation, social security, and others where New Information Technologies are introduced. Whence, a challenge to the educational system: school graduates should be able to work with New Technologies.

Taking into account the importance of this work, such themes as working with spreadsheets, databases, teaching programs (foreign languages, office work), various editors, are included in the syllabus.

By order of the Minister of Education, modems are installed in the administrative educational organizations of all levels. These organizations are thus joined by a computer network, which allowed to introduce paperless technology into management of educational organizations.

It is noteworthy that modems are installed in school "PRAVEC-8" computers, so now the schools having such computers can be connected to one another by modem and familiarize their pupil with yet another advantage of new information technologies.

Of course, the process of introducing new information technologies into educational process runs into serious obstacles. The first of them is, as we mentioned before, the insufficient number of computers in schools. Not all schools can afford to purchase new licensed program systems. It would make sense to renew the work upon the project "Pilot Schools". Taking into account new situation, it will be necessary to establish direct contacts with foreign partners from outside fSU. There is a great field of activity for analogous projects in other educational organizations (pedagogical colleges, institutes for raising qualification, etc.).

To attain the mentioned objectives, the following tasks are in order:

1. Taking stock of the computer equipment in schools and colleges and replacement of obsolete computers by modern ones, as well as supplying the required number of modern computers to educational organizations.
2. Didactic revising of the existing school courses with inclusion of the computer as means of teaching; computers should be used for doing and presentation of school tasks.
3. Development and purchase of new licensed program systems, which will allow one to teach and test students in various subjects with the minimal participation of the teacher and the maximal orientation at the student.
4. Development of programming language translators, language translating programs, text

editors for all languages spoken in the Republic.

5. Development of standard educational blocks in principal subjects: physics, mathematics, chemistry, foreign languages, biology basing on the best didactic recommendations, and of utilities which allow the teacher to prepare for the classes basing on these blocks.

The tasks for the nearest future are as follows:

1. Modernization of the existing and supplying new computer equipment to schools: 800 classes per year.
2. Creation of a public pool of algorithms and educational programs:
- Instrumental programs for teachers.
- Sets of educational blocks.
- Ready-made lessons.
- Exam-taking programs.
- Didactic materials.
3. Annual refresher courses for teachers; the theme should be "Using new program systems in education".
4. Teaching basic computer literacy to adults in rural areas.
5. Creating a computer information network and a data bank for the Ministry of Education.

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NATIONAL REPORT OF ZAIRE

ABSTRACT

The theme "Education and Informatics" comprises two aspects:
1. Using new information technologies in the educational system as a teaching tool.
2. Introduction of informatics as a new discipline in teaching syllabi.
Information technologies in the first aspect have not yet found their way into the national educational policy. Of course, there exist some experimental programs that imply using information technologies for education, but they are far from being completely taken stock of. Moreover, these programs are realized by non-state organizations and commercial companies in the framework of their cooperation with educational institutions.
Informatics in the second aspect is an object of attention of the Zairean administration, which has been applying much effort during several years to introduce this discipline into the syllabi of the primary, secondary, and higher education.
In brief, this is the state of affairs related to the theme "Informatics and Education" in Zaire.

INTRODUCTION

In Zaire, as well as in other countries, new information technologies and informatics in particular are regarded as necessary working tools in all areas of life.

The variety of applications of new information technologies and the wide scope of the problems solved with them indicate how great is the influence these technologies may have upon the process of development.

All spheres of social life are getting within reach of the great capabilities of these technologies. The educational system is no exception to this tendency, even though it has numerous problems to encounter:

- The overpopulation of the country;
- The weakness of infrastructure;
- Shortage of didactic materials;
- Non-adaptedness of teaching programs.

It is these problems that caused the session of the General States in Education (Etats generaux de l'education), which took place in Kinshasa from January 19 through January 29, 1996, with the assistance of UNESCO, the UNO Development Program and the World Bank.

The analysis of the ways of transformation of the educational system lead the States to a conclusion that education "for all and by all" is necessary for Zaire. This is a praiseworthy aim, which, however, may very well remain a good wish if one does not use the great opportunities offered to the peoples by new information technologies.

This is where the interest of Zaire towards congresses devoted to informatics and education stems, in particular to that was held in Paris in November, 1989, and to that scheduled for July, 1996 in Moscow.

In the present report, which is prepared for the latter congress, the situation related to usage of new information technologies in education is analyzed. The degree of infiltration of new information technologies in the education is estimated, the possibilities of standardization and the prospects of international cooperation are discussed. Much attention is paid to the presentation of computer equipment and software Zaire has at its disposal.

I. INTRODUCTION OF NEW INFORMATION TECHNOLOGIES INTO THE EDUCATIONAL SYSTEM OF ZAIRE

I.I. REALIZING THE IMPORTANCE OF THE PROBLEM ON THE POLITICAL LEVEL

The political administration of Zaire has actually realized the importance of new information technologies and the opportunities offered by them for securing dynamic development and progress of the national educational system.

An evidence for this realization is provided by presidential decrees prescribing the creation of special organization responsible for the problems of informatics. Among these decrees one may list the following:

1. Decree No 72-419 of November 1, 1972, establishing Zairean Information Service.
2. Decree No 76/104 of May 29, 1976, establishing Zairean Permanent Council on Informatics.
3. Decree No 76-356 of December 23, 1976, regulating the questions of acquiring and using informatic equipment.

4. Decree No 83-033 of January 27, 1983, establishing the Presidential Service for Informatics development in Zaire.

5. Decree No 83-034 of January 27, 1983, regulating the sphere of information activities in Zaire.

6. Decree No 87-242 of July 23, 1987, establishing Presidential Research Service.

7. Decree No 87-243 of July 27, 1987, regulating the sphere of information activities in Zaire.

Further on, a great number of conferences was held, at which specialists form various spheres of activity discussed the problem "Informatics-Education". At each of these conferences, the questions of education were on the agenda, even though not always they were the principal items. This concerns, in particular, the problem of equivalence of diploma specialists in informatics have.

The National Sovereign Conference is coming into its new period of development, when experts should discuss the problems of teaching informatics particularly. As a remedy, some recommendations were suggested, among which there are studying and using new information technologies by teachers, students, and administration of educational institutions.

During the session of the General States in Education that was held on the suggestion of the Transition Government according to the recommendations of the National Sovereign Conference, the task of introducing a course in informatics and adjacent technologies into the new educational system was named as a priority.

The attention that the government paid to this session is clearly indicated by the following words: "The political will is the key element, without which no structural changes in the cultural and educational space are possible". This session allowed all the persons having to do with introducing informatics and adjacent technologies into the national system of education on all levels, to get a deeper knowledge of the problems pertaining to it. According to the recommendations of the General States in Education, National Committee of the regional information network in Zaire included the question "Education and Informatics" in the list of priorities of its working program for 1996.

One may hope that accomplishing of this project, which is intended to stimulate the work of all persons and organizations involved, will give rise to a great number of initiatives and stimulate the process of introducing new information technologies, as a tool of teaching, into the educational system.

1.2. TEACHING INFORMATICS

Many educational institutions - primary, secondary, and higher - have informatics courses in their syllabi.

This situation cannot be regarded as the result of isolated initiatives of the private sector only. The present achievements resulted from the analytical efforts that had been made by the state authorities during last several years. Indeed, the introduction of informatics courses into the educational system was, as we mentioned before, initiated by Presidential Service for Informatics development in Zaire, which was later reorganized into Presidential Research Service. It is only later that private schools appeared, which specialize in teaching informatics and act under the supervision of presidential services and in cooperation with specialized departments of the ministries related to the national educational system.

At present, informatics is taught in both public and private colleges as well; these colleges prepare specialists in informatics on various levels.

I.3. NATIONAL PRIORITIES IN EDUCATION AND INFORMATICS

The General States outlined some priority measures to be taken to secure innovations in the educational sphere, teaching informatics included.

I.3a. Innovations

1. Introduction of informatics courses in primary and secondary school.
2. Creating the "Informatics" section in the system of high school education.
3. Standardization of programs for training information teachers on all levels.

I.3b. Measures to be taken

1. Creating special programs that correspond to the particular features of each level and each discipline.
2. Creating a program that will allow to create the "Informatics" section in the system of high school education.
3. Creating a unified program for training informatics teachers.
4. Creating a program for popularization informatics via mass media by the ministries related to the national educational system and the ministry of culture.

I.3c. Practical measures

Creating the "National commission for introduction informatics into the Zairean educational system".

I.3d. Working program

For the short term:

1. Joining in the work of the National commission for introduction informatics into the Zairean educational system.
2. Active popularizing work with the Zairean authorities that will cause them to exert more political will in the field in question, and with various other partners (with coordination of their efforts).
3. Enlightening the national intelligentsia on the necessity of studying informatics and its usefulness for the development of the country.
4. Training highly-qualified professors that will be able to teach school teachers new information technologies.
5. Gradual introduction of informatics courses on various levels of education via several experimental schools.
6. Creating experimental independent information centers that will be joined to local, subregional, regional, and international networks

and will be able to provide information service to a great number of nearby schools.

7. Providing support for private initiatives and projects of state-independent associations with coordination of their activities.

For the longer terms:

1. Creating data banks on main spheres of national life.

2. Developing structures for production of software adapted to the needs of research and education with the features of the national environment taken into account.

3. Creating servers joined to international data banks.

4. Purchasing computers for educational institutions in order to help them in solving their didactic, scientific, and administrative problems.

I.4. NEW INFORMATION TECHNOLOGIES AS PEDAGOGICAL TOOL

New information technologies are very poorly represented in our educational system. There exist centers of professional and general education in the country that use methods of "computer aided teaching". However, the experience of these centers is not acquired by numerous schools and colleges. This situation is due to the absence of the national policy for introduction of new information technologies, as teaching tool, into the educational system.

I.5. DIFFICULTIES

One may distinguish the following groups of problems caused by the lack of coordination in the system of teaching informatics and non-adaptedness of new information technologies to the particularities of the educational system:

I.5a. The political situation

In spite of the presence of the political will, there are political problems that prevent some projects concerning vitally important problems of the leaving century from realization, projects related to new information technologies included.

The long duration of the transition period in the political life of the country and the isolation from international connections prevented all the governments from initiating projects able to provide for progress in the field in question.

I.5b. Social and economical crisis

Social and economical difficulties are smothering our country and make us put off the realization of any innovations that imply transfer of technologies and demand for massive investments.

Indeed, if our schools have already run into problems with providing schools with conventional didactic materials, how can one think of innovations that demand for a steady flow of investments? Thus, the school infrastructure, which is not ready to accept new technologies, remains one of the most serious obstacles.

I.5c. Lack of qualified personnel

Although our country does have some potential in informatics, it experiences lack of trained personnel capable of teaching and adapting to the new program. To solve this problem it is necessary to prepare specialists that will teach the teachers.

I.5d. Problems with electricity

The realization of this problems in this country will meet serious difficulties, especially in the inner regions, where electricity is not yet installed. However, the towns are for the most part provided with the electric power, which will secure fulfillment of the program.

I.5e. Insufficient development of telecommunication networks

In spite of the existence of telephone and several private data transmitting networks, the existing telecommunication infrastructure prevents using new information technologies in the educational sphere on a large scale.

II. EQUIPMENT, SOFTWARE AND TEACHING PROGRAMS AS MEANS OF EDUCATION AND ADMINISTRATION OF THE EDUCATIONAL SPHERE

II.1. NEW INFORMATION TECHNOLOGIES AS A TEACHING TOOL

Lack of the national policy in introducing new information technologies does not mean that the authorities underestimate their great capabilities. The administration of the country gave support to some governmental organizations that were oriented at creation of computer-based educational systems for some categories of the population.

By way of example one may name the Maman Moboutou foundation, whose occupation is computer-based training of secretaries and plumbers; this training is oriented at girls and boys respectively. The teaching center of this foundation was equipped by Canada, and now it has a powerful computer network and specialized software.

Many private schools are beginning to use new information technologies as well; they use them to solve elementary pedagogical problems in secondary and even primary school.

II.1. Information equipment

The stock of information equipment the administration of educational system has at its disposal can be divided into two parts: the equipment of the ministry of primary, secondary, and professional education and the equipment for the higher education. It includes two minicomputers HP3000 and a few microcomputers respectively.

Concerning the number of computers used for teaching purposes, it is quite small, and only a few educational institutions have such computers at their disposal. One may name the Information school of the Ministry of Finances, which (the school) has one minicomputer. Besides, a few educational institutions have microcomputers, very imperfect as a rule.

Many schools have a need in information equipment that could be used for teaching, but their needs are often left unsatisfied because of the high price of electronic equipment. Here, one would like to suggest the state to make purchase of information equipment for the needs of educational system tax-deductible, according to the recommendations of the National Sovereign Conference. Moreover, one should make purchases of computer equipment in the framework of projects of international cooperation tax-deductible as well.

It is necessary to develop the system of humanitarian aid in education, as it is done with medical service. The reason for such a solution is that the developing countries cannot make use of the system effect that results from interaction of the components in the triad "Education-Industry-Informatics".

We would regard this situation as justified when educational institutions, government and non-government organizations of developed countries help their colleagues from developing countries to make use of this effect, at least "on the periphery".

II.1b. Software and educational programs

One can only be sorry for the present situation with software, for the lack of educational software that meets the specific requirements of our educational programs. Stimulating the inventiveness of specialists in informatics with the aid of specialists in teaching might be a solution to this problem. On the practical plane, it is necessary to create the conditions for protecting copyright and to think of such stimulators as prizes, scholarships, etc.

II.2. NEW INFORMATION TECHNOLOGIES AS AN ADMINISTRATIVE TOOL

The possibility of using the computer for solving administrative problems is a reality one cannot doubt. State authorities, with the aid of the World Bank, provided the country with an information center whose aim is to computerize all the administrative system in the Ministry of Primary, Secondary, and Professional education. One should admit, however, that many functions and problems remain beyond the scope of computerization due to the lack of the information culture, on the one hand, and to the insufficient coordination of efforts, on the other hand. The most computerized field is somewhat specific: it is processing the results of graduate exams, that are held before issuing the diploma.

Among other computerized spheres one may name such as calculating the salary, statistics, financial control and accounting, budget control, control of human resources, processing of cardfiles, archives, the document flow control, etc.

III. USING BROADCASTING FOR EDUCATION

Using broadcasting equipment for education had begun considerably earlier than informatics emerged in the Zairean educational space.

As early as 1963, that is but three years after the acquisition of independence, a religious radio station appeared in Kinshasa. This station was named "African technical radio service" (ATRS). First it was supervised by catholic missionaries, later protestants joined in. The specific feature of this station was that its broadcasts were entirely devoted to the questions of education and culture.

The necessity of adapting this station to the technology of that time lead to the creation of a TV center, which was named "Tele-ATRS". The objectives and ideology of Tele-ATRS coincided with those of its predecessor; as a result, the arrival of Tele-ATRS caused increase in the influence of audiovisual media upon the sphere of pedagogics and education.

However, in 1973 ATRS and Tele-ATRS were nationalized, and an organization called "National Directorate of Educational and Cultural Programs", which had the same objectives as the mentioned stations, appeared.

After the "Zairean Directorate of Broadcasting and Television" was organized in 1983, National Directorate of Educational and Cultural Programs was incorporated into its structure and began its department called "Educational and school Radio and TV".

As it is clear from the name, the basic aims of Educational and school Radio and TV remained the same, but technical difficulties caused decrease in efficiency of this department. The percentage of homemade programs dropped from 90 to 50.

At present, the program "Open school" that is broadcast by the national radio and TV enjoys great popularity among both Zairean teachers and pupils.

Other educational programs are aimed at large groups of the population and often contain sections intended for raising qualification of teachers from the informal sector.

Rural radio stations, such as "Radio Candip", also play an important role in solving the problems of professional and general education of the people. Strengthening of their position resulting from liberalization of the national market of audiovisual production, as well as the proposed upgrade of the equipment of the Zairean Directorate of Broadcasting and Television with the aid of the International Program for Development of Communications, are the two main means of enlargement the scope of using broadcasting for education.

IV. POSSIBLE STANDARDIZATION POLICY

Without the special policy for introduction new information technologies into the educational system and without mentioning it in the framework type law on national educational system, standardization measures in this field can be taken only within the framework of the information-computer educational policy.

IV.1. STANDARDIZATION SERVICES

In the text of the corresponding law, the following standardization services are named:

IV.1.a Presidential Service for Informatics Development in Zaire (PSIDZ)

As we mentioned before, the first organization to work upon standardization in this field was PSIDZ. It is pointed out in Article 13 of the decree establishing this organization that "Presidential Service for Informatics Development in Zaire (PSIDZ) organizes and supervises research in informatics".

There is no direct mention of standardization in this article, but in practice PSIDZ has the functions of inspecting organization that inspects, according to the law, the fulfillment of educational programs in informatics.

IV.1b. Presidential Research Service (PRS)

In the decree that establishes PRS, this service is assigned the tasks analogous to those of PSIDZ. In the Article 14 of Presidential Decree No 87/243 of July 22, 1987, which replaced the corresponding decree of 1983, the same words are contained: "Presidential Research Service organizes and supervises research in informatics. This research may concern equipment, software, educational materials, applied information systems, questions of creating information computer centers".

The fact that, according to the Article 2.14 of the Decree No 87-242 of July 22, 1987, which established PRS, this organization is to provide for "development in the territory of the country informatics-related activities by promoting education systems and research programs in informatics" leaves no doubt about the intent of the authorities to solve, in the framework of this act, the problems of informatics aided education development, as well as of development of new information technologies.

It should also be pointed out that these questions will be discussed at the sessions of National Sovereign Conference and General States in Education.

IV.1c. Legal rules in standardization

Without special policy for introduction of new information technologies as a teaching tool into the educational system and without the special service responsible for standardization in this field, one has to rely upon the regulations concerning informatics and computer related activities.

Still there are no special legal base that would prescribe official procedures or establish obligatory standards.

As we mentioned before, various services whose task is to standardize teaching programs in informatics do it according to the concrete problems and priorities established in this field.

IV.1d.. Prospects

Establishment of standardization services and forming an obligatory complex of procedures and standards related to introduction of new information technologies into the educational system should enrich the general policy of adaptation these technologies to the problems of teaching.

Thus, one should state a policy first, so as one could determine the tasks of a standardization service and the rules regulating its activity. At the present stage one should take into account the following ideas that will allow to achieve better results in this work:

1. This policy should be in accordance with the policy of introducing new information technologies into educational sphere; this latter policy should be a real constituent of the educational policy.

2. The standards should ensure uniformity and compatibility of information and computer equipment and its telecommunication base, uniformity of performance and compatibility of the software used for teaching, flexibility of its usage.

3. It is necessary to provide for uniformity of the syllabi of primary education in informatics, so as to avoid the danger of "losing the roots" after transfer from one educational institution into another during or after the academic year.

4. The efforts aimed at promotion of education and standardization should be applied to all the regions of the country and to all educational subsystems (public, private, etc.).

5. The educational software should correspond to the programs outlined in the national educational policy and concern the disciplines contained in these programs.

6. The standardization service whose task is to work with introduction of new information technologies into educational sphere should be created by ministries related to the educational system, in cooperation with the corresponding state services.

V. INTERNATIONAL COOPERATION

All the countries that participated in the first Congress "Education and Informatics", which was held in 1989, realised that cooperation in all fields of applications of new information technologies to education is a must. It was declared that the aim of this cooperation is to "shorten the gap between developed and developing countries and converge on an equity basis". However, two obstacles paralyzed the political will exerted by the Zairean authorities.

The first obstacle was severing the structural cooperation with the main partners of Zaire. For the educational system this "cutting off the oxygen supplies", meaning by oxygen the foreign aid, implied real withering.

The second obstacle is related to the financial difficulties of the country, which had to deal with other first order social and economical priorities.

The inclusion of developing countries into international cooperation in the field of introduction of new information technologies into education may bring these countries more trouble than benefit if the developed countries and international organizations do nor offer specific structures and mechanisms of cooperation related to transferring technologies and experience, information exchange and joining international information networks, acquiring and adaptation of the reliable educational software, training of teachers.

In this case such a decision cannot be made without sacrifices.

As it was pointed out at the first congress in Paris, the prerequisite is "the necessity to solve the problems of usage new information technologies basing on the analysis of possibilities of each country from the standpoint of its economic, social, and culture prospects".

After all, the cooperation is of vital importance not only for the developing countries, but for the developed countries as well, since all the parties to cooperation benefit from exchange of information and experience.

CONCLUSION

Our country has no alternative to introduction of new information technologies in the educational system, now that economics is being internationalized. Our first necessity is the transformation of the political will of the authorities of the country into concrete decisions. This should be accompanied by efforts in wide propaganda of informatization ideas among the population in order to form the information culture. This is a necessary prerequisite for developing the educational policy including new information technologies as a teaching tool and for the readiness to accept plans and to choose variants of their fulfillment.

However, the political will and the necessary information culture should be supplemented by international cooperation implying the aid on the part of developed countries and international organizations.

A merit of the technology itself is its "neutrality", which offers the opportunities of its relatively easy assimilation, although the high rate of moral aging, which is characteristic of new information technologies, can put the developing countries into a vulnerable position due to the necessity of regular upgrading the equipment and its technical service.

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