

THE THINK PROJECT

FIRST DRAFT

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CONTENTS:

INTRODUCTION: THE THINK PROJECT	1
SECTION 1: AXES OF TENSION	3
Axis 1	3
Axis 2	4
Axis 3	5
Axis 4	6
Axis 5	7
Axis 6	7
Axis 7	8
Axis 8	9
SECTION 2: THE THINK SCENARIOS	11
Scenario 1: ICT strengthens centralised regulation	11
Scenario 2: ICT and schools as learning organisations	17
Scenario 3: Citizenship at the centre	23
Scenario 4: Technology melts down	28
Appendix 1: Sectors of society identified in the THINK process	31
Appendix 2: Five potential learning functions for ICT	32
SECTION 3: THE THINK FRAMEWORK	34
Introduction: The THINK project	34
A note on methodology	35
ICT, cultural values and educational aspirations	36
A threat from ‘globalised education?’	37
Digital divide, non-literacy, illiteracy, literacy & fluency	39
What kind of tool is ICT?	40
ICT and teachers	41
ICT tools for teachers and learners	43
Teaching roles, conditions of service and contracts	45
Curriculum and Assessment	46
ICT and value for money	48
Impacts of ICT on learners and learning	49
ICT as an element in the curriculum	49
ICT and traditional curricula and goals	50
ICT and new or re-prioritised goals	50
Public and private sectors	51
Appendix 3: Interview Schedule	54
Appendix 4: Principal participants in the interviews	63

INTRODUCTION: THE THINK PROJECT

REPORT BY DAVID WOOD

There are three sections to this report. Although these are closely related, each is designed to stand alone and to be readable in any order. Each draws on a series of in-depth interviews with key members of the education ministries and agencies from Denmark, France, Holland, Portugal, Sweden and the UK¹.

Section 1 of the report identifies and outlines key “axes of tension” identified from the interviews as defining crucial policy options in developing coherent and effective strategies for the exploitation of ICT in schools. These will be the main focus for the EMINENT presentation, which is why they are presented first in this report.

Section 2 presents four scenarios based on envisaged consequences of different policies designed, implicitly or explicitly, to resolve the axes of tension identified.

Section 3 provides a more in depth, discursive commentary on the main ideas, concerns and themes that arose out of the THINK interviews. These provided the impetus for the identification of the axes of tension.

The *axes of tension* in Section 1 draw out critical issues for those tasked with the job of influencing, formulating and implementing educational policies with respect to ICT over the next five years or so. Although based on material drawn from the six national case studies, the claim is that these represent generic issues that will have to be faced by any educational system embarked on innovative change in response to the opportunities and challenges opened up by the technology.

The *scenarios* in Section 2 are not intended to be prescriptive, predictive or descriptive. They illustrate imagined states of the educational world in a few years time that emerge in response to different combinations of policy decisions. They represent examples of the use of the axes of tension to construct possible worlds; a process that could be appropriated and used by any reader to develop and evaluate their own visions of the future.

The *framework* section adds detail about the current and hoped-for impacts of ICT on education in the six national contexts, together with a discussion of the main constraints acting on attempts to formulate and realise ambitions for the future of schooling. The experience of conducting the interviews, coupled with evidence and examples drawn from associated documentation, provided the main stimuli for articulating the axes of tension and for the extrapolation of these into the scenarios.

¹ See Appendix 3 for the interview schedule. A list of participants will appear in Appendix 4.

Although the content of the report rests on testimony and ideas put forward by the interview participants, the responsibility for the identification, selection, contextualisation and analysis of their contributions obviously lies with the author of this report. Until the partners in the THINK process have had an opportunity to comment on and suggest amendments to this report it remains a subjective product that has yet to be exposed to close evaluation and, hopefully, to eventual agreement.

The main purpose of this first draft is to stimulate scrutiny, discussion and debate among the THINK partners and other interested and concerned readers.

SECTION 1: *Axes of tension* in educational policy for ICT

When ICT becomes mission critical for educational systems, several processes will be set in chain that will generate new tensions and dilemmas for schools and education authorities. The main dynamics driving innovation in schooling stem from strategies adopted to resolve a set of “axes of tension” created by the impact of the technology on learning. Three scenarios are presented that explore different attempts to co-ordinate resolutions to the eight such axes of tension identified.

This section provides a rationale for the analysis and identification of the axes and indicates how each motivates the three scenarios constructed. A fourth scenario explores what happens when there is a failure to resolve one or more of the tensions.

Axis 1

Innovation with ICT is inhibited and stifled by a failure to re-think the curriculum.

There is a growing tension and contradiction between demands for radical change in educational priorities and processes and the expectations and goals embodied in the school curriculum. Whether a curriculum is determined locally or nationally, reform is not taking place at a fast enough pace to support the radical changes demanded.

Both the definition of what is worth knowing and the skills and tools that implicated in what it is to be knowledgeable are being transformed by the impact of technology on all aspects of professional, vocational, private and public life.

The widely held belief that the “half life” of much knowledge is falling implies that there is scope for the extent of coverage in traditional school curricula to be cut down. Add to this the evolution towards life long learning, which promises to extend personal learning time by a factor of four or so, and the need for a radical reappraisal of the traditional knowledge transmission role for schools becomes even more apparent.

At the moment, these factors are acknowledged but not acted upon and the main trend is simply to pile new learning and teaching demands on top of traditional ones. This situation creates an unnecessarily heavy load, undue stress and confusion of aims for schools.

In scenario 1, this tension is refuted. The belief is that the curriculum can (or, for political reasons, as in the UK, France and Portugal must) remain relatively intact, although there is some extension of the educational pathways available in the later years of schooling. The view taken in Scenario 1 is that it is through changes in pedagogical practice, not curriculum goals, that schools will achieve the new priorities.

In scenario 2, the tension is accepted. A strategy is developed that preserves a core of traditional curricula goals and assessments but also creates significant space for innovation. As in Holland, this system exploits the historical practice of assessing school achievement by two routes; one based on national examination and the second on school-based assessment. Schools have the task of developing and evaluating innovations in meeting goals that reflect the new educational priorities. As in Denmark, teachers are recruited as external examiners and are tasked with and trained in the role of identifying promising innovations in the effective use of ICT for teaching and learning.

In scenario 3, the tension is also accepted but a more radical policy for innovation is developed. The traditional conception of school learning as primarily concerned with the mastery of a pre-determined body of knowledge in preparation for future work or education is rejected. The overarching objective in scenario 3 is to create and develop a system in which schools become the core centres of community life and the development of skills in self-managed learning, critical thinking and responsible citizenship form the major goals of schooling. As currently happens in Sweden, decision making about specific educational goals, strategies and practices are the primary responsibility of the school and its community. It is their task is to translate the overall priorities for education into practice. ICT networking is exploited to engage the expertise of different communities in new ways of assessing the value and impact of innovative approaches to learning and teaching.

Axis 2

Innovation with ICT fails, being inhibited and stifled by a failure to capture the imagination and support of parents and the public.

Attempts to exploit ICT to promote school innovation come into progressively deeper conflict with demands for public accountability. A tension exists between the need for radical change demanded by educational policy and the majority sentiments of parents, the media and the electorate. Attempts at educational reform are currently too inward looking.

Scenario 1 – This tension is not acute in the short term since the curriculum and examinations reflect the status quo and have majority support. Investment in ICT and in teacher training rests on the promise that it will enable the extended educational priorities to be realised through improved teaching and learning. ICT networking is used widely in attempts to maintain the support and educational involvement of parents.

Scenario 2 – Public confidence will be supported by the fact that recognisable elements of the traditional curriculum and certification are maintained in the early stages of reform. Strategies to capture the public imagination and support include the use of networking to

communicate and disseminate innovative uses of ICT for teaching and learning identified in the course of peer assessment by teachers.

Scenario 3 – The use of ICT for extensive, deep and sustained networking between schools and the community are central to this educational system, so the nature and rate of innovation is directly influenced by parental and public support. One role for the educational authorities is to exploit ICT in order to help in identifying, celebrating and disseminating innovative examples of the new schools.

Axis 3

Innovation fails because the tools and practices used to monitor and guide learner progress and achievement do not support the achievement of new objectives.

The tools and practices used to assess learning and, ultimately, to evaluate the quality of teaching, are basically concerned with memorisation, reproduction and mastery of approved bodies of knowledge (this applies whether assessment is formative or summative, national or local). Even if there are radical reforms to the curriculum these tools and practices will inhibit the system's ability to realise innovative uses of ICT.

Most teachers are not supportive of innovation. Training and demands for change in their practice will be undermined by the fact that most will appeal to the need for learners to succeed on traditional forms of assessment as a reason not to change.

In the absence of recognised and accepted tools, technologies and practices to help learners, teachers and parents to recognise progress and achievement it will be impossible to guide and coach the learning process effectively. This will create confusion and resistance from learners, teachers and parents. Many learners, and teachers, will feel “lost in freedom”.

Scenario 1 - This tension not recognised initially. Later, regimes of national testing and the use of on-line assessment will be developed in an attempt to recognise and support new skills.

Scenario 2 – since teachers and schools will become centres for educational research and development, the task of discovering and perfecting new approaches to learner guidance and formative assessment will rest on them. These will be validated against school-based assessments of learner achievement.

Scenario 3 – This tension is not recognised since schools and the community will be tasked with the job of developing their own methods of assessment and guidance.

Axis 4

The innovative use of ICT will increase the gap between high and low school achievement.

ICT is used to open up more choices for the learner and to create favourable opportunities for “anywhere/anytime learning”. This increases the magnitude of the gap between high and low school achievement, leading to accusations that innovation in schools is promoting greater inequalities in educational opportunity and life chances, contributing to social exclusion and weakening social cohesion.

When ICT enables learners to take more responsibility for their own learning and confronts them with more challenging and complex learning demands, then variations in rates of progress and attainment that result from individual differences in interest and aptitude are amplified, increasing the gap between high and low achievement.

When ICT promotes more opportunities for learning at home and for networking between households and schools, then the impact of different levels of family and community support on rates of progress and attainment will be amplified, increasing the gap between high and low achievement.

If schools respond to this variability by trying to hold back the fast track learners, they risk the accusation that they are failing to realise these children’s potential. If they respond by accepting and accommodating to this situation, they will be accused of inequity of treatment. In either case, they will be seen as failing to promote equality.

In scenario 1, the educational system seeks to resolve these tensions by making schools accountable for minimal levels of educational achievement in key areas, and by exploiting ICT to strengthen and defend regimens of selection and streaming (both within and across schools) to accommodate the increasing variability in rates of pupil progress.

In scenario 2, greater emphasis is placed on identifying and supporting individual potential. The aim is to minimise apparent under achievement by expanding the range of opportunities to succeed and by enhancing the system’s ability to offer sound guidance and advice. This leads to a greater diversity of provision, more varied educational pathways and a wider definition of educational success.

In scenario 3, a more radical approach is taken. Individual differences in achievement do *not* figure in educational accounting. The approach to assessment adopted is itself innovative. More emphasis is laid on the value and evaluation of contributions to the community and the development of responsible citizenship. Assessment is based the documentation of individual and group portfolios and includes evaluations from a variety of sources.

Axis 5

Teachers as technicians versus teachers as professionals

Teachers are already in the front line of attack in attempts to implement policies designed to reap educational benefits from investments in ICT. Innovations in the effectiveness of teacher recruitment, training and professional development have become key issues and will remain so. Although all educational systems recognise the need for changes in teachers' roles, the nature of these will vary significantly over the coming years.

In scenario 1, where the State defines in detail what is worth knowing, and prescribes how the assessment of knowledge and skill will take place, the main role of teachers is to optimise their practices in order to maximise the fit between the stated goals and the measured outcomes of schooling. Teachers are essentially technicians.

In scenario 2, the professional roles of teachers expand and become far more demanding. They are tasked both with maintaining standards on nationally defined assessments of pupil achievement and with a research and development brief. Discovering how ICT can be exploited to realise the enlarged set of goals for education laid down by the State is largely their responsibility. They must discover how changes in school practices can be accompanied by innovative forms of assessment, and demonstrate how these support the achievement of each learner's potential.

In scenario 3, the extent of the teacher's professional responsibility is even greater. Individual schools and teachers are professionally accountable to learners, parents and the community for defining the content of the curriculum and for the documentation of evidence for what pupils learn and achieve. Additionally, teachers must work with their school to develop and sustain close community links as they collaborate with others to identify and realise the locally defined objectives for schooling.

Axis 6

Learners as consumers versus learners as an asset

This tension invites the most radical re-thinking about the role of schooling.

In scenario 1, both learners and the taxpayer are viewed as consumers of educational products and services. The main role of schools, as providers, is to equip learners with the knowledge, skills and attitudes they will need to function as productive and prosperous future citizens thus minimising social exclusion and contributing to social cohesion. Contributions from the taxpayer are defended as an investment in that future. Schools are held accountable for giving value for money by achieving standards that, in the view of the state, are held to be the best available and most reliable indexes of future potential.

These values, in combination with highly centralised state control over curricula and certification, could underwrite the progressive transfer of responsibility for schooling from the state to the private sector, in which case the state would act as regulator.

In scenario 2, with its emphasis on schools as centres for creating and disseminating knowledge about learning and teaching, a similar view of learners and families as consumers prevails. However, the desire to delegate the task of knowledge creation and expertise to schools militates against any significant transfer of educational responsibilities to the commercial sector.

In scenario 3, the major emphasis lies on learners as an asset to the local and wider communities. With a greatly reduced burden of knowledge transmission, learners and schools become “time rich”. Learners are viewed and treated as junior citizens with the time, motivation and potential to make significant contributions to the social, cultural, intellectual and economic lives of their communities. Such contributions are co-ordinated with the pedagogical goals of helping learners to become more independent learners who are able to collaborate in identifying and tackling complex and authentic tasks to become critical and informed participants in national life.

Axis 7

The burden of maintaining high quality of ICT provision exceeds available public funding.

The cost of maintaining and upgrading ICT infrastructure and services in order to build sufficient capacity and redundancy into technological and human resource provision for schools is currently under-estimated. A realistic assessment of the levels of recurrent investment needed will only become clear over the next five years when the technology becomes mission critical for schools. The degrees of freedom available under each scenario for access to additional, non-public sources of funding differ fundamentally.

In scenario 1, the educational system is best placed to augment public funding with private financing. Given the widespread use of common content in the delivery of the national curriculum, households present a large and recurrent market for ICT products and services. This supports a buoyant domestic industry that is then able to provide for the less lucrative school market. The provision of teacher training as an element of commercial service provision becomes common freeing the state from the costs associated with updating and re-training teachers. The state is able to target additional resources for enhanced support to less well off schools and households.

Since schools demand similar content and services for the primary years of education, this also creates economy of scale for the commercial sector. In the secondary years, the movement of some children post-14 into more vocationally oriented training also widens the base of financial support to include potential employers and well as private sector providers.

In scenario 2, maintenance of infrastructure remains a state responsibility but there is the expectation that, within 5 years, teachers will become the major producers of content and services to support educational uses of ICT. Thus, expertise grows within the educational system leading to less reliance on external provision and support and lower costs than those that face scenario 1. As the continuous professional development of teachers takes place, training costs are reduced, this function being served by professional networks.

It is likely that the contracts and conditions of service for teachers will change significantly, seeing the emergence of new specialists around the functions of knowledge creation in schools. This will help to create more challenging and rewarding career opportunities in schools and help to overcome problems of teacher recruitment and retention.

In Scenario 3 – This scenario will be the most demanding on public approval and financial support. Schools will rely heavily on gaining support and expertise from local communities. Where significant variation exists in the levels of prosperity of different communities these will be reflected in the levels and quality of ICT available to schools. The State will attempt to compensate for any such differences through selective regional funding.

Axis 8

Protection versus Censorship

ICT creates enduring tensions between the goals of providing the learner with open access to the information society and responsibility for regulating their own learning and the need to protect them from potential exploitation, indoctrination and crime.

The growing power and intelligence built into the Internet calls for a fundamental re-think of the nature of privacy, rights of ownership over personal information and intellectual property rights.

Open access by young learners, and the potential for undesirables to have open access to them, raises the potential for morally repulsive, politically subversive and economically dishonest and illegal contacts. As never before, it is possible for the young to be exposed to the more mature in unaccompanied and unguided non-public spaces. With parents and the community, schools share a responsibility for informing and arming learners to be critical and self-protecting individuals. How and when this responsibility should be discharged is currently unclear.

In relation to schooling, technological developments in the technological capacity to track and model the journeys that learners make as they explore and learn leaves them open to exploitation. For example, who will have the right to monitor and have access to personal records of work in school and performance in any assessments? Who will have access to information that could signal learner interest and motivation?

Although these issues clearly go beyond the concerns of schooling alone, there are specific issues regarding the rights of children in school that are the special and proper areas of concern for educational policy.

In scenario 1, the potential for both state protection and state censorship are strongest. The state exerts direct control over, or it regulates, the content and functions of ICT in schools. Here there will have to be nationally debated and agreed constraints over the role of the state as gatekeeper to the world of information. In addition, there will be a need for specific regulations or guidelines concerning the ownership of the information and intelligence gained from a learner's use of ICT and concerning rights of access to such information.

If this scenario develops along the lines of non-state provision where, for example, formative and summative information about learner performance and learner interests are collected and processed by non-public agencies, these demands will become particularly acute.

In scenario 2, it is more likely that the main responsibility for decisions about access and rights to see will be formulated by schools and parents, albeit within a regulatory framework laid down by the state. Since ICT content and function will develop within the schools, issues such as intellectual ownership, copyright violation and access to personal information will be taxing issues for local management.

In scenario 3, the moral, legal and economic dimensions of ICT will be an integral part of the intellectual concerns of learners, schools and the local community. It is likely that early but guided and critical exposure to potentially harmful materials will be a feature of schooling from the early years. The timing and nature of such contacts will be determined at a local level in collaboration with parents and the community within a national framework of regulation. It seems likely that such an approach will only be tenable within a highly coherent system.

SECTION 2: THE THINK SCENARIOS

Scenario 1: ICT strengthens the centralised regulation of schooling

The Political Context:

This scenario develops in a political context marked by a generally held view that schooling needs to change and improve significantly in order to further the economic prosperity and well being of the nation and the individual. A key objective is that every child will achieve the minimum standards deemed necessary to reduce risks of future unemployment and social exclusion and will be provided with an education designed to realise their potentialities and to recognise their efforts. The key standards to be achieved are clearly defined within a national curriculum and examination system.

Schools are thus held accountable for -

- universally high levels of achievement in core skills
- greater levels of competence in “work place attitudes and skills”
- the development of school leavers with the attitudes, motivation and skills needed to equip them for a life of self-managed learning.¹

ICT is accepted as a primary vehicle for supporting schools in the realisation of educational objectives. Resources are allocated for the provision of adequate ICT infrastructure, including approved content and services. The training and up-skilling of teachers in the effective use of the technology is also seen as a priority. Increasingly, this training is integrated into ICT service provision and delivered by the service providers.

The curriculum and forms of assessment remain rather traditional in character (albeit performed with an increased use of ICT tools). However, schools and teachers are expected to achieve the other objectives through appropriate methods of teaching. *The assumption is that skilful teaching can combine the achievement of the three sets of objectives.* Effective pedagogy can realise the delivery of a common curriculum adapted to the needs of individuals whilst also ensuring that learning is managed in such a way that pupils develop the requisite motivation, attitudes to learning and generic learning skills to achieve the other competencies. On this view, it is the manner, rather than the content, of pedagogical practices that inculcate such general attitudes and generic skills.

Schools, goals, curricula and assessment.

¹ These objectives summarise the general goals mentioned in practically all of the interviews. They are also common to all of the scenarios, which are about policies, practices and priorities for the achievement of similar ambitions rather than an exploration of differences in long-term goals.

Primary attention is paid in the early years of schooling to the teaching and learning of core knowledge and skills. State regulation of the content of the school experience is strongest in these initial stages. The range of educational options expands with learner age, reflecting an increasing emphasis on learner choice and responsibility for their own learning, albeit within the regulatory framework of state accreditation and certification. Schools for older pupils are expected to develop their own missions and to communicate these, together with evidence of achievements, to the authorities, parents and learners. ICT supports the auditing of these claims on a scale and at a level of detail never before possible.

The increased differentiation and specialisation of schools is likely to create two main educational journeys. One leads into academic routes for those learners likely to move directly into the tertiary academic sector and into employment as “knowledge workers”. The second leads into several routes towards technical, vocational and service employment. Some schools in this second sector may develop close links with local, regional and national private enterprises to create opportunities for work experience and accreditation of learning in contexts of practice. In the longer term, this may see the main responsibility for education post-14 move from these school premises into work based training with school/college support. However, certification of the outcomes of these developments will remain the province of the state.

ICT provides the technical means to deliver extensive and detailed curriculum materials; down to the level of individual lesson plans, ensuring control over the content of educational material by central regulators. ICT also offers new ways of influencing how that content is delivered and is able to monitor interactions between learner and learning environment for purposes of formative assessment, selection and guidance. This information is also collated centrally to monitor the impact and value of ICT content on learning.

ICT curriculum content is annotated with accompanying guidance to the learner, teacher and parents providing new avenues through which the education authorities can influence the use and integration of ICT materials alongside other teaching and learning activities. It also enables the authors of the material to explain to parents, teachers and learners how the learning experiences offered relate to the personal needs of the learner and to national ambitions and plans for education.

Newly emerging forms of on-line assessment and examination underpin a number of functions -

- They provide intelligence from which value-added measures developed to evaluate schools are derived.
- They provide a primary means for assessing national achievement and information used to demonstrate the systems accountability to the taxpayer. .
- Curriculum content acquires an “audit trail” as evidence about strategies proved to be effective in achieving its learning outcomes are appended to curricula materials.

- Evidence from formative assessment is used, in the longer term, to map assessments of school performance (carried forward in electronic CVs) on to later progress and progression beyond schooling. This evidence is used to test the utility and relevance of educational objectives - a form of learning by society made possible by the impact of ICT.

A learning society of one kind thus begins to emerge. But it is a society that concentrates what is learned around pre-established objectives. Such a system is unlikely to have the means to learn from innovation or from discoveries outside of the goals of its tightly prescribed curriculum.

Teachers

The demands on teachers are considerable. Teachers are expected

- to achieve pedagogical fluency with ICT
- to enhance achievements in traditional areas of schooling (although these will be delivered and partly assessed by unfamiliar, ICT tools and services)
- to embrace and achieve the new educational priorities needed to equip learners for life in the information society.

ICT provides new tools for teachers, once they become fluent in using the technology. However, these tools support only a limited range of functions – these mainly concerned with measured achievements on national tests. ICT provides access to national, professional networks that many teachers exploit for their own continuous professional development in order to support the achievement of the expectations and responsibilities put on them. There is a growth of virtual professional communities and these start to create an extensive evidence base about pedagogical practice for the effective realisation of nationally prescribed curriculum targets. Evidence of membership of these networks and of contributions to them becomes increasingly important as a means of personal promotion and progression for teachers.

Professional international networking is weak in comparison. The attention of the teaching profession in other countries is not focused on educational goals that are relevant to the national curriculum and there are few areas of mutual interest with colleagues in other educational systems.

As ICT impacts on home-school collaboration and opens up new opportunities for learners to push ahead with their learning outside of the school walls, new tensions also come in to play as teachers are faced with an increasing diversity in learners' prior experience relevant to curriculum knowledge and skills. The increased complexity of teaching is also increased by the fact that many find it difficult to achieve the joint demands of teaching for high performance on national examinations and helping learners

to achieve other expected goals in developing motivation, confidence and self-managed learning skills. There are few tools to help them to understand and guide learner achievement in the areas of 'work place attitudes and skills' and the self-management of learning. It is difficult for them, and for the authorities, to discover whether or not the assumption that the pursuit of high levels of achievement in core skills can be harmonised with these other demands.

Such demands on teachers come into play when the prestige of the profession and levels of remuneration compare unfavourably with those in other professional sectors. Teacher recruitment and retention will remain deeply problematic within this scenario unless job satisfaction and/or spending on education is enhanced dramatically (either by the state and/or by the private sector). Frequent initiatives designed to attract and keep teachers will be one sign that the system is suffering from these troubles.

These problems are compounded by the fact that new vocational opportunities appear for teachers as connections between the state and private sectors develop. ICT skills, coupled with closer working contact with the world of work and commerce, opens up new employment horizons for digitally fluent teachers. It is much easier for the non-state sector to offer more flexible and attractive terms and conditions of work since they are not so tightly regulated by the state or by professional bodies. Similarly, schools that prove successful in attracting significant levels of private funding may also wish to weaken links with the state sector and to become less dependent on central funding and control in order to further their own ambitions.

If the state views such increased private sector involvement in educational provision as a welcome source of enhanced funding for education, then such developments are greeted as one means of adding value to the tax payer's 'investments' in schooling.

Learners and Parents

Parents whose children are entering the school system find much that is familiar to them in statements about educational aspirations, curricula and assessment regimens. A majority, particularly among those from the sectors of the population that fared well in the school system themselves, are likely to accept and support these. As children tend to 'inherit' from parents their attitudes towards schooling and school achievement, the pupils coming from this sector are also likely to experience high levels of consistency in the attitudes and expectations met in school and at home. The new approaches to teaching and learning offered by ICT, and the expanded goals of the educational system, are likely to be taken on trust (in the short term). This trust will only be maintained in the longer term to the extent that the innovations are not seen to interfere with children's sense of security, self-esteem and their progress on the more traditional curriculum.

The parents on the right side of any digital divide within the society will be familiar with, and likely to be accepting of, the use of ICT in school. Parents from non-digital households are also likely to welcome the opportunities opened up to their children to learn ICT skills and to become digitally literate. Parents and pupils with the means and

motivation to exploit ICT in the home find many new opportunities to learn. ICT-mediated home-school links, nationally networked interactive educational programmes and other learning experiences are available over the Internet. These provide powerful new means for parents to participate in and to encourage their child's education outside of formal schooling.

One effect of any digital divide on schools (or differences due to parental aspirations) will be an increasing variability in their pupils' readiness for school learning. If schools respond to this variability by trying to hold back the fast track learners, they risk the accusation that they are failing to realise children's potential. If they respond by supporting and amplifying dramatically different rates of progress, they will be accused of inequity of treatment and the perpetuation of inequality.

As schools attempt to change their roles and practices, the additional demands fall not only on teachers but also on learners, who have to –

- Make progress in learning core skills
- Develop competence and skills in self-regulated learning
- Develop skills in team working, communication and other 'vocational' skills

To the extent that the achievement of these different objectives *cannot* be harmonised in a learner's experience they are likely to feel increasingly over-burdened and confused as to what is expected of them and why. If this happens, parents and pupils are likely to start to complain and may create a pressure to return to 'basic' education and the 'old status quo'. This will be compounded by the fact that whilst progress in examined knowledge and skills is clearly defined, formative guidance and summative evaluation in the other areas are non-specific and vague.

Competing demands may come from learners and parents who find more motivating, interesting and useful learning experiences available to them through ICT out of school. This group of 'innovators' start to question the validity and relevance of state schooling. An erosion of trust in schools leads to a movement of children out of the state sector. Alternatively, if the development of core curriculum skills is achieved alongside the development of work place and lifelong learning skills, the educational system may fulfil its aspirations.

Providers of ICT services and content

The existence of a large and coherent domestic market for educational products and services in this scenario creates a healthy context for the educational supply industry. However, the international market is not so open to the industry, given the nationally oriented curriculum and pedagogy of the domestic market.

New forms of partnership between different players from the relevant commercial sectors emerge and it is likely that one or two of these will come to dominate the market. Any

small to medium players will tend to be displaced by or absorbed into the larger commercial groupings.

Collaborations between this private sector and government will be close. The content and pedagogy of educational materials and services provided will have to reflect the goals of government policy and be approved or sanctioned by results on national tests. There may be regular demands by government for the creation of new technologies that can enhance and harmonise achievement in areas of individual attainment of core skills, skills in self-managed learning and work place competencies. The frequency of such demands will be an index of the extent to which the assumption is that skilful teaching can combine the achievement of the three sets of objectives is being challenged by nature.

In addition to new public-private collaboration in the provision of national ICT infrastructure, services, content and user training, new forms of partnerships with schools and with individual teachers may emerge. The identification and marketing of both “teacher stars” in curriculum delivery and innovative schools that have created successful ICT-based educational programmes will be an element of market strategy.

A demand for high quality raw material from which to develop educational content creates other forms of partnerships between the ICT providers and what may traditionally have been publicly financed services in fields such as broadcasting, libraries and museums. The adaptation of the nation’s archives of “cultural capital” to which these sectors have access, coupled with knowledge and capacity to develop ICT networking for schools and with a knowledge of digital pedagogy begins to create opportunities for new careers and professions to take advantage of commercial opportunities. The economic returns from these activities may begin to lessen any dependency on state funding and support for the hitherto publicly funded services. To the extent that this happens, the state may move to a more regulatory role rather than a direct provider of educational services funded from the public purse.

Scenario 2: ICT supports the creation of schools as “learning organisations”

The Political Context:

There is a shared political sense about the general direction of change in education that is needed to ensure future prosperity and well being for both public and private lives. There is -

- Agreement in broad terms about the general competencies and skills that will be needed by the citizen of tomorrow.
- A common belief that investment in ICT will act as a catalyst for change that will finance the new technologies and tools that are vital to support the achievement of the necessary educational innovations.
- Uncertainty surrounding the issue of how the day to day processes and practices of education need to change to meet the needs of the learner and the society of tomorrow.

Uncertainty means that schools must be given the scope and the capacity for innovation in order to become centres of knowledge creation. In short, they must develop a capacity for educational R&D. Schools are the only places in which it will be possible to gain the experience from which to construct and perfect knowledge about learning and teaching. For the time being at least, there are no significant party political divisions to inhibit change. This may not be the case if the promise held out by ICT is perceived to fail or to fall short of expectations (Scenario 4).

One of ethical driving forces behind this scenario is a strong commitment to equity in schools. Politically, this is seen as a vital as a way of enhancing and maintaining social cohesion. Economically, it seeks to ensure a productive working life and prosperity for citizens. Educationally, it seeks to guarantee that every child’s potential and interests will be recognised, developed and accredited.

Schools, goals, curricula and assessment

To achieve these objectives, considerable freedom is allocated to schools so that, while ensuring that all learners achieve defined levels of attainment in core knowledge and skills, provision is sufficiently differentiated to nurture any and all talents and abilities. Traditional forms of assessment and accreditation of achievement remain important,¹ but a need to develop new tools for formative and summative purposes is recognised. The system attempts to “think outside of the box” in order to develop fresh ways of mapping the educational process on to the achievement of educational goals. Much of the

¹ These, depending upon national traditions, may be based on formative, continuous and local documentation of progress and attainment, on summative, discrete and national examinations or on some combination of the two.

responsibility for helping to develop such new forms of accreditation of learning lies with the schools.

The detailed nature of the challenges to be met varies in this scenario. The constraints on change in a system that has been strongly regulated from the centre will differ from those in which much of the responsibility for defining the curriculum, teaching practices, expectations of pupils and the assessment of attainment have been decided locally

One challenge for schools is to co-ordinate demands for high levels of pupil attainment in basic knowledge and skills with a need to inculcate attitudes, motives, competencies and skills in self-managed learning and knowledge acquisition. It is not simply the case that schools face a need to embrace and achieve additional goals and demands. They have to ensure that these are pursued in such a way that, for the learner, these demands do not engender disabling levels of confusion and conflict in the school experience. They are charged with the task of finding out how to do this effectively and efficiently.

A second challenge will be to integrate the pursuit of equity with the differentiation of learning pathways. Documentation of pupil progression and progress, planning of individual educational pathways, and career aspirations, advice and planning will be crucial to success, as will the creation of opportunities for learners and their families to be partners in planning and decision making. The recruitment of support from the wider community as a means of improving the quality of fit between educational planning and career opportunities may also emerge to provide intelligence to guide development.

ICT *promises* to help schools to realise the expectations put on them in a number of ways. Examples of these promises include¹ :

(1) Learning of core knowledge and skills can be made more effective and efficient with the support of ICT tools. Although mastery of such things cannot be achieved without good teacher support, the technology will enable pupils to achieve mastery more surely, reliably and efficiently than was possible with conventional class teaching. By exploiting ICT to support these aspects of learning, two other benefits are promised:

- Pupil autonomy and motivation are enhanced. With ICT and teacher support learners can take increasing control of and responsibility for their own learning.
- The use of ICT frees up more of the teacher's time to act as coach and facilitator rather than class instructor.

(2) ICT provides more authentic, dynamic, challenging and potentially interesting ways of gaining access to sources of information, models and simulations for the learner. It

¹ these are generalised cases based on examples given during the interviews. If necessary, they could be referenced and/or expanded upon by the partners.

enhances the range of ways in which information may be accessed, displayed, manipulated, tested, discussed, criticised, evaluated and communicated. It *promises* both to enliven the learning process and to help in transforming the teacher-learner relationship from one governed by knowledge transmission to one directed at the shared construction, evaluation and communication of knowledge.

- (3) ICT *promises* to provide the means to negotiate access to and opportunities to collaborate with representatives of virtually any sector of the networked national and international community. Learners and their teachers thus have the potential means to exploit expertise, ‘authentic voices’, archives, databases and information about current world events and situations never before available in schools. These provide an unbounded set of opportunities to develop the experience, knowledge and skills considered central to life in the modern world – e.g. in information search and selection, interpretation, reflection, critical evaluation, problem formulation, problem solving, decision making and communication.
- (4) ICT *has the potential* to provide powerful new environments to support effective communication, group work and collaborative learning with peers, both locally and remotely. It enables schools to tap into and to develop a powerful and underused educational resource: the time, energy and intelligence of its pupils. It could facilitate a change of perspective from one in which learners are seen as a consumer to be satisfied (Scenario 1?) to one that regards pupils as a natural resource that may be developed. This opens up new ways of facilitating independent and collaborative learning and provides a means of exploiting the experiences and expertise that learners develop in their out-of-school communities.²

Early indications of progress towards realising this scenario include:

- evidence that the use of ICT in schools for purposes such as those illustrated in 1-4 above is on an upward trajectory. Information would be available within the system to document what ICT tools and environments are being used, by whom, where, when, for how long and towards what ends. ICT, of course, could be designed to trap, process and present much relevant information.
- Increasing signs of flexibility and choice in the missions of schools and the curricula available to pupils.
- Evidence based on publicly recognised and trusted methods of assessment (whether these are undertaken by teachers or through formal, state testing) to demonstrate any enhanced levels of achievement in core knowledge and skills.
- Innovative mechanisms and processes that are designed to identify, celebrate and disseminate examples of innovation and effective practice.
- The development of new tools and procedures designed to support formative assessment and the communication of achievement. These help to evaluate the impact of innovation and to promote dissemination and public understanding. These might include, for example, evidence from the school inspectorate or professional

² The necessity for such activities as a means of bringing the experiences of schooling into closer contact with children’s out of school culture was stressed in at least one interview.

associations of teachers. Schools may also solicit and draw on testimony about impact and significance derived from the local community and/or from teachers and pupils in other schools.

- Piloting and validation of innovative ways of exploiting ICT to build up and to maintain individual portfolios of pupil attainment and achievement that augment information derived from any common assessment tools.

Teachers

Demands on teachers are considerable. They are expected

- to achieve pedagogical fluency with ICT
- to enhance achievements in pupils' acquisition of key knowledge and skills through the strategic use of ICT
- to embrace and achieve the new educational priorities needed to equip learners for life in the information society
- to function as part of a learning organisation able participate in generating, evaluating and disseminating/sharing knowledge about the learning process.

The first three of these demands are shared with colleagues involved in Scenario 1. However, what differentiates the role of teachers in the two different futures is the degree of external specification of educational goals, practices and the means for obtaining and evaluating knowledge of results. The teacher in this scenario will be involved in R&D designed to enhance understanding and knowledge about how educational provision and practice can enhance pupil potential and achievement under the first three bullet points above. Fundamental uncertainties about the way in which changes in school practice and the use of ICT might impact on learning are acknowledged in this scenario, and the task of discovery and knowledge creation become an explicit part of the training, development and professional contribution of teachers.

It is unlikely that knowledge and skills in R&D will form a part of the cultural history of the school, nor are they likely to be acquired during traditional training². The aspiration is that networking with other teachers and with colleagues from relevant sectors connected with education research will support the creation of an R&D culture within the organisation, helping teachers and schools to develop the necessary knowledge and skills to discharge this responsibility. Teachers and schools have ample access to the 'raw materials' needed to study learning. In partnership with colleagues drawn from other educational and professional sectors, and with pupils, they would need to develop a capacity to capitalise on this access to help society to learn about learning in the school of

² the interviews identified one example of a programme to build up research capacity in schools. However, to the best of my knowledge, this was not consolidated into a process of continuing professional development. Any further information from the partners on this point would be extremely useful in assessing the viability of this scenario. It is possible that current developments in INSET are essentially to do with this R&D function.

tomorrow. ICT provides crucial tools both to construct a 'virtual colleague of learning' around the school and to track and collect information to inform investigations into the processes and outcomes of learning and teaching. Such uses of ICT to support the school's role as a learning organisation naturally synthesise with the exploitation of national and international networking to support the continuing professional development of teachers.

What, in the short term, would act as signs and indexes of the fact that a system was being transformed towards this end?

- Schools are making an increasing number of contributions to national and international networks in order to share, disseminate and discuss examples of R&D within the school and in collaboration with colleagues from other schools.
- Portfolios of teacher experience and professional development have been drawn up which include a prominent place for examples of R&D contributions to knowledge of learning and pedagogy.
- Evidence is growing for the impact of school R&D on the development of ICT design and functionality i.e. schools are becoming more informed and demanding consumers of ICT products and services.
- Advanced discussions about changes in teachers' conditions of employment to acknowledge and make space for the time needed for professional development and their R&D roles are in progress.
- Changes in the recruitment of teachers and in the nature of training and professional development are in place to help to prepare and support the teachers of the future for the schools' role as centres for the creation of knowledge.

Learners, Parents and the Community

The radical 'step change' in the transformation of schools demanded to realise this scenario will demand considerable levels of public trust and support. It is easy to envisage a counter-scenario in which innovation fails because change is resisted by combined forces of many well-educated parents, their children, an ageing electorate and conservative forces from within the educational system.

Serious attempts to realise this scenario will, therefore, co-ordinate any changes in curriculum, assessment and school practices with strategies designed to inform, engage and solicit support from parents, communities, the media and the public at large.

ICT plays a crucial role in securing this support and trust. The educational system exhibits as much concern with the flow of information and communication between

schools and parents, school and community, schools and the media and with the wider public as it does with the flow of information within and between schools and with other educational agencies. The success of attempts to involve members of the community in all stages of R&D within the school – conception, planning, implementation, assessment of impact and dissemination – will provide one sign of success in the school’s attempt to build up public understanding and trust.

In common with peers involved in Scenario 1, school will be a different and potentially more challenging place for its pupils that was the case for their parents. As proved true in the past, however, the degree of consensus that the learner experiences in the attitudes, views and aspirations of school, home and community will exert a powerful influence over motivation and commitment. Strong and productive networking between school, household and community will thus be crucial for both maintaining the trust of both the public and the learner.

Providers of ICT services and content

The schools in this scenario will obviously need extensive ‘generic’ ICT infrastructure together with the means to maintain and upgrade this. Unlike the schools in Scenario 1, however, who would create demands for similar ICT content and services approved within a nationally laid down curriculum, schools here would have more differentiated requirements, demanding a more ‘bespoke’ market.

The schools will become progressively more discerning, demanding and explicit as consumers. The demands on schools, teachers and learners outlined above identify several ways in which ICT tools will have to play a vital role in helping them to realise national and individual ambitions for education. Many of these tools, and their integrated use within the schools’ system of knowledge management, would demand sustained, individual collaboration with partners in the ICT educational supply sector. This situation might favour the creation or maintenance of a large number of SMEs in the sector, rather than foster the emergence of a few large providers as in Scenario 1.

As in Scenario 1, schools will create a demand for high quality raw material from which to develop educational content and one major source will come from the adaptation of national archives of “cultural capital”. It is possible here, however, that the development of the knowledge in how to exploit such resources for educational use develops in the partnerships that grow up between schools or networks of schools and their partners in the ICT sector.³

³ Here too, the interviews provided examples of this starting to happen. It might be useful to have any additional instances from partners to demonstrate the plausibility of this development.

Scenario 3: Citizenship at the Centre: ICT supports the emergence of schools as core nodes in their communities

The Political Context

This, the most radical of the scenarios, develops in a national context marked by generous economic investment, historically high levels of public confidence in the state school system and a tradition of de-centralised responsibility for curriculum planning, assessment and accreditation of learning. It envisages a school system, five years or so down the line, that has committed itself to the view that, for all students, developing confidence and competence in their own ability to learn is the primary objective for schooling¹. The development of “competent citizenship”² is also raised from its traditional status as an implicit goal of schooling to form a second, primary function.

The central education authorities identify and monitor evidence of progress as schools move to realise the new vision, identifying promising innovations that it celebrates and disseminates. ICT provides the new infrastructure and tools needed by the authorities

- to establish and sustain the extensive networks with schools and communities needed to gather new forms of intelligence in order to monitor, regulate, evaluate and defend the system.
- for collaborations with the tertiary education system, training and employment sectors that have identified the criteria used to monitor and assess the impact of educational innovation on learners’ prospects and progression beyond the years of schooling.
- to communicate with the media and the general public. These functions complement the local and regional collaborations between schools and their communities in efforts to engage the public at large in decision making about the objectives, design and evaluation of their educational system.

The intelligence gathered from schools, communities and ‘next destination hosts’ is integrated, interpreted and used to sustain a level of national coherence in provision and a shared vision of educational innovation.

Schools, goals, curricula and assessment.

Decisions about the actions to be taken by schools to achieve national objectives are decentralised to a local level. Schools must balance and satisfy the demands of learners,

¹ Swedish partners in the interviews made it clear that this objective is already a national priority and one that pre-dated current innovations with ICT.

² Such an explicit emphasis on citizenship was underlined in the interviews held in Denmark, Holland and Sweden.

parents, local communities and the national inspectorate regarding their performance in achieving the aims and objectives of education.

Schools have re-engineered the educational process to meet national goals for independent learning and citizenship. Their students are expected to develop a critical, reflective and strategic approach to the regulation of their own learning. The aspiration for all is that they will pass through formal schooling with a confidence in their own capacity to learn and leave armed with the motivation and ability to recognise and meet their own future learning needs. They will also develop attitudes, values and knowledge that will enable them to function as responsible and responsive citizens. ICT provides the tool kit they need to support the achievement of these objectives.

*Investigative, problem based learning*³ has become central to the curriculum and this has led to fundamental changes in the way in which schools function as organisations and in the nature of their relations with the wider world. Learning activity is focused on real and unresolved issues and the identification and exploration of problems that offer authentic, real world relevance and significance. The issues selected are judged likely to arouse public interest so that the school's publication of new findings, insights and discoveries will demand attention. The local and the wider community are directly involved in setting the agenda for investigative learning. Pupils are actively involved and share ownership of all processes; planning, execution and evaluation.

The change in pedagogical focus has led to dramatic changes in the use of time, space and human resources both within and outside the school gates. Defining features of investigative learning include -

- learning activities are extended over long periods of time. The processes involved move from problem definition through to published findings and require active time management by all concerned. A system based on rigid timetables and space allocation was not able to meet these demands, so school management has changed to support the greater flexibility needed.
- collaboration takes place through the stages of issue identification, problem definition, the search for evidence, problem solving and evaluation. Schools have developed new forms of collaboration within the school and learners and teachers identify and make extensive use of knowledge and expertise drawn from the community and beyond. ICT designed to support these functions lies at the centre of innovation.
- evaluation of what learning achieves has led schools to develop innovative methodologies for assessing the impact, costs and benefits of investigative learning. These involve pupils and teachers in the collection, analysis and interpretation of evidence solicited from other schools and communities (who act as assessors) to help to document the quality of the

³ Although this term was not used in the interviews, the aspects of learning activities to which it refers often were and examples of community-based project work along the lines envisaged were outlined in the Scottish interviews.

work they have produced. Thus, many voices contribute to the continuous process of assessment and, hence, are also recruited into the process of innovation and change.

- the assessment of individual contributions to, and benefits from, investigative learning demands attention to issues of fairness and credit assignment. Pupils learn to evaluate and document both their own and each other's contributions to the collaborative effort. Portfolios of achievement based on such evidence augment traditional forms of assessment in the accreditation of learning.

ICT thus supports each school as it strives to become a hub for the community whose children it serves. Learners are re-conceptualised as an asset and a local resource that can be recruited to undertake problem-based activities of concern and benefit to the community and beyond. They are not only dependent, customers of education but junior citizens who are 'time rich' and energetic and who have access to a powerful and previously under-used infrastructure of material and expertise. Their contributions challenge all pupils to learn how to tackle complex and realistic problems; with opportunities for the management of their own and their group's learning. They also provide a way of engaging with the community in order to build up trust, co-operation and a positive view of the value of schooling; with opportunities to contribute to life in society and demands for communication and public presentation.

Teachers

The need to slim down the formal curriculum in order to create time, space and opportunity for investigative learning has motivated a sustained debate about the nature of *necessary* knowledge. Teachers and schools have had to identify the body of generic knowledge and core skills that all learners need to be able to adapt to and prosper as a member of the emerging society. This constitutes the common curriculum.

Teachers have built up a new body of pedagogical knowledge to address two key issues. When and how can schools exploit investigative learning to help to motivate interest in the learning of generic knowledge and core skills? When is a mastery of such knowledge and skills itself a necessary condition for effective participation in investigative learning? The integration of traditional forms of teaching with investigative activity is still a key pedagogical issue but knowledge and understanding are increasing. Professional networks have supported the creation of extensive, purpose-designed archives of evidence-based case studies from which general pedagogical principles have emerged. International networking is also growing in volume as this educational system, and its progress, becomes a centre of international interest.

The demands made of teachers have underpinned a dramatic growth in the use of technology to create and promote professional development. As ICT has become mission critical, most teachers have developed significant levels of digital fluency in the pedagogical exploitation of technology. On top of their traditional functions of teaching,

assessing, coaching and pastoral care, teachers have developed new motives, knowledge and skills in investigative learning and in collaborative working with colleagues inside and outside of the school. Offsetting some of the increased demands, greater community involvement, coupled with increased exploitation of Web-based access to support, have served to augment the resources available to teachers. The teaching profession is starting to differentiate and specialise in response to the expectations and demands put on it. A need for new contractual arrangements to support this process of evolution is widely accepted inside and outside of the profession. Recognition of the contribution of the wider community and access for schools to a greater diversity of expertise in supporting education also leads to the emergence of new career pathways linked to educational provision.

Learners, Parents and Community

The maintenance of parental confidence and trust is accepted as a vital requirement during such a period of radical change. For parents, innovation means that their own experience provides an inadequate guide to understanding, supporting and assessing own child's school experience. The emergent, new roles that are being opened up for parents in the educational process have to be articulated, illustrated and disseminated. Supporting voices from the media, future employers and those in the tertiary education sector need to be raised in support of what the schools are trying to do. These strategies, coupled with the community-based practices of schools, are formulated with the clear aim of convincing parents of the need and potential for innovation.

In the community, those in work, the 'time rich/work poor', and those retired from full employment have new opportunities to contribute to the planning, execution and assessment of the schooling process. These groups are also a focus for policy action at national and local level. Evidence is collated from communities regarding their assessments of the significance of what schools are achieving. Testimony is also assembled from the 'next destination hosts' of learners about the relevance and value of what students are gaining from their schooling. The dissemination of this information forms an important element in the strategies designed to win and keep public hearts and minds. ICT and the media provide the routes and tools to implement these strategies. The technology is designed to co-ordinate the tasks of providing public information and building up public confidence with the activities and achievements of schools.

Providers of ICT services and content

A heavy reliance on local, national and international networking creates an overwhelming need for common standards to underpin the provision of educational technologies. This education system will thus be in the forefront of demands for coherent and consistent international protocols and standards. The maintenance of the national learning-network 'backbone' will fall primarily to the state, which is likely to enter into national

agreements with service providers. The need for customised ICT tools to support the central educational authorities in processes of communication, intelligence gathering, system monitoring and evaluation will also generate a need for national public-private partnerships to create common protocols to sustain the networking with schools, communities and the other relevant sectors of society.

The highly de-centralised nature of education will also create a need for customised services. Sustained partnerships between schools and service providers will emerge. It is likely that a strong sector of small enterprises will grow up to provide the community-specific support needed. The functions supported by this sector will include –

- the design and implementation of the tools, databases and archives needed to scaffold investigative learning;
- the development of new ICT tools to support the documentation of learning and the creation of profiles of experience and achievement;
- services to link home and community that are designed to support collaboration and dissemination.

Scenario 4: ICT fails to deliver: Technology melts down

This scenario is designed to identify and discuss indicators that, in five years time, could act as signals of the fact that a school system is failing to gain the expected benefits from ICT and that the public school system is in trouble.

1. A lack of clarity in the formulation of educational policy and its objectives.

Despite a constant pressure on teachers and schools to change their priorities and practices in response to the opportunities opened up by ICT, *there is little evidence that the process of policy making itself has been modernised enough to meet the challenges of reform.* Policy formulation and its realisation remain too slow, too risk-averse and too ‘departmentalised’ along traditional lines to meet the challenge of educational innovation. This is signalled by the fact that no one person or clearly identified group has been empowered with sufficient influence and responsibility to lead and co-ordinate action. As a result, policy objectives, and their implications, have not been put forward with the clarity of vision needed to capture the imagination and commitment of the 17 different sectors of society whose active participation in innovation was needed for success¹.

2. A failure to document and demonstrate real progress towards the achievement of the new goals for education.

The THINK interviews identified five key areas of learning and educational achievement that, it is intended and hoped, can be enhanced by the impact of ICT on schooling². It was necessary to initiate educational innovation in the absence of any compelling evidence that any of these promised effects could be guaranteed. Large-scale, system wide and ‘mission critical’ implementation was necessary to provide a means of evaluating the promise of the technology and to identify the conditions for its successful educational applications. For this process to succeed, the educational system had to become a ‘learning system’, and for this it needed to achieve both a broad consensus about national ambitions for the future and generally acceptable indicators for monitoring progress towards the achievement of these ambitions.

In five years time, on this scenario, a lack of clarity about the expected nature and magnitude of the expected benefits from the technology, coupled with an absence of any compelling evidence for its impact, act as signals of the fact that attempts at reform are floundering. *The political consensus that supported the investment in ICT for schools is starting to break down.* The introduction of new priorities for learning with ICT needed to be linked to ways of using the technology to provide feedback and guidance to

¹ This list, derived from the THINK interviews, is summarised in Appendix 1.

² these are listed in Appendix 2.

learners, teachers, parents and policy makers about the achievement of the new priorities. This need has not been met.

3. The mismanagement of expectations: A miscalculation of the magnitude of the challenge of educational re-engineering with ICT.

The magnitude of the gap between achieving a ‘proof of concept’ which serves to demonstrate the potential impact of ICT on learning, and the time needed to re-engineer schooling and teaching to realise this potential proves to be far greater than early innovators had imagined. *As a consequence, political and public expectations about when society should expect to see evidence of obvious benefits from investment in ICT have been over-inflated.* The demands on teachers and schools as they set out to discover how to appropriate, use and reap benefit from the technology require a re-structuring of their own thinking and practice about learning and teaching. This process takes longer to satisfy than anticipated and is certainly not perfectible within 5-10 years. For teachers, each of the five potential uses of ICT to support learning³ requires extensive, direct experience in practice, and this experience has to be gained in a context of constant technological change and innovation. Processes designed to promote the professional development of teachers are not extensive or robust enough to support them as they try to discover and develop the new pedagogical expertise. *This endemic and structural problem is signalled by ever more frequent attempts to direct new training initiatives at the teaching profession, by increasing complaints in the media about “ICT hype” and growing demands from the general public for a return to more traditional values and practices.*

4. A widening gap opens up in indicators of educational accomplishment

As educational innovation proceeds over the next five years, the demands and responsibilities placed on learners increase. In part, this arises as an intended consequence of innovation. However, it also results from the fact that learners are developing in home and school environments that embody less relevant experience and expertise about learning than has been the case historically. Unlike their parents or their teachers, children of the near future will be schooled in a society that has not shared significant aspects of their educational experience. As a result, informal and formal support for learners who find it hardest to learn in the ICT rich school of tomorrow will be less robust than was the case in yesterday’s school. Households with the motivation and the means to complement their children’s learning by exploiting open access to opportunities to learn will also tend to increase inequalities in children’s educational opportunities and support. *These forces will result in increasing diverse rates of progress and achievement in schools, re-fuelling long-standing debates about the origins and causes of differential educational achievement.*

³ see Appendix 2

5. The provision of ICT infrastructure exceeds society's willingness to pay

Calculations of the 'true cost' of maintaining an up to date technological infrastructure for schools and in providing for the development and continuous training in its use have been under-estimated. The pace of technological change and the associated costs of upgrading, coupled with a need to build into the system enough redundancy of provision when ICT becomes truly mission critical, made it impossible to calculate or anticipate true cost. On this scenario, these turn out to be far greater than anyone had anticipated five to ten years earlier.

Attempts to cover increased costs by greater contributions from the private sector through new forms of public-private partnership have not worked. Even the larger European countries proved to be too small to provide a substantial enough market to underwrite the long-term investments needed. National jealousies and protective practices regarding the regulation of education effectively militated against the identification of common educational functions that could be developed jointly and served by the technology. Consequently, Europe is failing to create the market conditions under which a viable educational ICT supply industry might be developed. *Increasingly, the school systems are resorting to supporting learning with re-worked US software, rather than driving the development of a commercial sector of their own.*

APPENDIXES

NB to Roger et al: The contents of Appendix 1 and 2, taken in combination with the “axes of tension”, represent analytical outcomes from the THINK study. They also provide a framework that we could develop to create a “do it yourself scenario construction kit”. It would be possible to develop these appendixes and the axes document to create a user friendly and intelligible set of practical guidelines for use by policy makers and school authorities wishing to think through and discuss their own objectives, aspirations and plans for the future of ICT. Such guidelines would be designed to enable users to identify potential constraints, barriers and levers likely to act on any attempt to innovate and to help them to articulate implications for action and for monitoring and demonstrating progress.

Appendix 1

The list of 17 sectors of society identified from the THINK process is -

- **‘internal’ to the policy making process:** includes what may be independent offices responsible for –
 - curriculum development
 - assessment, examination and accreditation
 - school inspections
 - teacher training and development
 - collaboration with trade and industry
 - fiscal policy and taxation
 - law, rights and obligations of citizenship

And ‘externally’ with

- any relevant regional and local agencies who share responsibility for any of the functions listed above
- schools and their management
- teachers, their unions and professional associations
- learners and parents
- the education supply sectors
- “next destination hosts” including tertiary education, training and employment sectors
- any relevant, special interest groups (e.g. based on religion or ethnic background)
- non-public school sector(s)
- the media
- the general public and the taxpayer

Appendix 2

The five main, potential functions of ICT in supporting the learning process identified from the THINK interviews are -

- (1) Procedural learning – ICT is already being used widely in some countries to replace textbooks, work sheets and pencil-and-paper based drill and practice activities with on-line, adaptive, interactive software that is designed to maximise the quality of the fit between individual learning needs and lesson design. This should make the learning of procedures and rule-governed activities more motivating, less confusing and more time efficient.
- (2) ICT can be exploited to help learners to develop more robust conceptual understanding, greater flexibility of reasoning and an enhanced capacity for knowledge application. This is the case because ICT can be exploited to link dynamically, and to model, different perspectives and representations of information. This enables information to be externalised, envisaged, shared and discussed in entirely new ways. ICT thus promises to provide environments for both individual and group learning that will help to avoid superficial, piecemeal and rote learning, underwriting the acquisition of more integrated knowledge structures.
- (3) ICT provides a natural vehicle for supporting the development of new ways of learning and thinking that are needed to operate and prosper in the information society of tomorrow. Environments and activities for individuals and groups can provide for complex learning demands involving multiple channels of information, non-linear organisation, dynamic operation and complex interactions. These will help to harmonise the experience of learning in school with the demands of experience and life in the information society
- (4) ICT and the access to archives and databases that it provides creates necessary opportunities for learners to perfect self-directed and self-managed activities involved in search, retrieval, representation, critical evaluation and applications of information. The acquisition of these competencies and skills is vital for life long learning and for work in the knowledge economy.
- (5) As multi-media tools have been integrated with communications technologies extensive new opportunities have been opened up for learners to create, disseminate and help to evaluate products approaching professional standards of presentation. Communications technology also brings learners and their products into new relationships with a wider audience. This is creating demands for the invention and learning of new maxims to govern productive and morally acceptable inter-personal communication, knowledge and skills in personal responsibility and self- protection

and with new genres of digital literacy. Local, national and international learning networks are vital in providing learners with a chance to acquire and perfect these skills that will be a necessity for the responsible and productive citizen of tomorrow.

SECTION 3: THE THINK FRAMEWORK

Introduction: The THINK project

International concern about the impact of ICT on the development of schooling has been running at a high level for some time. One sign of this is the number of publications that have emerged over the past few years each laying out and exploring scenarios designed to answer questions such as "What might education for the 'knowledge economy' or for the 'information society' of tomorrow look like?" Scenarios have been published by a variety of national and international agencies, usually looking forward over the next two to three decades.

These exercises often envisage multiple scenarios bounded by two main, competing visions. In one, state-provided schools come to the end of their useful lives within the next 20 years or so, atrophying and giving way to new structures and processes that are better able to equip the young to meet the demands of life in a fast changing world. On the alternative view, school systems get stronger and more effective by identifying and capitalising on the opportunities and challenges opened up by the effective exploitation of ICT.

The brief for the current exercise is also to construct scenarios, but for a much shorter time horizon (3-5 years) and with a specific focus on the exploitation of ICT within schools designed to enhance and strengthen public school systems.

A luxury in laying out scenarios for the long-term future, which is not open to those seeking less than 2020 vision, is that it is possible to proceed without making strong connections between the way things might be and the way they are now. In considering potential for innovation for the short term, the intention here, it is necessary to pay more attention to relevant aspects of current practice and its potential for change. To make this approach feasible, it was necessary to inform the scenario building process with specialist and local knowledge about educational policy and practice relating to ICT. The current exercise was informed by the views and visions expressed by a specialist group of partners drawn from members of the European Schools' Network (EUN). The selection of participants by the EUN was designed to provide intelligence about the current situation in several national contexts and about contemporary, informed thinking concerning the immediate future regarding educational policy and ICT within the participating EU states.

Existing scenarios are concerned with trying to envisage how developments in ICT may impact on the future shape of society. The current exercise has to be equally sensitive to the issue of how the history and shape of a society impacts on the way in which it sets out to exploit the technology. Although the countries participating in this exercise share their most fundamental values and beliefs about society and education, they are pursuing the

achievement of these by means of distinctive institutions and practices. Such differences matter here because these institutions and practices will clearly constrain the way in which a society can expect to promote, identify, celebrate, consolidate and disseminate any attempt at educational innovation. Responsibility and control for the direction, delivery, management and assessment of educational provision and performance vary significantly from country to country. It follows that different school systems may well have to travel individual routes to the achievement of successful innovation – even if they share common aspirations and an agreed vision of how educational provision needs to change in the medium to long term.

The partners who gave their time to this project come from educational systems that are at different stages in the process of developing both the ICT infrastructure and the human resources needed to support innovation and change. These differences will not be a major focus for this report. The exercise was explicitly designed to *exclude* a strong focus on infrastructure, which has been the topic of so many current surveys. The brief was to "imagine that you have all of the ICT infrastructure for education that you may need. What are you going to do with it (and why?)?"

Although the THINK project was designed to adopt a focus on possible transitions from present to near future, I have tried to develop an approach that will provide a way of mapping scenarios about the possible short term impact of ICT policy onto those concerned with longer term vision. I have done this by exploiting the scenarios advanced by the OECD (main refs). The aim is to consider where, looking ten to twenty years in to the future, decisions about how to exploit ICT in the next few years might be leading us. For example, do some combinations of initiatives for changes made now seem destined to result, in the longer term, in promoting the emergence of schools as “learning organisations?” Or do they seem more likely to lead to a reinforcement of the status quo and the enhancement of centralised control over the process of education? In either case, are any such destinations in harmony with long term policy aims and with national aspirations?

A note on Methodology

This report is not based on a scientific study. The main sources of information used are responses from face to face interviews with key members of the education ministries and agencies from Denmark, France, Holland, Portugal, Sweden and the UK. The interview schedule, reproduced in Appendix 3, was intended as a stimulus and guide to thinking about current and future prospects for education, in particular, its response to the potential and the demands of ICT. Each interview, as intended, developed its own dynamic. The depth and detail in which specific areas were covered varied from partner to partner. Thus, the information for this report was not collected as a basis for a systematic, comparative analysis of educational practice in the partner countries. Rather, the aim was to solicit a variety of views and perspectives from the partners to help to inform the construction of the THINK framework document and its scenarios

Scenarios are not an exercise in prescription or recommendation: They do not attempt to spell out desirable futures. Nor are they a descriptively accurate portrayal of the current or likely situation in any one country. They are not predictive either, since the processes they seek to illuminate are simply too complex to model. Rather, their aim is to try to identify and explore the complex of factors that seem likely to shape the future, and to speculate and illustrate how some of the potential interactions between these factors may influence the ways in which the future unfolds.

FRAMEWORK:

ICT, cultural values and educational aspirations

Both the "people processing" and the "culture processing" expectations of education have changed in each of the partner's countries in response to the commonly perceived demands of a new World order. The challenge now is to clarify, articulate and realise what these demands mean for the organisation and practice of schooling.

Everyone interviewed subscribed to the view that their educational systems and some of their schools are already innovating and must continue to innovate and reform. It is necessary for school systems to re-define and clarify their roles, responsibilities, organisation and practice in the context of global economic, political, social and personal change.

The exacting and expanded demands on education highlighted in the many scenarios and consultative documents currently circulating around the world seemed to be taken as givens by the partners interviewed¹. They include, inter alia,

- the changing nature of what it means to be a good and competent citizen in response to ICT and globalisation. Schools must be transformed to help to foster the safe, secure and responsible citizen of tomorrow
- fostering in the developing child the attitudes, motives, competencies and skills they will need to equip them for a life of change, learning and re-training
- the challenges to be faced and met in order to enhance social cohesion and to eradicate social exclusion in response to the pressures of economic globalisation
- developing the new base of knowledge and skills needed for national competitiveness in the global economy
- arming all learners with adaptive workplace attitudes skills and competencies as well as enhanced core knowledge and skills
- quickening in the citizen of tomorrow the desire, ability and skills to participate in the democratic process.

¹ this is open to challenge! Even if it is true, we have to bear in mind that the interviews were conducted with people who are deeply and personally involved in this area. This should not be read to imply that everyone involved in the educational systems would necessarily know of or subscribe to these views.

These demands on the schools of tomorrow were seen as imperatives, not options.

In relation to the THINK exercise, the specific brief of the interviews was to identify and explore the roles that ICT can play in helping to meet this challenge. What opportunities need to be seized or created with the use of the technology to support looked-for educational innovations, and to strengthen the systems of state schooling?

ICT, acknowledged as one of the main drivers of the changing world order, was also seen as a principal means of motivating and achieving the challenges demanded for educational change. ICT infrastructure has already helped to underpin and is continuing to underpin efforts to secure both national and EU funding for educational innovation. It is serving to motivate and focus international, national, regional and local participation in debate and action about the fundamental issues just listed. It provides essential tools that promise to provide learners, households and schools with the motivation and the means to make possible the looked-for innovations.

A threat from ‘globalised education’?

In tandem with the new opportunities opened up by ICT come anticipated challenges and threats that were also a focus for the interviews. One of these was the potential threat to national values, social cohesion and social inclusion opened up by the capacity of the technology to bring foreign influences to bear (specifically from USA) on socialisation and education. Here, attitudes expressed by the partners interviewed divided and diverged.

Denmark, the Netherlands and Sweden have a longstanding tradition of well-documented achievement in multi-lingual competence amongst their citizens, and the level of national competence in English as a second language is high. Each of these countries has a long history of adaptation to the influx and impact of foreign media on their populace, and each recognises the importance of maintaining and enhancing the second-language competencies of its citizens. Access to the 'virtual culture' afforded by media and the Internet offers an important means for motivating their young - typically from an early age - to develop their second language competence - often before they even appear at the gates of the school.

Because these countries have a long history of adapting to and exploiting such linguistic and cultural incursions into the everyday of their citizens, there is a wide-spread and endemic capacity in homes and in schools to exploit them towards beneficial educational ends. For example, discussion, debate and reflection about the origins, sources, content, meaning and values implicit in extra-national sources of information provide opportunities to cast one's own assumptions, practices, values and beliefs into relief. *The impact of ICT in such national contexts serves to provide new and more motivating routes to support the development of linguistic competence, to an enhanced sense of citizenship and to a more active participation in critical thinking about alternative World views.*

The long history of national adaptation to the incursion of foreign influence which characterises this caricature of the situation for Denmark, the Netherlands and Sweden creates but one context with respect to the potential and desired impact of ICT on educational goals and practices. For the partners from the other countries the situation is quite different. Competence in English as a second language for purposes of education, everyday cultural life, domestic economic activity and the national place in the world for countries like France, with larger populations and different economies, have not, historically, been such a crucial requirement. *Thus, whilst for each of the countries ICT opens up new opportunities and challenges from educational globalisation, the nature of these differ fundamentally from country to country.*

For partners from both France and Portugal another dimension of the issue of mother-tongue provision in ICT content and services was raised in the THINK interviews. Both countries, like the UK, have long fulfilled the function of providing educational content and services to other countries throughout the world. *Europe, with its variety of languages, cultural archives and world views, has an important role to play in providing access to educational content and pedagogical materials for speakers of languages other than English and in the expression of world views other than that of the USA.* We need to underline the potential contribution that European educational innovations with ICT can make in helping to overcome the international digital divide. As both Portuguese and French partner observed, their own country has a duty to supply educational access to materials for the school of tomorrow, in the mother tongue, to Portuguese and French speakers World-wide. The Portuguese partner also highlighted a responsibility to offer services to Portuguese language publishers and authors in other countries. Similar roles for Europe, including, in the words of one of the Swedish partners, the "small but beautiful" contribution from countries with relatively small populations and multi-lingual skills were also envisaged in the interviews with colleagues from Denmark and the Netherlands.

All of the partners, notwithstanding their national needs with respect to second language learning, or their stance on the majority values portrayed in the media and on the Internet, expressed a common view. *Any exploitable non-domestic ICT products and services would need to be tailored at a national level to reflect the values of their own educational systems.* Much of the content of the Internet embodies values that are at variance with national sentiments about education. For example, partners from Denmark, the Netherlands and Sweden expressed confidence in the fact that their teachers, parents and pupils would reject the educational practices embodied in much of the ICT content and available for "e-learning". The UK partners, although expressing the view that cultural tolerance was high for US products and services, also saw that domestic adaptation to the demands of the local educational market was necessary.

I found no enthusiasm for the idea that Europe should adopt what one partner termed a "single major competitor" stance in relation to the US with regard to ICT products and services. The products and services of no single country, nor of any one educational system, could provide for the needs of all: There is no prospect of "one size fits all" ICT

provision for education. Although important roles had and could be played by the EU in the ICT arena, the "single major competitor" vision was neither a feasible nor a desirable option. Since the discussion of national and European-wide ICT roles intersected with those about relations between public and private sectors, the ideas, views and potential initiatives that could be taken to enhance the future of schooling with ICT will be developed further in a later section of this report.

The digital divide, digital non-literacy, illiteracy, literacy and fluency

It was not a part of the THINK brief to attempt to gather facts, figures and arguments about the relative levels of ICT infrastructure in the partner countries. However, given national differences in the "starting dates" for building up ICT in schools, levels of investment and progress in building that ICT infrastructure, and significant variations in the proportions of "digital households", it was to be expected that such differences would surface in interviews. The issue of access to ICT emerged most often in discussions about the digital divide and its potential for impact on social cohesion and exclusion, and on opportunities for learning and training. Although the partners in the interviews were asked to put concerns about infrastructure to one side, they were also asked to consider policy options and actions for the next few years; not to gaze into blue skies. Clearly, it was difficult for some partners to square this circle of constraints.

There is one perhaps self-evident point to make about infrastructure and innovative potential for education (in schools and beyond). They do not occupy a simple linear sequence. Innovations in the professional development of teachers and the creation of schools as knowledge producers can and does occur in advance of universal networking for schools; though not at a system level, obviously. For example, in Portugal, the partners reported serious limitations in the ICT infrastructure in homes and schools that constrain progress towards the achievement of their vision of the education of tomorrow. Their creation of "Competence Centres" (see the section on ICT and Teachers) as an innovative approach to promoting and supporting innovation in teaching and schooling offers a model of how to realise the potential of ICT to enhance educational practice, not least for those addressing the international dimension of the digital divide.

A concern expressed by one of the UK partners, about balancing priorities between expenditure on ICT for schools with that spent on adult training in the creation of more digital households, also raises issues of national and trans-national importance. These include up-skilling of the populace in ICT capacity and the relative effectiveness of other than traditional schooling as a means of addressing the digital divide and the pursuit of enhanced social cohesion. One UK interviewee raised and addressed contentious issues about the relative "value for money" in the investment of ICT for schools versus other areas for expenditure in creating his nation's ICT skills base. The vexed and complex question of value for money is developed further in the section on Curriculum and Assessment.

Without exception, partners expressed the view that digital literacy was a sine qua non for modern life, and that the achievement of universal levels of digital literacy was a non-

negotiable goal for education. What it will mean to be 'digitally literate' in even five years time will differ from today, however. A shared view was that the achievement of technical skills with ICT was not to be equated with digital literacy. Beyond literacy lies digital fluency - including the ability to understand when, why and how ICT is relevant and useful to the demands of particular contexts and situations; this should be the goal for schooling.

Another frequently expressed concern about the effective use of ICT in schools was the nature and the incidence of what could be termed "digital illiteracy". This is not attributable to a lack of access, exposure and opportunity use ICT - digital non-literacy. Rather, it refers to a set of concerns about a minority of learners (suggested figures ranged between 10 to 20%) who, though perhaps technically competent with the technology, are not motivated or able to exploit it to support their own learning. This may apply either to learning alone or through group work. The identification of this minority was always accompanied by the view that they had a particular need for additional support and guidance from the teacher. As to the nature and identity of this group, I found no obvious shared, defining criteria expressed by the members of the THINK group.

Given that the achievement of large-scale and enduring exposure of large populations of learners to ICT is such a new phenomenon, it is inevitable that we are only just beginning to gather intelligence about the potential of the technology for such putative, differential impacts on specific groups of learners. The absence of any intelligence does mean we cannot rule out the possibility of a potentially negative impact of ICT on equality of opportunity and access to lifelong learning for a minority. A more focused consideration of the possibility of digital illiteracy could be a useful contribution from members of the EUN. It is hard to see how, if schools are not charged with the task of helping to identify such potential problems, we will be able to find out if they are real or not. This is a concrete example of the potential of schools as "learning organisations" taken up in the scenarios.

The issue of digital fluency and the nature of digital illiteracy are issues for which a more in-depth and considered analysis would be timely, promising a significant contribution to planning for the exploitation of ICT in schooling.

Powerdrill or Thermometer: What kind of "tool" is ICT?

The meaning of the term digital fluency is also bound up with the most general phrases I heard in the THINK interviews about the role of ICT in learning and teaching - "ICT is a tool" or "ICT is just another tool". The question is "*what kind of tool is ICT?*" Is an analogy best drawn with a "powerdrill" that serves to amplify performance over that delivered by pre-existing tools? Is ICT simply a way of accomplishing old functions in more powerful new ways? Or is it more akin to the thermometer; a tool that served to revolutionise concepts and systems of thinking about the physical and biological worlds and the thermodynamic relations between them? (see Appendix 2 of Section 2 in addition to the following).

ICT and teachers

Teachers were in the forefront of almost everyone's thinking and in the front line of reform. One reason why the phrase "ICT is just a tool" is so common is that it embodies a rejection of any belief that ICT or 'e-learning' can produce 'stand alone' solutions to the demands and needs of schooling. None of the participants in the THINK interviews placed any credibility in this belief, and all saw new vital and challenging roles for teachers (under a broad meaning of that term). ICT demands teacher "up-skilling", not de-skilling or redundancy. *The identification of the knowledge, skills and competencies of the teacher that need to be raised and inculcated into the school system is a key requirement in realising the potential of ICT for the future of education.*

Innovative teachers, schools, communities and authorities (a focus for the NOW study) provide an "existence proof" for the positive impact of ICT on learning and teaching in school. I was provided with many such examples during the interviews. These cases provide the evidence to demonstrate that claims made for the potential of ICT have plausibility. They are demonstrating the kinds of innovation that is possible in some of the schools of today and have to be realised in all of the schools of tomorrow. The challenge for educational systems, as everyone in the interviews stressed, is to ensure that the motivation, commitment, attitudes, knowledge and skill displayed by these innovators is communicated to and inculcated in the majority of their peers, some or most of whom are resistant to change (the only guesstimate I was given was of 30% innovators and 70% conservatives).

ICT is being exploited by all of the partner countries to revitalise and reform teachers' professional development. There was a general recognition that basic skills in the use of ICT, such as the competencies encompassed by computer driving licenses, were not designed to meet the demands of the profession. As with the concepts of digital literacy and fluency more generally, the concept of ICT pedagogical skills demands a knowledge of when, why, how and in what circumstances the technology can be used for specific educational purposes. As one of the French partners observed, however, what one often finds in schools are uses of ICT for specific, often cosmetic and mechanical applications of the technology to existing practice.

This exploitation of the technology to enhance training and continuous professional for teachers integrates the pursuit of a number of objectives –

- *ICT training in 'basic skills' and in-service training (INSET) have provided a crucial impetus to change, experimentation and innovation in national systems of initial training and INSET.* The fusion of ICT with new approaches to professional development represents a transformation of attitudes towards training and a vital step

in providing teachers with an introduction to the power of the technology for their own learning and that of their pupils.

- ICT is being exploited to enhance access to course material and expertise in both initial training and INSET. Such materials are, in principle, available anytime and anywhere and can be continuously updated and augmented by a variety of authors, including the trainees themselves.
- National and international networking with ICT has made possible the creation of groups of teachers and teacher trainees both within and across schools, sometimes networked with identified external sources of expertise, to support and exploit group-based methods for professional development and teacher learning.
- By participating in networked and in group learning teachers gain first-hand experience of the learning potential and the demands of the technology for both private study and in collaborative learning. This experience should provide an experiential base to inform their pedagogical attitudes and practices in the school - whether in single teacher classrooms or in teacher group contexts.
- *ICT has the power to transform attitudes to what training means and to take attempts to "up-skill" teachers away from a transmission model of 'training' to a create a truly continuous basis for professional development.* The objective need for an exclusive or primary reliance on timetabled, tutor-led, short-term, fixed duration approaches to training passes away with the advent of ICT.
- *The extent of the new demands falling on teachers and the speed of development of the pedagogy of ICT are such that traditional models of training delivery cannot be expected to keep pace. Continuous professional development, such as that being developed with the use of ICT is a necessity not an option.*

As with all propositions about the potential of ICT, these stand in need of test and proof. However, the THINK interviews demonstrate that action has replaced imagination and speculation has given way to practice. There were indications from the interviews that some partners have or are obtaining preliminary indicators about the impact of their initiatives. *This would seem to be an opportune time to bring the partners together, to see if it is possible to produce models or even putative guidelines for the effective use of ICT in teacher training and development in countries at different stages of infrastructure development. The interviews suggested that some are or will soon be in a position to provide information about the nature and impact of innovative uses of ICT in INSET.*

Two major and connected constraints faced all of the partners in developing these innovative uses of ICT for professional development:

* A lack of ICT knowledge, skill, and an abundance of inertia, in their various teacher training sectors (sometimes mentioned was the fact that, like teaching, this is an "ageing" profession which, perhaps, serves to inhibit innovation).

* More crucially and of potentially long term consequence - these sectors were being asked to participate in training in a pedagogy of which they themselves have had little experience and knowledge (as have we all). A variety of strategies - e.g. the Portuguese Competence Centres and other ICT multi-professional networks and public private partnerships - have been employed by the partners to address this systemic problem of 'distributed knowledge'. Here too some serious comparative analysis might be useful. One issue to be addressed in the future is whether and to what extent any of these approaches is able to be pushed further to support the vision of continuous professional development just outlined.

Several partners emphasised the limitations of an over-emphasis on innovations in teacher training and development. I have tried to summarise these as follows - *An emphasis on the obligations on teachers to innovate and to embrace the demands of continuous professional development will only succeed when co-ordinated with changes in the constraints acting on them and their pupils.*

These constraints include -

ICT tools for teachers and learners

Teachers and pupils are not currently being well served by the current generation of ICT tools being offered to them. One Dutch partner also commented that even the information that we did have about the effective deployment of ICT for teaching and learning was not available in an accessible and useful form for teachers and teacher trainers.

There is an extensive gap between what is technically possible with the technology and what is currently available to schools. Most partners envisaged that this situation would change in the next 3-5 years and many, contingent problems could be ameliorated. But, as one Dutch partner observed, the ICT industry is largely opaque to the most educationalists. Educational needs and practices are equally opaque to people in the ICT industry. What strategies are being used to articulate the demand side of the educational ICT supply-demand equation?

A range of specific limitations in the educational design - or lack of it - underpinning ICT tools, content and in the organisation of archives were identified in the interviews. Recurring themes were:

* The Internet is a potential learning environment without guides, signposts or a well designed educational "front end". Although exploration and search are important

skills in their own right, there are times when efficiency of search and retrieval are best supported to allow the learner (and the teacher) to focus on other aspects of learning. The erection of guides and signposts is not simply a technical problem. It also requires design knowledge based on an understanding the learning objectives and educational processes specific to the context of ICT use, and a knowledge about how and when the learning process might need to be supported.

* Copyright of material on the Internet is "a nightmare" and, according to one partner, teachers in their schools were violating copyright law on a daily basis. If we expect teachers to develop their own and their pupils' skills and competence in exploiting the Internet for educational ends the creation of large scale, digitally accessible resources for use in schools was vital. *"A digital archive of European culture" was how another partner expressed a similar view of a major contribution that the EU could make to the development of ICT infrastructure for schools.* The creation of digital archives within member countries was already taking place, but European action could speed up this process and open up resources to both schools and, potentially and under different conditions, to commercial users.

* *Digitally archived materials are not accessible in an educationally useful form.* Although some commercial tools were being developed to support the assembly and "authoring" of materials, there is a long way to go in developing robust and functionally rich tools needed to support use in schools. Some partners envisaged major developments in this field over the next few years. This same issue was raised in discussion with colleagues from the BBC who are involved in the development and delivery of interactive, on-line learning resources for homes and schools. Some of these have already been broadcast, others are under development. One fundamental constraint on the development of these materials was a lack of knowledge in the production teams about how content could be effectively prepared for interactive, on-line learning. The technical, artistic and production experience of staff was based on the construction of linear, non-interactive and 'user-independent' narrative structures. The demands met in designing environments to support non-linear delivery, in "parsing" and in adapting this material to fit the needs of individual learners or for specific age groups of learners was not part of the expertise within the organisation.

This is a fundamental problem and one for the near future. *It calls for new forms of inter-professional collaboration and, perhaps, the creation of new career structures within or without the school to support the future development of ICT.* This emerging new role was echoed in interviews with one of the French partners. Teachers are the main holders of the pedagogical intelligence that has to be extended and developed to realise the potential of the new tools and the new pedagogics. There is risk, if this potential is not realised within education, that the "raw material potential" that is represented by the intelligence of teachers will be exploited by external, private concerns. France has established a national scheme that, since 1999, allows teachers who develop innovative teaching projects to be seconded to make their skills available to multimedia producers.

(a) *ICT has an enormous potential to help to inform and support learners, parents and teachers in formative assessment, feedback, guidance, careers advice and in the creation of educational portfolios to carry forward beyond schooling.* It can give insights into the process of learning and documented evidence of interest, effort and personal motivation that have been long sought after as complements to traditional forms of assessment and accreditation. The task of tracking, parsing, describing and reporting on the experience of an individual learner or a group of learners is not a technical issue but an educational and conceptual one. When technology is exploited to this end and its use becomes "mission critical" to schools, this will also raise significant ethical and legal issues about ownership of information and 'right to see'. This potential, and such issues, will probably emerge as critical questions for the design and use of ICT networks within the next few years.

Teaching roles, conditions of service and contracts.

An interviewee from outside of the educational system concluded that *the new roles expected of schools and teachers² are such that a radical re-think of the contractual obligations of teachers is demanded.* The creation of more differentiated career structures should be matters of immediate concern. In his view, the potential of ICT, even given a well motivated and ICT-fluent teaching force, will not be realised until the system is adapted to enable teachers to specialise and concentrate on a more manageable set of roles.

Although this issue goes beyond specific questions about the impact of ICT on schooling, there were some signs from the interviews that other partners believed that fundamental changes in the structure of the profession in their own countries would be necessary to meet their aspirations for innovation in education. One of the Danish partners predicted that there would be fundamental changes in the training and conditions of service for teachers in their primary sector. She anticipated, in the next few years, teachers in this sector would not be trained to teach across the whole of the primary age in all aspects of the curriculum. There would be more differentiation and focus in teacher's roles and training. Colleagues from Portugal also identified signs that the impact of ICT and new educational priorities had led to changes in school management of teaching time by enabling lesson times to be extended.

These examples demonstrate an acceptance of the fact that the ways in which schools and teachers manage their time and resources will need to change in response to ICT and the new demands on schools. It is difficult to offer any generalisations about the likely nature or impact of such changes over the next few years since the situation regarding teachers conditions of service appear to vary significantly from country to country. There

² i.e. teacher as * 'learning guide' and personal advisor; * learning broker, charged with co-ordinating the demands and opportunities of the world of lifelong learning and career with the aspirations of individual learners; * as manager of both traditional and new learning environments; * as motivator; * as assessor and guide; * as co-constructor or transmitter of knowledge

may, however, be common demands for changes in the roles of teachers and in the support for the teaching function that will have to be accommodated by any school system.

As one of the UK partners observed, ICT has not yet become truly “mission critical” for schools. His prediction is that when it does, over the next 3-5 years, we will find that the levels of resource and support needed to enable teachers and schools to do an effective job will considerably exceed what is deemed necessary at present. *The amount of support, redundancy and back up that teachers and schools will need to exploit ICT will increase dramatically in the near future.* This will occur when ICT ceases to be principally an “add on support” for teaching and learning to one in which it becomes central and necessary to the delivery of key areas of learning (i.e. mission critical). This will force recognition of the need to re-think not only the role of teachers but also the technical resources they will require in order to meet the demands put on them. The implications of this snapshot of what the future holds in explored in the “technology meltdown” scenario.

Such demands for a transformation of attitudes and roles is also coming at a time when, generally, the perception of public prestige accorded to teachers, and their salaries, are falling in relation to other professional sectors. They also coincide with an advancing average age in the teaching profession (explicitly mentioned as a cause for concern in interviews with partners from Denmark, France, Portugal and the UK). Further, the improved training and professional development of teachers with ICT could serve to open up new and attractive career opportunities outside of the school sector. These factors identify a genuine need for concern about the future recruitment and retention of teachers. These ‘THINK’ concerns echo similar worries expressed in other scenario building exercises.

Curriculum and Assessment

A curriculum, whether laid down nationally or defined locally. represents a statement about what is worth knowing. Systems of assessment and examination, whether formative, continuous and local, or summative, periodic and national, are technologies that define how one is judged to have that knowledge or not. *A consensus to emerge from the interviews was that the nature of what is worth knowing to fit the learner for the future differs from that deemed appropriate in the past.* Furthermore, *the ways in which knowledge may be acquired, made manifest, and be used have changed and will continue to change in response to the impact of ICT.* The general perception of political, economic, vocational, social and personal lives is that these have been transformed and will continue to be re-shaped in the future by the impact of technology. It would seem to follow that the impact of ICT on schooling invites a complete re-think of the goals of the curriculum i.e. public judgements about what is worth knowing. At the same time, the systems used for formative and summative evaluation (i.e. the technologies used to decide whether what should be known is known) also need a radical reappraisal.

In fact, despite general agreement about the impact of ICT on society, working life etc., several different views on curriculum and assessment were expressed in the interviews.

Interviews with two of the French partners in particular expressed unambiguously the view that both curriculum change and innovation in assessment and examination would be a *sine qua non* for the successful exploitation of ICT in the classroom. One partner likened the Baccalaureate to a “mammoth”. It was in need of radical re-thinking to reflect the potential benefits and impact of ICT on learning and teaching. But she remained deeply sceptical about the chances that the radical changes needed would be made within the next few years. If this proves to be true, it suggests that schools, teachers, pupils, parents will be asked to innovate in a context where any positive benefits of their efforts with ICT will *only* be found if there happens to be a measurable effect on traditional assessments of old views on what is worth knowing. Even if such an impact was proved, these assessments would not begin to calculate any of the other benefits that might be accruing from the use of ICT – including those which may be more relevant to the needs of the citizen of the future.

One of the UK partners was also adamant that now was the time to “think outside of the box” in re-thinking the curriculum and examinations. His hope was that a public debate, soon to be launched in Scotland, would stimulate such thinking and help to underwrite change. He also pointed out that attempts to re-structure teaching training and professional development (that should also encourage trainees and teachers to radically re-think practices for formative and summative assessment practices) would only be likely to succeed when demands for change were reflected in national instruments and procedures used to assess results. For this reason, school-based innovative projects in ICT currently underway in Scotland were being “protected” from potentially negative assessment outcomes by ensuring that the Inspectorate accepted the new curriculum goals being adopted by learner, teachers and parents involved in these.

Another of the UK partners was much more circumspect about the timing of change. His worry was that any radical changes brought about by the use of ICT for assessment would simply enhance the “innovation-itis” from which schools were currently suffering. One of the Danish partners expressed a different concern over the future of curricula and assessment. Her worry was that current moves to de-centralise responsibility for curriculum decisions to the schools might go too far. One concern was that the emergence of too many idiosyncrasies might make it impossible for children to change area and school without a significant disruption to their education. Her more general concerns, about equity and fairness, were also echoed in the interviews with Dutch partners. The task of equating the competing demands of meeting national Constitutional rights and the de-centralisation of responsibility for educational “mission” to schools was currently the subject of political debate at the highest levels of the Netherlands’ Parliament.

Two different though perhaps inseparable issues are inter-twined in these concerns. One has to do with the extent to which both curricula and assessment regimes need to change in response to the impact of ICT on society. The second concerns a need to give schools

the independence they will need if they are to meet demands for a more ‘learner focused’ approach to curriculum design and provision. The need to ensure equity and equality of educational opportunity whilst, at the same time, moving away from any “one size fits all” approach to provision is clearly a multi-faceted and legitimately political issue. *Many of the partners seemed to be struggling with this common problem of “difference with equity” albeit in quite different political contexts.* Since it is largely in response to the opportunities for a more individualised approach to learning and learner choice opened up by ICT that these issues have become so urgent, this is one major way in which technology is impacting upon thinking about the future of educational policy. Here, perhaps, is where scenario building might be a useful tool for stimulating and structuring national debate.

Each of the Swedish partners drew attention to the fact that significant changes in national priorities for education have taken place; changes that pre-dated current thinking about ICT. Recognition that the ability to learn how to learn and a capacity for reflective and critical thinking were crucial goals for schooling had been accepted for some years. One partner added that Swedish pupils would “come out well” in critical thinking. To the best of my knowledge, there are no widely accepted criteria or procedures for the assessment of critical thinking. Certainly, I know of no international league tables that offer indexes of such achievements. With its highly decentralised approach to curriculum delivery and assessment, Sweden’s school system may well have the capacity to encourage and to recognise such achievements in its children. However, it is worth considering the proposal that we urgently need international agreement about what to take as evidence of such accomplishments since they are seen as such crucial skills for the citizen of tomorrow by all of the partners. At the moment, in common with national examinations, international league tables seem most likely to promote a conservative approach to educational accounting. They are certainly not providing much impetus to innovation and change and may well be acting to inhibit change.

ICT and value for money

Two of the partners (from Denmark and the UK) made explicit reference to the increasing pressure from their governments for evidence that the investment in ICT in schools and in teacher training and development were providing the tax payer with value for money. Trying to calculate the *costs* of investment in ICT is an extremely taxing fiscal undertaking, as one of the UK partners made abundantly clear. It is hard to see how the calculation of *benefits* can even begin without a clear and agreed view of what the expected and desired educational contributions of the investment are supposed to be. Without changes in curricula and assessment regimes to drive innovation towards the aspired-for achievements, it is difficult to see how clear and agreed views can ever be reached about value for money. *Thus, on this analysis, the issue of value for money from ICT cannot be disassociated from fundamental political questions about what a nation considers to be worth knowing.* Ultimately, questions about the school curriculum should be decided at the ballot box. This is where a number of deep constraints are to be found

that will shape the capacity of schools to innovate within any nation i.e. core constraints on how the values and history of a society impact on its capacity to exploit ICT.

As the OECD analyses (2000, 2001) demonstrate, the gap between tax payers' conceptions of what schools are for and what they should show evidence of achieving, and the aspirations, goals and practices being espoused and pursued through educational reform seems destined to get wider. An in-depth study of parental attitudes towards schooling (conducted by Soderberg, 2000) indicates that parents in Sweden who have achieved *most* from their own education are likely to be found in the parental sector least likely to support radical changes in the practices of the educational system. This group is also likely to include many articulate and influential voices, and to have urgent and current interests in what is happening in schools. Recruiting them away from the side resistant to educational innovation would seem to be a priority if the goal is to change radically the aims and roles of schooling.

The issue of public attitudes towards educational reform and of strategies designed to inform, engage and co-opt parents, tax payers and the media into an understanding of and a shared view of the future for schools did not emerge as a major theme in the THINK interviews. Perhaps this was due to time constraints and/or to the design of the interview schedule.³

The issue of "value for money" and public attitudes to teachers and to schooling go beyond the central brief of the THINK exercise. However, the specific issue of what ICT can contribute to learning and achievement raises key but unresolved issues about how one assesses and examines the impact of technology on learning and achievement. In turn, this would seem to be a key factor in how one calculates the "benefit" side of the cost-benefit equation for ICT expenditure.

Impacts of ICT on learners and learning

What kind of tool is ICT? Interview discussions about the role of ICT and ICT tools to support learning suggest a three-way classification of the uses and impact of the technology on the school curriculum and learning. Each of these seems likely to have different implications for the issue of public attitudes towards expenditure on ICT for schooling.

ICT as an element in the curriculum - It seems reasonable to assume that for learners, teachers, parents and the general public a focus on the need for schools to develop children's knowledge and skills with ICT has face validity. The partners from Portugal, for example, mentioned this role of ICT in schools as a major factor underpinning rising parental demands for enhanced ICT provision in their children's schools. Examples of the effective use of ICT in vocational training was mentioned in other interviews, though I was not made aware of any well-documented evidence that might be used to inform decisions about ICT and value for money.

³ I suspect that one reason stems from the fact that discussions of public-private partnerships dominated our discussions about the public and private sector.

ICT literacy involves not only technical skills but an understanding about how technology impacts on the process of communication and learning. It demands from learners a critical awareness of its potential abuse for purposes of corruption, indoctrination, deception, persuasion, exploitation and theft. It involves knowledge of when and how it is appropriate to use specific ICT tools and applications in different knowledge contexts, and the development of skills in handling new environments, complex tasks, and newly emerging genres of communication and artistic expression.

What technology and tools do we have to document, assess and guide learning in relation to these looked-for impacts of ICT on schools' attainments? Have these goals been publicly advertised and recognised as an important contribution of schooling to digital safety, good citizenship and generic skills for lifelong learning?

ICT and "traditional" educational curricula and goals. It was acknowledged by many partners in the interviews - even seen as an established given - that ICT and multi-media tools have already demonstrated their power to transform the meaning of what it is to know and to be competent say, in maths, sciences, humanities, communication or written composition.

Learners, parents and the general public are likely to accept and support these potential impacts of ICT on learning and understanding since they represent a familiar province of schooling. Clear evidence that ICT can achieve these contributions would seem likely to meet with public backing.

Do we have publicly recognised tools of proven reliability for documenting, assessing and guiding learning in relation to these looked-for impacts of ICT on schools' attainments? Are such knowledge, skills and competencies assessed by any extant regimens of evaluation and examination?

ICT and new or re-prioritised goals

Many new demands facing schools were summarised in the first section. For many of these, there seem to be no generally accepted and trusted practices, methods or tools with which to describe, document or assess the learning process and learner achievement. These are the areas that represent the most radical, looked-for impacts of ICT on schooling. They are the areas in which public acceptance is likely to be most uncertain. They are the also areas in which, at present, we seem to have no means of demonstrating and communicating to the public evidence of the impact and contribution of the technology to the 'benefit' side of the cost-benefit equation.

No one interviewed was confident that we yet any unequivocal evidence for a systemic, positive effect of ICT on any traditional and conventional measures of educational attainment. Several expressed the view that we have been looking in the wrong places for

the evidence. Even in relation to the assessment of traditional knowledge and skills, it is quite possible that

- the potential of ICT in this area has not been explored at the upper limit because the pedagogical expertise needed to derive its benefit has not yet been developed throughout the school system
- examinations and assessments are insensitive instruments with which to try to evaluate what learners have achieved in 'traditional' areas
- ICT impacts on a range of knowledge, skills, competencies and attitudes that we have never developed the tools or infrastructure to assess.

A review and re-think of formative and summative evaluation systems is demanded. This is needed if learners and teachers are to be given relevant and constructive feedback about their achievements in pursuit of the new goals of education (whether these are assessed formatively and locally or summatively and nationally). It is also needed to construct an updated balance sheet for calculating the benefits of education is to be drawn up.³

Public and private sectors

The issue of developing the future supply of ICT content and services to schools had become an issue high on everyone's agenda by the time the THINK interviews took place. It dominated discussions about relations between the public and private sectors of education. New forms of public-private partnerships (together with new public-public and new private-private ones) were emerging in the educational system, but with the "public" side being represented by one or more combinations of people from the sectors of school, networks of local schools, regional authorities and/or national bodies. All accepted that this was an crucial area of policy in which rapid developments would take place in the next few years. It will obviously exert fundamental constraints on the school sectors ability to meet the challenges and realise the benefits of ICT reviewed in the proceeding sections.

It was difficult for partners to give an overview or draw general lessons at a time when many were in fast-changing contexts. For example, government consultative documents had recently been put into circulation in some countries. Meetings between branches of government with various combinations of state broadcasters, domestic ICT producers and publishers, together with representatives of large, international corporate concerns had taken place, were ongoing or imminent in others.

It seems plausible to suppose that the future shape of national policies and practices for PPP and ICT will project forward existing national traditions in the definition and

³ A new model of examinations currently being developed in Holland may well provide evidence of interest to all.

delivery of curricula and their assessment. For example, Sweden has a highly devolved system of responsibility for educational management that leaves schools with curriculum decisions and the assessment function. One Swedish partner observed that centralised procurement, approval or "kitemarking" of materials for use in schools was not a part of their system. However, it seems likely that the central authorities will need to establish active links with the potential supply sector in order to develop the standard 'backbone' for Swedish schools. Countries like France and the UK, with centralised responsibility over the national curriculum and examinations have a long history of consultation with their educational supply industries. These differences in national policy will obviously shape and constrain the forms of partnership that will emerge and the kind of ICT products and services that are and will be offered to schools. This is not to imply, of course, that by drawing such parallels the implication is that the two countries are or will embark on the same policies and strategies for the delivery of ICT products and services to schools.

One scenario that I confronted each of the partners with was presented as an alternative to one in which a large, multi-national agency gained a monopoly of managed learning environments for schools. The alternative envisaged the development of a national or European facility (working title EMILE (Educational Management of Interactive Learning - Europe)) as one means of providing schools, teachers and learners with the range of functionality they needed to support the exploration and exploitation of ICT's educational potential.

The "EMILE" scenario met with a mixed, but usually negative, reception. It also provoked a variety of alternative visions about the best way forward in the development of ICT educational tools and environments. These paralleled the views solicited in discussions of the domination of the Internet by the USA.

One of the Dutch partners argued that a useful focus of mutual interest was not the development of such common operating system or Learning Management Environment but an agreed analysis of the "logical design" needed to underpin the (currently under-specified) requirements for ICT in education. He added the observation that the history of standardisation in this field (e.g. HTML) demonstrated that it was in liaisons between producers and users (not governments), that had identified the needs and addressed them.

It is perhaps worth considering if an organisation such as the EUN could articulate the "users" voice in this scenario. The partners have extensive networks into the relevant sectors of expertise that could be exploited. *With a clear brief, a group drawn from these networks, given a few days in a think tank, should be able to establish if there is enough common ground to demonstrate that such a "logical design" or 'functional specification' is a realistic and a desirable target. More generally, competing visions of the future relations between national and European actions in developing ICT content functions and services for education need to be articulated and debated.* This need motivates the development of Scenario 4.

APPENDIX 3

Interview protocol

1 The aim of the framework of questions given in this document is to stimulate a general and forward looking discussion about the future of education in response to changes in technology, employment and society stimulated by the emerging information society and knowledge-driven economy.

The questions have been designed to help to solicit and explore your thoughts and ideas about the innovation potential of ICT in education, and how this potential could be realised. This gives rise to issues about the future development of educational goals, policies and practices.

2 The focus of the exercise is on the years of compulsory schooling in your country.

3 Although the rationale for the interviews stems from the growing impact of ICT on learning and education, *the main aim is to look beyond technical issues and concerns about the provision of infrastructure to consider and discuss the wider political, social, economic and educational questions which will have to be addressed in response to the impact of ICT on society.*

4 The information arising from the interviews will be used as a basis for the construction of scenarios. The purpose of these will be to show decision makers the options available to them, helping them to shape their future strategy. The first drafts of these scenarios will form the focus of workshops in which all contributors to this process will have the opportunity to participate. The final drafts of scenarios will then be completed in the light of the workshop discussions.

5 The framework of questions is designed to stimulate the views, ideas and speculations of participants in this project without imposing tight constraints. If there are issues and questions which you consider relevant to the exercise but which are not adequately covered by the questions, these will, of course, be covered.

6 I anticipate that the interview will take a maximum of two hours to complete.

SECTION 1: Cultural and Socio-political Issues

Although much has been written about the impact of using ICT on societies, almost no attention has been given to the way in which a society's values and attitudes impact on its likely uses of ICT. This section is designed to provide an opportunity to discuss any general aspects of the historical, cultural and political influences on the process of education in your country which you feel will shape the way in which ICT is likely to be taken up and used in your schools and homes. If you prefer, we can consider these broad, open-ended issues towards the end of the interview.

The following, specific questions may help to focus our discussion of these general issues:

Are there important aspects of developing a sense of citizenship and common social values which should be preserved and promoted as your system of education responds to the impact of ICT? For example, do you have any concerns that these values may be challenged and undermined by the widespread impact of ICT in your country? Are there ways in which the impact of ICT can be exploited to promote these values?

It is estimated that 80% of the on-line educational multimedia software products and services currently produced come from the USA. If this trend continues, will it be a cause for concern in your country? What do you plan to do about it?

What part will be played in policy formulation by European and other multi-national initiatives such as the EUN and Val Net?

What steps need to be taken (in any policy decisions about ICT) to safeguard entitlement to education and to ensure access and opportunity so that no one is excluded? For example, will educational policy prevent the gap from widening between those who have access to new knowledge and those who do not?

SECTION 2: Impact on learners and the learning process

Individuals in future will be employed as much for their ability to acquire new skills and knowledge as for what they already know

How is the changing world of employment and the knowledge and skills needed to work in the information society impacting on what, when and how pupils learn in your schools?

Do you foresee any tensions between the current practices of teaching, learning and assessment within your schools and demands to support the acquisition of such new knowledge and skills? What actions will be taken to resolve any tensions?

The combined effect of new technology, growing prosperity and the demand for more control will provide learners with wider opportunities and more choices.

How can your schools and teachers help to equip learners with the knowledge and skills they will need in order to exploit the opportunities and choices open to them?

What will new technology allow learners at different ages and different stages of schooling to do differently in the future?

How can on-line learning improve the quality of and access to educational opportunity?

What mix of on-line and face-to-face learning at the different stages of schooling will come to predominate in the future?

If learners are able to learn about the same things using ICT in different contexts (e.g. in home and at school) what steps will be taken in schools to ensure the co-ordination and coherence of their learning experiences?

SECTION 3: Impact on schools and schooling

The future learning experience for the individual will be very different from today. As well as empowering the individual to have a greater say in what and how they learn, the technology will result in less reliance on formal institutions and providers, although they will still play an important part.

The next developments in e-learning will be challenging. They will lead to new structure models of education and learning and may, in some circumstances, challenge the existing educational systems and structures. For example, new virtual communities may grow independently of state funded provision.

The challenge will come when intermediaries, in collaboration with learners, begin to interact in totally new ways and develop new forms of learning and teaching outside of formal systems.

What in your view are the main challenges facing the schools in your country as a result of the increasing use of on-line learning?

What are the main opportunities which will open up for the schools in your country as the result of increasing access to on-line learning opportunities and to on-line information?

How might the use of new technology affect the traditional geographic, age and ability boundaries within your school system?

A new learning environment can be created which favours autonomy, flexibility, decompartmentalisation of subject areas, establishing contacts between centres of culture and knowledge and facilitating access by all citizens to the resources of the knowledge-based society.

The important leap is to go beyond exploiting technology only to do the same things more effectively and consider how technology can allow us to do entirely new things.

Are there traditional areas of education in which technology **can** help to do things more effectively?

What new learning systems or structures are required prepare learners for life in the information society and what will be their key features?

Do you think that ICT will have a significant impact on the content as well as the delivery of school curricula and, if so, what form is this likely to take?

Do you have any plans to exploit ICT in order to change the way in which your schools are involved in the assessment, examination and accreditation of learning?

More generally, if learning does become increasingly reliant on an on-line environment, do you envisage any redefinition of the ways in which schools will look and function as institutions?

SECTION 4: Teachers, teacher training and professional development

The role of 'teacher' will still be critical to the learning process and the learners educational experience. We are likely to move towards a broader description of human resources that support the learner - e.g. a range or group of individuals, such as designers and other specialists, rather than a single teacher with a multiplicity of roles.

With the growing emphasis of the role of ICT in schools, what changes do you foresee in the ways in which teachers and teaching support staff will be recruited into your school sector?

Do you think that ICT will have any impact on the kinds of people who will be attracted into the education profession?

Do you have a clear sense of the knowledge and skills that teachers will need to use ICT to good pedagogical effect?

More generally, given the likely impacts of ICT on schools and schooling, what significant changes will take place in the future roles and responsibilities of your teachers?

It is estimated that 50% of jobs in 5 years will depend on the new technologies. Although there are no data about the number of teachers who have sufficient knowledge and skills to prepare pupils for these jobs, there are almost certainly too few of them at present.

We must accelerate the adaptation of education and training systems so as to allow all teachers, trainers and trainees to acquire a true digital culture.

How will the need for ICT knowledge and skills impact on the training and accreditation of your teachers?

What steps will you be taking to ensure that teachers in schools will be able to develop the knowledge and skills required to use the new technologies?

What roles will ICT itself play in the delivery of initial training for teachers and in their continuing professional development?

In what ways do you envisage ICT being exploited in your schools to support teachers in their teaching roles?

SECTION 5: Public sector provision and the private sector

The expansion of the education and learning market will make it increasingly attractive for the private sector provider ... this may give rise to a debate around what constitutes state provision. Tensions could arise between state education, with its established concepts of entitlement, and the potential for diversity and choice in the private and international sector.

A trend that looks to continue is the establishment of new links between business and schools e.g. as service providers and e-learning gateways.

The development of an adequate supply of software, contents and services which are suitable for the needs of European society is a major challenge for Europe. e-Learning will strengthen the partnership between the public and private sectors

What issues will arise if the distinction between commercial and public providers of education and learning blurs?

What issues are raised by the potential use of educational products and services developed from different cultural, ethical and/or social perspectives? How will you address these?

What or who are currently the most important drivers in the design, development and implementation of ICT to support learning in your schools?

If there is a continued growth in private sector provision, how will your public sector respond e.g. in order to ensure equality of access and opportunity, and to protect privacy and entitlement?

In this new learning environment, pupils will have access to a wide variety of contents and services - questions will arise time and time again in this context on matters of quality, reliability and usefulness and recognition of these contents. Quality criteria, methods of academic or vocational evaluation and recognition of contents and levels of training provided, will need to be established in order to steer teacher and learning alike in the new learning environments.

What steps will you be taking to ensure the relevance, quality and value of the educational content and services provided for schools?

Section 6: Policy formulation and implementation

In the light of responses to the questions about learning, schooling, teaching and public-private sector relations, can you comment on

(1) Current educational policies and actions in your country that are in progress or are envisaged over next 2-3 years which are relevant to the issues, challenges and opportunities you have raised?

(2) The longer term (at least the next 5 years) - what do you think the policy priorities for schooling should be?

Finally, can you identify or envisage any new approaches to policy planning and implementation processes themselves that are required to deal with the fast pace of developments in ICT?

APPENDIX 4

Principal Participants in the THINK interviews

The THINK project and report were constructed around the information, intelligence and imagination provided by a number of partners from the 6 participating Ministries who took part in extended interviews:

Denmark

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Portugal

Isabel Oliveira and colleagues (names, and their spellings!, to be confirmed)

Sweden

Leif Davidsson
Mats Ekholm
Tomas Eneroth

UK

Dominic Flitcroft
Neil MacFarlane
Stuart Robertson

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Roger Broadie, in his capacity as Chief Executive of European Education Partnership

Chris Yapp, ICL Fellow, Lifelong Learning

In addition, less formal discussions with Anne Diack of the BBC made a valuable contribution to our thinking.