2017 WORLD CONFERENCE ON COMPUTERS IN EDUCATION
3-6 JULY 2017 / DUBLIN / IRELAND

ifip

Implementing Computer Science Curriculum in schools in Poland

issues, challenges, and practice

Maciej M. Sysło
University of Toruń
syslo@mat.umk.pl, http://mmsyslo.pl/

The School System in Poland: 2008, 2016-1

A new government and a new education reform !!!

Tertiary education – University

high school – 9–12 grades
vocational schools – 9–13 grades

Secondary education

common/public/general/ordinary school,

1-8 grades
Primary education: 1-3 grades

Pri education

Pre-s year

19 - 18
16 - 18
13 - 15
10 - 12
7 - 9

Informatics introduced in SH curriculum in 1990s – tools for HS has never been removed !!!

2014: ICT/Informatics as a stand-alone subject on all school levels

Pilot implementation of a new curriculum:
Informatics for all students
with elements of programming
in 2016/2017
and from Sept. 1, 2017 will apply to 1st, 4th, 7th grades

Computer Science education

The new curriculum

A new national curriculum for all subjects including computer science (CS) in primary schools K-8 has been approved by the Ministry of National Education on February 14, 2017.

The new CS curriculum for K-8 will take effect from September 1, 2017 (in the 1st, 4th, 7th grades)

A new curriculum for secondary schools including vocational schools will be ready in 3-4 months.

The general construction and building blocks of the CS curriculum are described in:

Sysło, M.M., Kwiatkowska, A.B.: Introducing a new computer science curriculum for all school levels in Poland. ISSEP 2015, LNCS 9378.

The new curriculum: Unified Aims for each Level

1. Understanding and analysis of problems based on logical and abstract thinking, algorithmic thinking, and information representations.
2. Programing and problem solving by using computers and other digital devices – designing algorithms and programs, organizing, searching and sharing information; using computer applications; ← ICT
3. Using computers, digital devices, and computer networks – principles of functioning of computers, digital devices, and computer networks; performing calculations and executing programs;
4. Developing social competences – communication and cooperation, in particular in virtual environments; project based learning; taking various roles in group projects; equity.
5. Observing law and security principles and regulations – respecting privacy of personal information, intellectual property, data security, netiquette, and social norms; positive and negative impact of technology on culture, social live and security.

Challenges – 1

1. How to motivate and engage students through K -12, for 12 years, e.g. learning programming requires constant practice

   Guimaraes (2016): Introducing … order through 12 years – sorting (as a collection of methods) is present in all curricula

2. The role of coding (programming) – when and how to start with programming

3. When and how to switch from visual to textual programming?
   1. Visual – for beginners, non-professional
   2. Textual – for those who seriously think about CS – we don't want to loose them, for professionals

Challenges – 2

4. Computer science classes/activities should be about computer science: concepts, methods, algorithms, computational thinking …

We present an environment in the cloud – e-book which is not a book – a place for students and teachers where they learn computer science through activities, partly with computers.

Important: teachers also learn computer science

The proposal is addressed to teachers of elementary education in K-3 who (in their background) are not prepared to teach computer science integrated with other topics – usually they ask teachers from higher levels to have 1 hour of CS class a week.

Expected outcome: 1 hour of CS in K-3 will last … a week as integrated with other subjects.

The new curriculum – general comments

- remember: computer science ≠ programming
- concepts before tools, before programming:
  - problem situations, cooperative games, puzzles, meaningful objects
  - discovering CS concepts through abstraction and heuristics
  - algorithms, solution methods
  - programming
- there are plenty of ways to introduce/teach computer science concepts … without computers: computer science unplugged, for instance Bebras tasks (panel)
- when appropriate, we extend unplugged CS by adding … a computer
- The Hour of Code – very popular in Poland – 500 000 students in a year!

e-book: 2017

INFORMATYKA dla smyka

Learnetic
Każdy uczy się inaczej

„paper student”
only for 1-3

Youngest students like to have something own and they should learn to read, write, draw, paint, …

e-student

The cloud is her/his place for working, learning, communicating and saving all resources

e-teacher

Her/his place is where her/his students are

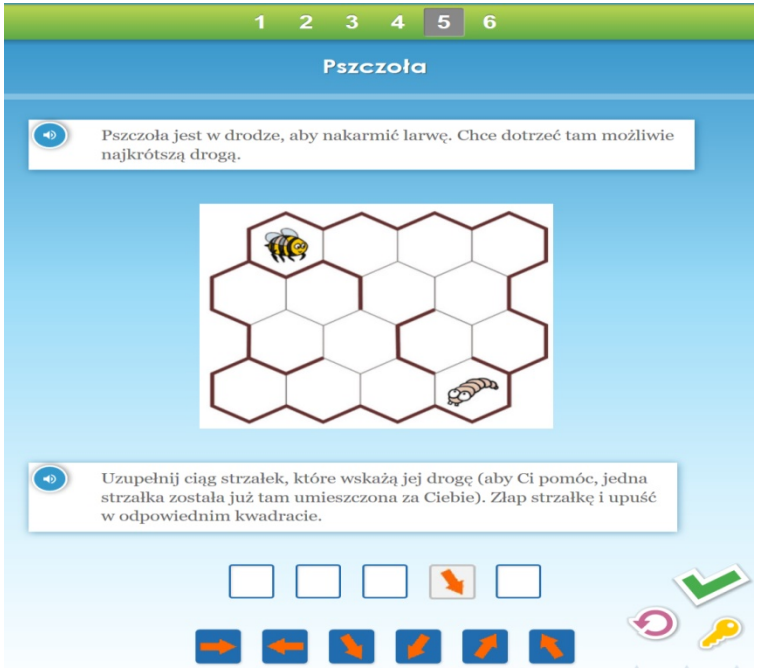
For teachers:

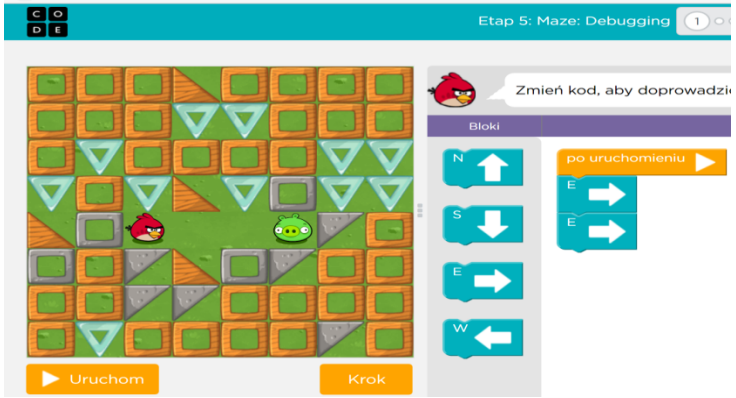
- lesson plans
- „a textbook for CS”
- access to students’ data, achievements

e-book

Maciej M. Sysło

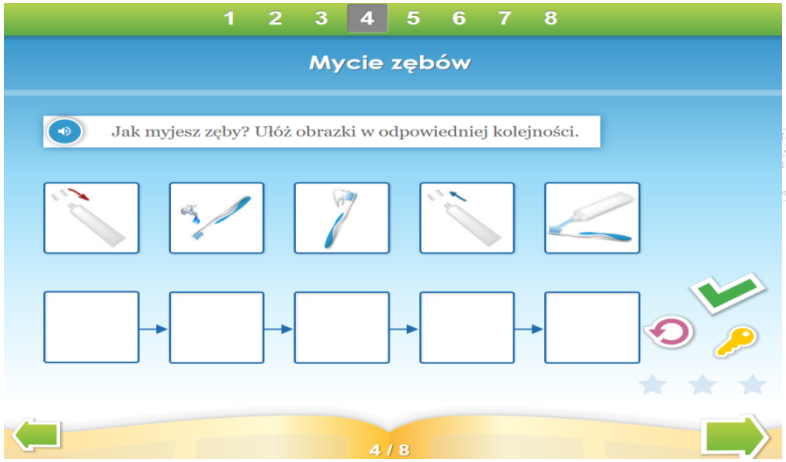
e-book: elements of Bebras, Hour of Code

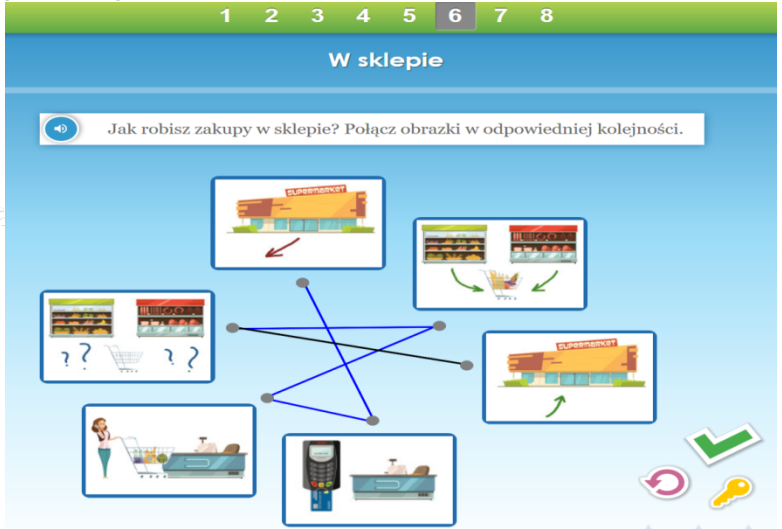




e-book – linear algorithm

Curriculum: presentation of every day activities





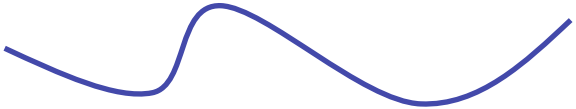
non-unique solution

discussion among students

Linear algorithm

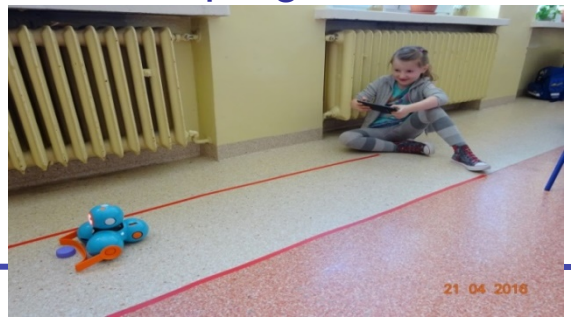
which is not in a line

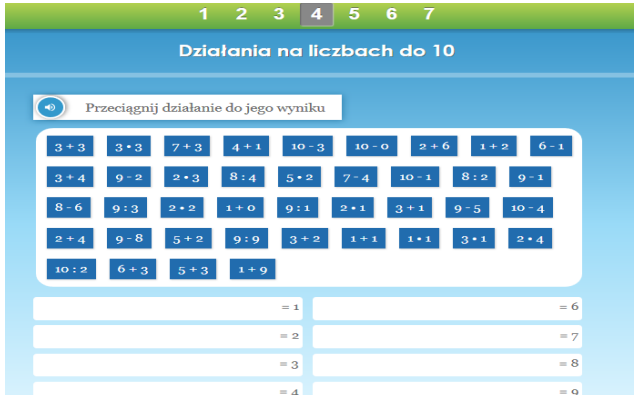
Discussion: what is a line?



e-book – sorting, garbage collection

Garbage collection with robots, programmable

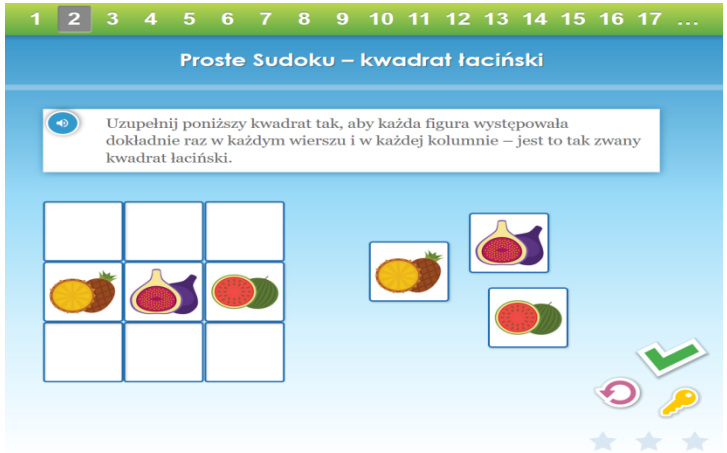




Concepts:

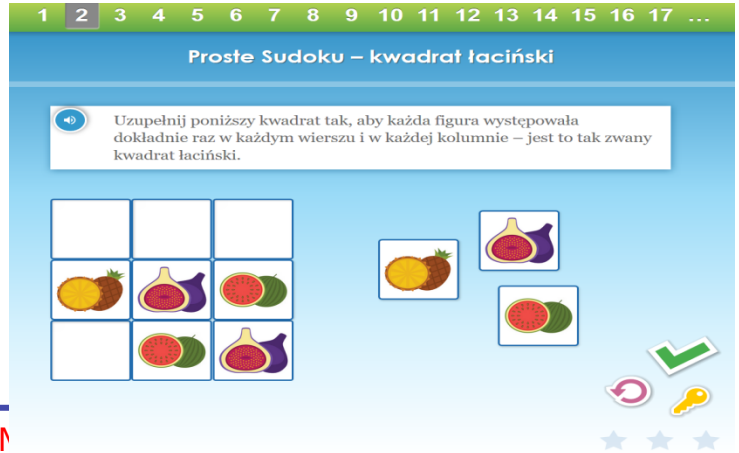
- bucket sort
- hashing

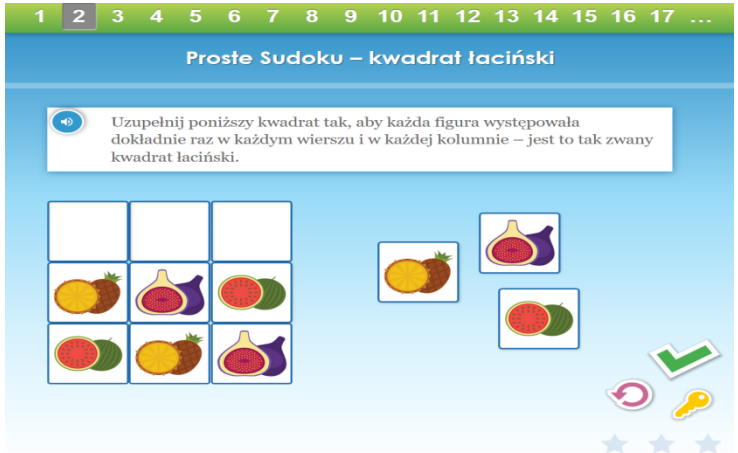
e-book: Sudoku



Concepts:

- decomposition,
- logic, conflicts
- steps
- Latin squers





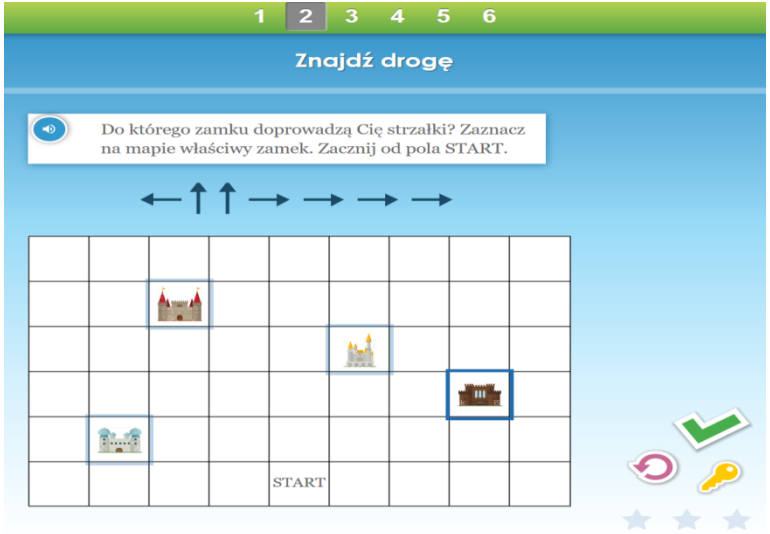
e-book: Sudoku – abstraction

In paper book: Sudoku
Sudoku with geometric figures

Concept: abstraction – no matter what we arrange: fruits, animals, figures, numbers, the rules are important

Each computer program is an abstraction of situations, for which it is a solution, e.g. the same implementation of the Dijkstra algorithm solves many various optimization problems

e-book – program



Many correct and shortest solutions

Methodology

- Computer science in K-3:
  - CS activities in the same place where kids and playing
  - no need for a full equipped classroom – equipment is always a problem in schools
  - integration of CS with other „subjects” during the whole week – 1 hour lasts a week
  - sometimes a teacher may take kids to a computer lab
- a teacher has an access to kids’ results regardless of the place they work, in school or at home (home works)
- it is easy to include flipped learning
- a teacher my add her/his resources
- an easy way to correct and upgrade the e-book and its environment, however in on-line environment all actors should be on-line: authors, administrators, teachers, …

Conclusions

With the new curriculum:

- students acquire a broad overview of the field of informatics and applications
- informatics instruction focuses on problem solving and CT;
- informatics is taught independently of specific application software, languages, environments – students are free to make their own choice;
- informatics is taught using problem situations coming from school subjects and real-world applications;
- informatics education provides a background for the professional use of computers in other disciplines.
- students experience a solid foundation in CT through problem solving with computers;
- students experience that programming is a creative process;
- students learn how to collaborate on projects, which are mostly a group task;
- students witness that computing enables innovation also in other fields;
- PBL and flipped learning style contribute to a better personalization of learning.

Thank you for your attention