ICT in Finland

Gábor Törley

In December 2007 the new PISA results were released [PISA 2007]. Finland, with an average of 563 score points, was the highest-performing country on the PISA 2006 science scale. Generally, we can say, the Finnish education is very effective; it gives useful and practical knowledge for pupils.

In this writing I'm concerned with one specific part of the Finnish education: how does teaching of information and communication technology (ICT) appear in it.

Historical introduction

In Finland the strategy planning and implementation have been based on autonomous decision making. This means that Ministry of Education published an upper level strategy and National Board of Education designs an implementation plan for schools. Schools can plan their own strategies, based on the national framework, so they can decide how they want to implement them.

In 1986 the TOP project formulated a strategy integrating modern technologies in school education.[TOP 1986, TOP 1989] Its aim was that information technology (IT) should be inserted in school work to help students in their daily work. The school's responsibility is to train student as active workers of the information society thus students should work with information on multipurpose tool programs and build actively their own knowledge structures [Meisalo 1989.] This program emphasizes the teachers' in-service education.

At the same time with TOP project Nordic Council of Ministers was promoting very much IT use in education by helping the development of software for computer assisted learning (CAL).

In the national framework curriculum for comprehensive schools [FCCS 1985] a new voluntary subject, Information technology (IT), was introduced. This subject focused on computer skills both in comprehensive and in upper secondary schools. Its goal was to make more efficiently the students' work. The pupils were taught among other things word processing and programming.

In practice, the implementation of the project plan was pedagogically one-sided. [Meisalo et al 2007] The teachers were not able to use sufficiently the new possibilities of IT.

In 1995 general national guidelines for ICT use in education were published in the strategy document of the Ministry of Education: *Education, Training and Research in the Information Society: A National Strategy*, and the resulting implementation policy document, *Finland towards on Information Society*. The Finnish Framework curriculum for the comprehensive schools [FCCS 1994] introduced simultaneously ICT as an intercurricular subject. It was mentioned ICT should use in all subject based on its goals. The schools had the opportunity to create an optional subject, IT or ICT. In practice usually the teachers of IT taught word processing, spreadsheet, etc. focusing on the technical skills. [Huovinen 1998] That's why it was criticised, because the pupils was not taught, how they can use their word processing knowledge outside of the school; how it has changed the working methods.

Because of these problems, the Second National Strategy [SETRIS 2000] was based on the pedagogical use of ICT in education. This strategy suggests establishing virtual schools or new learning environments that relate to future operational environments. Moreover, it was recommended to begin collaboration between active teachers and researchers, start pedagogical computer- supported development networks to support the development of a

professional culture of collaboration, efficient uses of ICT in teaching and learning and network oriented study.

Explaining the ICT part of the curriculum

In current curriculum for basic education [NCCBE 2004] the place of ICT has not changed, it is an intercurricular subject. This means, that Finnish pupils do not have an individual comprehensive subject about ICT, the requirements appear in other subjects. Two cross-curricular themes handle with ICT: "Media skills and communication" and "Technology and the individual". The general claims are the following:[1]

The pupils will learn to

- express themselves in a versatile, responsible way, and to interpret communication by others
- develop their information management skills, and to compare, choose, and utilize acquired information
- use media and communication tools in information acquisition and transmission, and in various interactive situations
- use information technology equipment and programs, and data networks, for various purposes.

Core contents

- analysis and interpretation of the content and purpose of messages, change in the communication environment, and multimedia communication
- data security and critiquing source
- tools of communication technology, their diversified use, and internet ethics
- information technology and the use of data networks.

Goals and contents focus on how pupils can use ICT in their everyday life. After comprehensive school all of students have at least a basic knowledge about ICT. Usually they choose other optional ICT subjects because of the parent's expectations.

Some comprehensive subjects draw more concrete way, how it wants to reach the goals above:[2]

- Mother tongue and literature: after 2nd grade the pupils are able to produce original text on a computer; after 5th grade the pupils will gain experiences in producing various texts with a word-processing program; learn to use different means of communication, and gain a basic knowledge of the media and utilize communications media purposefully; know the main phases of information acquisition; are used to utilizing the library and capable of searching for the information they need in printed and electronic sources; after 8th grade they can acquire information from different types of sources: information acquisition planning and assessment of dependability and usability of sources; know how to use data networks.
- Visual arts: after 4th grade the pupils know how to use the tools of visual communication; after 8th grade they know how to make good use of the internet's cultural services, the fundamentals of visual communication and media

[1] [NCCBE 2004] pp. 37-38., 40-41.
[2] [NCCBE 2004] pp. 46-55., 235-238

technology: photography and video photography, the processing of digital images, and graphic design; be able to analyze the contents, structure, and visual realization of media presentations.

In upper secondary education the philosophy is the same [NCCUSE 2003]. Generally, upper secondary school studies consist of compulsory, specialisation and applied courses. Specialisation courses are optional courses relating to compulsory courses in the same subject and students must include at least ten such courses as part of their study plan. "Their study, information acquisition, management and problem-solving skills and initiative are to be developed. Attention must be given to versatile ICT skills." Two cross-curricular themes handle with ICT skills: technology and society; and communication and media competence. Education providers have the possibility also to add and accept other cross-curricular themes for their own curricula. The cross-curricular themes will be complemented, updated and established within the local curricula. Key objectives are for students to[3]

- understand and be able to assess the relationship of people with modern technologies and know how to assess the effects of technology on lifestyles, society and the state of the natural environment;
- know how to deal with ethical and aesthetic issues: they will learn to assume responsibility in terms of media content production and use and their own media behaviour;
- acquire improved interaction, communication and influencing skills;
- be capable of producing media texts and diversify their expressive skills when producing contents for media texts and communicating these;
- become accustomed to using the media as a learning tool and environment, learn how to use the media in study-related interactive situations and for the acquisition and communication of information;
- obtain information on the media and communications sector, media production and copyrights.

Looking through the subjects, objectives and core contents cover these aims. Almost all of the subject handle with information acquisition on their field. Mother tongue (text producing, style), physics and chemistry (modelling); geography (Geographical information systems), and visual arts (digital images, graphic design, websites, visual communication) give a highlighted role for ICT to support the students' learning.

According to these curriculums, the pupil should have at least basic knowledge, and on some fields at least intermediate knowledge about using ICT as a tool after upper secondary school. Courses are practice-oriented, especially the specialisation courses.

[3] [NCCUSE 2003] pp. 30-31.

Own experiences – interviews with teachers

In this part I want to show the practice, how some schools apply the expectations of the curriculum. In generally, the institutions have much freedom to organize the studies. Because of the parents' expectations, usually the pupils can have special courses at least about application systems. All visited schools are well equipped, but there are differences among them.

Especially, in case of infortmatics/computer science teaching, the contents and the number of courses depend on school curriculum and the teacher itself.

1. Puistola Comprehensive School (Puistolan Peruskoulu)[4]

In this school there are 4 different courses.

- Application systems (1) (for 8th graders)
  - Duration: 1 year
  - Content: word processing, spreadsheet, making presentation with Microsoft® Office and OpenOffice
- Application systems (2) (for 8th-9th graders)
  - Duration: 2 years
  - Content: previous course + database managing, internet + e-mail, html-editing
- Graphics (for 8th graders)
  - Duration: half year
  - Content: using scanner, digital camera, image manipulating with Paint Shop Pro®
- Programming (for 7th-8th graders)
  - Duration: half year
  - Content: algorithm, variables, simple programs, loops, if sentences, simple mathematical problems, programming little games
  - Using languages: Java or Python

The pupils meet at first with programming, so the goal is to teach them interactive ways, and to show them programming as a game. Unfortunately, the students' motivation is very low, and this problem is hard to be handled. The only used supporting tool is the Frontier learning content management system.

2. Pakila Comprehensive School (Pakila Yläasteen Koulu)[5]

In this school the pupils can choose two optional subjects. Informatics/computer science is one of these optional subjects.

This non-compulsory subject handles with just application systems. The 8th graders learn word processing, spreadsheet, graphics and html editing (project). One year later they learn a bit of word processing, more graphics (project), spreadsheet, animation and database handling. At the end of 8th and 9th grade, pupils have to make a project about html editing and graphics.

[4] http://www.puisy.edu.hel.fi/
[5] http://www.pakilaya.edu.hel.fi/

The school has too many pupils and too many computers compare to the available space. It is hard to change the softwares on the schools' computer, because the Local Government decide about which programs the school can use, that's why it needs a long period to purchase/install new teaching or learning supporting programs on computers.

3. Aurinkolahti Comprehensive School (Aurinkolahden peruskoulu)[6]

This school offers two specialisations: Craft and technology and Science and technology or rather there is the possibility to go in Technology class from 7th. After the 7th grade the pupils, who did not choose Technology class, can choose one of specializations.

The programming teaching and learning is supported with Lego Mindstorms Robolab. With this environment pupils can learn during playing the basics of programming. Later they get to know the C++ language.

According to the school curriculum[7] the pupils begin their IT studies from the 8th grade (technology-specialised class from 7th grade). The following courses are offered:

	Technology class	**Craft and technology**	**Science and technology**
7th grade	○ Information technology working environment, ○ Principles of the programming	-	-
8th grade	○ Internet and networks , ○ Word processing, ○ Graphics, ○ Presentation graphics, ○ Hypermedia and web-pages, ○ Programming	○ Information technology working environment, ○ Internet and networks , ○ Graphics, ○ Presentation graphics, ○ Hypermedia and web-pages	○ Information technology working environment, ○ Internet and networks , ○ Graphics, ○ Presentation graphics, ○ Hypermedia and web-pages, ○ Principles of the programming
9th grade	○ Spreadsheet, ○ Programming	○ Spreadsheet, ○ Programming	○ Spreadsheet, ○ Databases ○ Programming

This school was the most prepared among this three comprehensive schools to teach ICT and support with it the pupils' learning process. Unfortunately, this quality is not general in Helsinki.

[6] http://www.auripk.edu.hel.fi/
[7] http://www.auripk.edu.hel.fi/OPS/Aurinkosuunnitelma.htm

4. Etu-Töölö Upper Secondary School (Etu-Töölön Yläaste ja Lukio)[8]

This school is the only upper secondary school among the visited institutions.

IT courses' goal is that the student is able to operate the computer and the information technology as a tool. The school offers the following courses[9]:

- Useful programs
    - This is an elementary course of IT in which the basic functions of the operating system and the use of useful programs are learned: for example word processing, spreadsheet, databases according to skills and needs of the group. This course is compulsory, if pupils want to attend on the other IT courses.
- Elementary WWW publication
    - With the course the basic structure of the HTML language is learned, WWW pages are created with an editor program, students will learn the basics of image processing.
- Advanced WWW publication
    - HTML language and other WWW techniques, such as the use of style files or script languages and image processing are learned in more detail.
- Elementary programming
    - Pupils learn the basics of algorithming and programming, then apply their knowledge in a programming language (Java).
- Advanced programming
    - The basic skills of the programming are supposed to be familiar, with the course more advanced matters, for example error handling, are reviewed. Students get to know the basics of the graphic user interface.
- Information acquisition
    - On this course students get to know the use of a virtual learning environment, in which they can find the thematic entities of other subjects, what they have learned before.

Summary

Generally, pupils can have deeper and specialised knowledge about ICT through election courses. Schools offer different kind and amount courses, according to their possibilities. At least, they use some learning management system for supporting teaching and learning. Unfortunately, just in few places was used any visual supporting tool for programming, although there are Finnish developments on this field.

At University of Joensuu the Jeliot[10] was created, which is a very useful debugging and programming simulation tool. In Israel and the USA are used in secondary school teaching. Jeliot 3 Team has been awarded with a finalist candidate position at the 2007 Premier Award Competition.

[8] http://www.tyly.edu.hel.fi/
[9] http://www.tyly.edu.hel.fi/Lukio/Oppiaineet/ma-at/at_uudet.html
[10] http://cs.joensuu.fi/jeliot/

TRAKLA2[11] was developed at Helsinki University of Technology. This program was made for supporting learning of algorithms and data structures. This learning environment supports especially self learning and helps to understand better the material with animations. This software has not been used in comprehensive or upper secondary schools.

Programming is the hardest part of ICT in comprehensive/upper secondary schools. With these two softwares there's a possibility to increase the motivation (with visuality) and to help the students when they stuck with learning.

References

[FCCS 1985] Framework Curriculum for the Comprehensive School 1985. The 2nd revised edition. Helsinki: Valtion painatuskeskus.

[FCCS 1994] Framework curriculum for the comprehensive schools (in Finland), Helsinki: State Printing Press and National Board of Education

[Huovinen 1998] Huovinen, L., 1998. Peruskoulujen, lukioiden, ammatillisten oppilaitosten ja varhaiskasvatuksen nykytilanne ja tulevaisuuden näkymät. Helsinki: Sitra 191.

[Meisalo 1989] Meisalo, Veijo 1989. The FINISTE Network and Pedagogical Research In V. Meisalo & H. Kuitunen (toim.) Innovations in the Science and Technology Education. Proceedings of the Second Nordic Conference on Science and Technology Education, Heinola 8-11 August, 1989. National Board of General Education, Finland. Information Bulletin 2/1989, 43-51.

[Meisalo et al 2007] Meisalo, V., Lavonen, J., Juuti, K., Aksela, M. 2007. Information and communication technology in school science in Finland In Erkki Pehkonen, Maija Ahtee & Jari Lavonen (Ed) How Finns learn mathematics and science, Department Applied Sciences of Education, University of Helsinki

[NCCBE 2004] National Core Curriculum for Basic Education 2004. Helsinki: National Board of Education

[NCCUSE 2003] National Core Curriculum for Upper Secondary Education 2003. Helsinki: National Board of Education

[OECD 2007] Executive Summary PISA 2006: Science Competencies for Tomorrow's World © OECD 2007

[SETRIS 2000] Education, Training and Redearch in the Information Society for 2000-2004. Helsinki: Ministry of Education, 1999.

[TOP 1986] Tietotekniikan integroiminen kouluopetukseen [Integrating Computers in School Education] 1986. Taustaa ja etenemisstrategia. Tietokone opetuksessa-projekti. Ammattikasvatushallitus & Kouluhallitus, Helsinki.

[11] http://www.cs.hut.fi/Research/TRAKLA2/

[TOP 1989] Tietotekniikan integroiminen kouluopetukseen [Integrating Computers in School Education] 1989. Tulosten arviointi ja jatkotoimet. Tietokone opetuksessa-projekti. Ammattikasvatushallitus & Kouluhallitus, Helsinki.