THE CHALLENGES OF COMPLETE INFORMATIZATION OF EDUCATION

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Abstract

Since the methods of teaching and learning are currently changing, Slovenian society is challenged to respond. Ministries responsible for the development of the educational system encourage informatization of education by launching strategically oriented tenders. This research presents three such projects, which together propose guidelines on how to further develop the Slovenian educational system with an emphasis on the introduction of information and communication technologies into everyday life in Slovenian schools at all levels (teaching, learning, management, etc.). There are three main areas that are covered: (1) technical assistance and support, (2) development and deployment of e-learning materials and e-textbooks and (3) teacher training. Using these approaches it would be possible to achieve an increase in digital competences and a change in our pedagogical paradigm.
Results show a better motivation, communication and improved teamwork among students. This is a consequence of changes in the way of thinking and teaching by both teachers and other school participants, especially the headmasters who put the student in the centre of activities.
The whole process of school informatization depends on a coherent development of various fields. The focus is on a change of pedagogical paradigm and the consequential teacher and managerial staff training.
Key words: *e-competent school, e-competent teacher, e-textbooks, innovative 1:1 pedagogy.*

Introduction

As a response to the challenges of teaching and learning in a modern information society, the Slovenian Ministry for Education and Sports has made calls for several strategically focused projects. The main challenge has been how to continue and stimulate the process of informatization of educational institutions (EI) according to their current state in the managerial, didactic and technical field, respectively.

As a response to the challenges, the largest project E-education was set up, operating in the years 2008-2013 and being continued in the E-school bag project, and especially in the project Innovative 1:1 pedagogy in the light of 21st century competences.

All these projects should respond to the actual state of an individual school, which requires an individual informatization plan with multifaceted and total changes in various fields. More specifically, in the field of technical support, change to the e-competent school; change in the field of development and implementation of e-materials and e-textbooks; changes in the

field of development and implementation of training for e-competent teacher; in the field of development of innovative 1:1 pedagogy with the goal that school becomes more innovative, as shown in the diagram (Bocconi, Kampylis, Punie, 2012).

E-education Project 2008-2013

The project, which ended in September 2013, included 1,900 or 98 % EIs (kindergardens, primary schools, secondary schools). Experts helped 41,181 teachers and headmasters and performed 15,249 counselling visits and more than 18,498 distant counselling's.

The main project activities were:

1. To develop a preposition for the standard of the e-competent school, which includes standards for an e-competent teacher, headmaster and computer expert, respectively. For every group of technical assistants various training courses (177 altogether) were developed that were implemented live or at a distance. Additionally 28 online classrooms for independent e-competence testing were implemented. A licence (e. g. for the e-competitive teacher) could be obtained in either described ways. The total number of participants in training courses was 36,949 (the number of all teachers in Slovene EIs is 46,000). (Flogie, Gruden, Kreuh, Šverc, 2013)

2. To develop a training system for teacher trainers and consultants who were mainly practicing teachers as well as experts working at faculties and at the National Education Institute of the Republic of Slovenia (1,100 co-workers).

3. Organization of an international science conference (named SIRIKT) where various experts and practitioners presented challenges in the field of complete informatization of education (300 participants in the first year and 1,200 in the last year).

4. Development of an online Slovene educational network. This is a website where stakeholders in education can find relevant information about education, various e-materials, dates of training courses, news, legislation and where teachers can interact in e-communities. The webpage has 8,000 and 10,000 visitors daily.

5. To develop an advanced information system for project management purposes.

6. The evaluation phase of the project was directed towards quantitative monitoring of indicators and the quality of the service of consultants and teacher trainers. For each EI this evaluation included a complete scan of the current situation e.g. equipment, software usage to the certification of the staff. Together with the involvement of an external consultant the evaluation enabled individual EIs to create a high quality plan for the informatization of the school. (Flogie, Gruden, Kreuh, Šverc, 2013)

Results:

- Defined roadmap for each e-competent school, headmaster, teacher and computer expert.
- Improved school culture of innovative teaching,
- Defined conditions for a quality ICT learning environment,
- Changed attitude and mentality regarding the ICT use of all stakeholders,
- Development and strengthening the modern pedagogical strategies and teaching methods with the ICT integration.

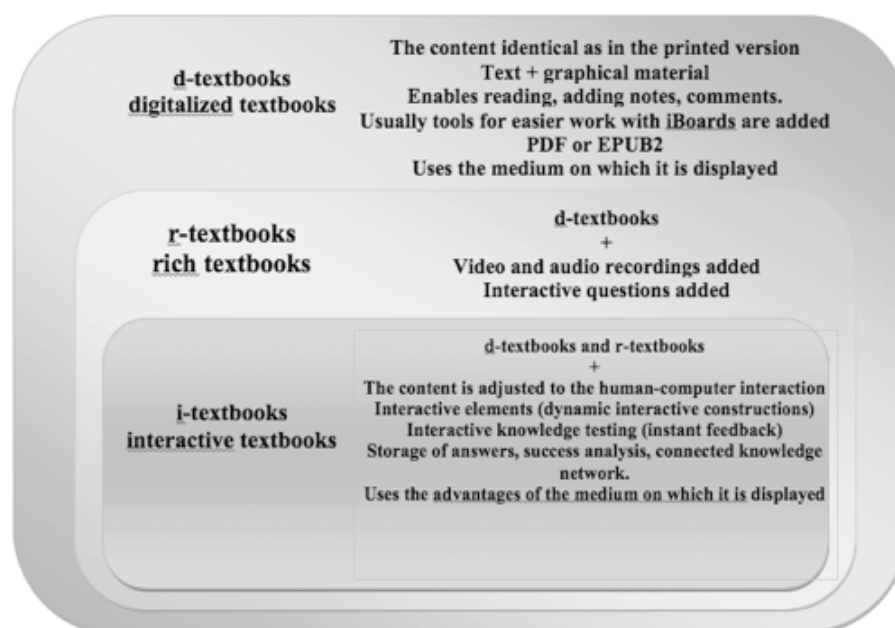## Project E-school Bag and E-textbooks, 2011-2015

Supplementary to the E-education project two additional projects were initiated, dealing with the development of modern e-textbooks. Within the E-education project, the conclusion was reached that in order to be able to perform modern lessons with the use of ICT, teachers necessarily need modern e-contents harmonized with curricula, since teachers do not have enough time and energy to develop all the material by themselves, despite their good qualifications.

Magdalena ŠVERC, Igor PESEK, Andrej FLOGIE. The Challenges of Complete Informatization of Education

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 61, 2014

123

In the last ten years, Slovenia has invested considerably in the development of free accessible e-materials (OER) for all subject fields. The experience gained from the preparation of this material has been upgraded and used for the development of the first e-textbooks mainly for science and mathematics. As a starting point the goals were set that an e-textbook must principally contain all three basic elements: acquisition of knowledge, repetition and testing as well as additional learning activities. An e-textbook is therefore a set of learning materials, composed of a textbook (acquisition of new knowledge), a workbook (repetition and refreshing) and learning tools (additional learning activities). Such an e-textbook set can be used by students and teachers in the classroom, as well as at home.
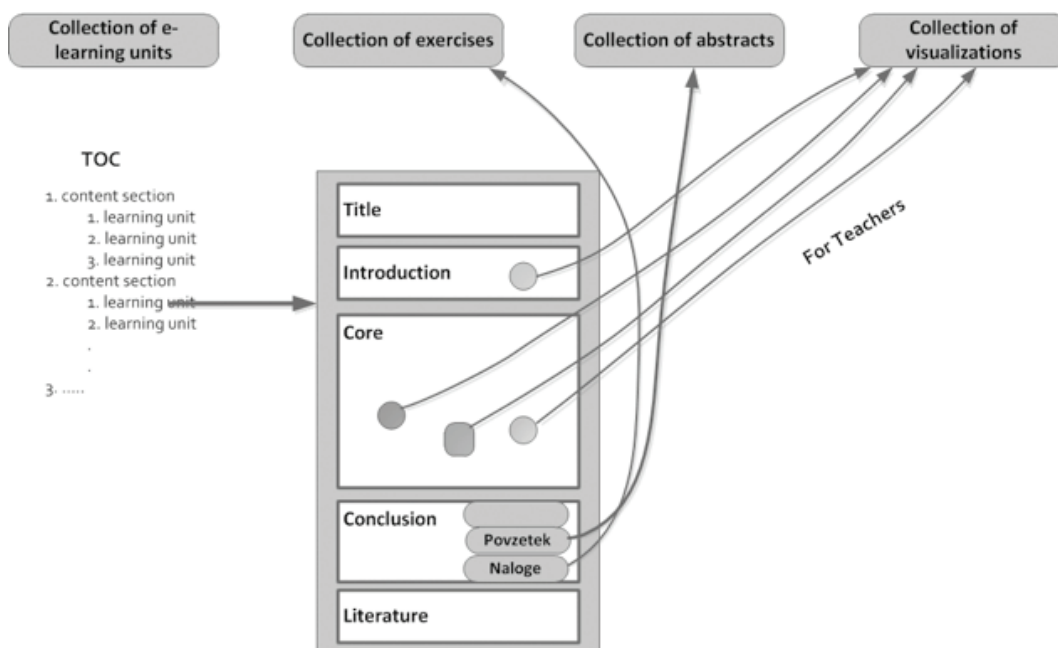
Figure 1: Basic structure of the e-textbook set.

Since there are several different types of e-textbooks on the market, the division according to the elements included is presented here. The basic form is an e-textbook in a digital format that uses the advantages of digital media regarding transportability and digital recording and is usually identical to the corresponding printed textbook, therefore it is named a digital e-textbook. If multimedia elements are added to the digital e-textbook, it becomes a rich e-textbook. If interactive elements, namely interactive simulations, interactive knowledge testing as well as interactive models and constructions, are added to a rich e-textbook, then it becomes an interactive textbook. It is important to stress that all the three e-textbook forms must work on all operation systems and all devices (tablets included). In Slovenia there are already some interactive e-textbooks that have already been introduced in schools within the frame of pilot schools. On the basis of evaluation improvements will be made.

124

d-textbooks
digitalized textbooks

The content identical as in the printed version
Text + graphical material
Enables reading, adding notes, comments.
Usually tools for easier work with iBoards are added
PDF or EPUB2
Uses the medium on which it is displayed

r-textbooks
rich textbooks

d-textbooks
+
Video and audio recordings added
Interactive questions added

i-textbooks
interactive textbooks

d-textbooks and r-textbooks
+
The content is adjusted to the human-computer interaction
Interactive elements (dynamic interactive constructions)
Interactive knowledge testing (instant feedback)
Storage of answers, success analysis, connected knowledge network.
Uses the advantages of the medium on which it is displayed

Figure 2: Basic forms of e-textbooks.

Innovative Pedagogy in the Light of 21st Century Competences (2013-2015)

Because of the success of the e-Education project, the Slovenian Ministry for Education and Sport decided to further systematically develop the implementation of the 1:1 pedagogy (Smart classrooms, 2013) and all its accompanying e-services e.g. the introduction of tablet computers, the e-portfolio, an open university for students and teacher training in didactics and pedagogy. The main objective of the project is to develop new strategies, to define criteria, to assess promising practices and implementation of the curricula that integrates innovativeness and activities with ICT.

1:1 pedagogy is also known as "wherever-whenever" learning or "notebooks-tablets for students". The use of this pedagogy is increasing in innovative schools around the world. Most schools are interested in use of virtual learning environments in a way that deepens the understanding of concepts and stimulates knowledge. 1:1 pedagogy programs are a part of a global shift towards individualization and personalization of learning, which can increase the independence and autonomy of learning as well as broaden learning outside the classroom (Microsoft Educator Network, 2013).

It has been established that pupils and students with their own mobile devices are more proud of knowledge, ability and competence that they achieve with this transition to more flexible forms of education (Ihanainen and Moravec, 2012).

Experience indicates that 1:1 pedagogy upgrades formal learning with the integration of experts, community, parents, relatives and other people who are important in the lives of students.

The project's vision is to develop innovative pedagogy that leads to 21st century competences like global communication, collaborative work, constructive problem solving, critical thinking and creative development. To achieve these goals pupils, students and teachers were supplied with mobile devices and thus increased their opportunity to obtain individual and personalized learning and teaching. The equipment helps schools attract a digital generation with the development of a personal (or 1:1) learning experience. The successful introduction of an innovative 1:1 programme at participating schools was based on:

- Jointly supported vision and collaboratively oriented culture of the school community
- Effective technical support and infrastructure
- Pupil- and student-oriented pedagogy - AND
- The structure of permanent professional training of teachers.

Project Purpose and Goals

The purpose of the "Innovative 1:1 pedagogy in the light of 21st century competences" project is:
- To develop a curricula for testing innovative strategies and models as well teaching and learning approaches in the classroom and to effectively employ the results and best practice examples
- Implementation of the curricula must be supported and upgraded with meaningful and effective use of modern ICT, effective e-services and quality e-content that enables a higher level of individualization and personalization in the classroom or in learning.

The goals of the project are:
- To reduce the digital divide and to stimulate digital fairness and e-participation,
- An improvement of 21st century competences of students and teachers (critical thinking, creativity, problem solving ability etc.),
- To improve the success and competitiveness of students (recognising various vulnerable groups),
- To innovate teaching and learning,
- To develop a new culture of technology supported learning, where the learner is the centre of attention (flexibility, personalization, various learning styles are intertwining).

Key Pillars of the Project

The project has three key pillars, namely development, implementation and evaluation. The project focused on:
- Development of an innovative 1:1 pedagogy integration strategy,
- Development of a methodology for 1:1 pedagogy introduction, which will be tested in innovative classrooms in 10 schools, including 243 students,
- Development of innovative implementing curricula, based on modern pedagogic paradigms and methods that support individualization and personalization of lessons as well as the use of modern ICT,
- Development of promising practice examples within which the innovative strategies, models as well teaching and learning approaches in classroom will be tested, and in doing so the examples and results of best practices up to this point will be used effectively,
- Development of several e-services (e-portfolio), "Innovative pedagogy node" distance learning and other quality e-content supporting innovative organization of pedagogic work,
- Development of programs and training for 129 teachers, 10 headmasters, technical support, and 243 students,
- Evaluation of all stages of the innovative 1:1 pedagogy implementation process.
- It has to be realized that modern information technology itself does not change the methods of teaching and learning. Technology must become a part of both culture and pedagogy which enables a transition towards teaching that is student-oriented wherever and whenever (Bocconi, Kampylis, Punie, 2012).

Evaluation and Monitoring

To evaluate the implementation of the innovative 1:1 class, The Acer-European School-net Educational Netbook Pilot methodology developed in the Microsoft PILSR system (Microsoft Educator Network, 2013) for measuring the progress of six digital competences was used. This evaluation includes teachers, students and parents and monitors the level of use of innovative teaching. The aim is to monitor the progress of teachers and students as well as parents at a later stage.

Effect of the Innovative 1:1 Pedagogy on Teachers and Students

The aim of the evaluation is to analyse teachers' and students' work according to the use of ICT during school lessons and when preparing for them. A questionnaire was divided into six chapters:
1. General information about the selected class
2. Teaching and learning in an innovative class
3. Access to ICT and its use in the class
4. Professional development
5. School management and the school atmosphere
6. My competences

Figure 3 presents the question about the frequency of students' participation in the activities of self-evaluation or peer evaluation taken from the 2nd chapter (teaching and learning).
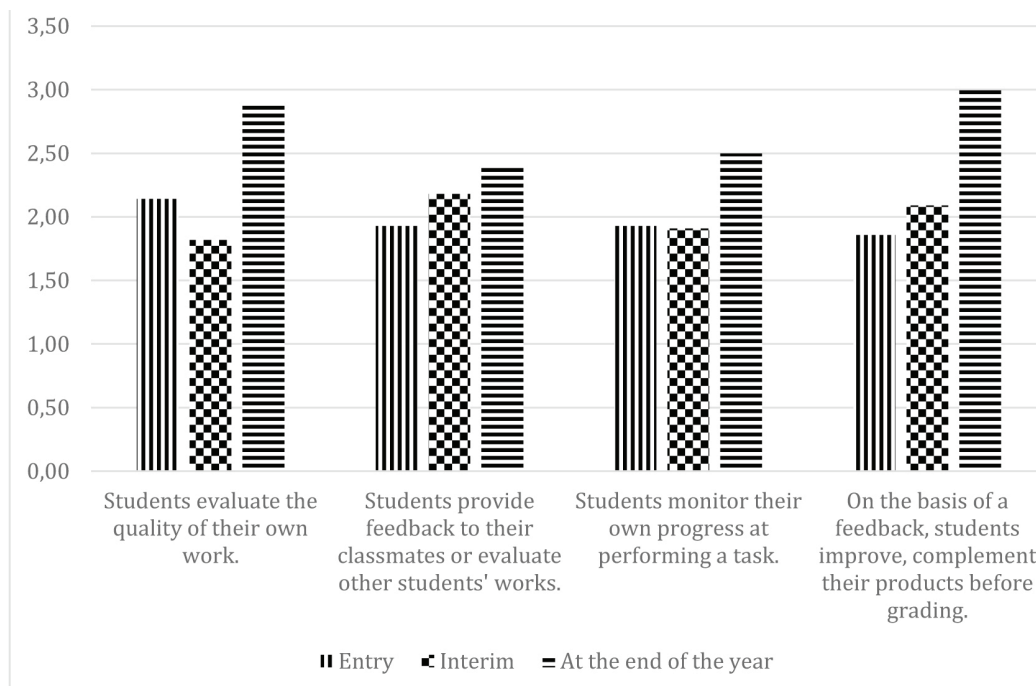

Figure 3: The students' activities of co-evaluation.

The results presented in Figure 4 show that the activity of giving feedback to classmates, enabling them to improve their work or product, increased the most. The other two columns that refer to the evaluation of one's own work did not show any increase at the interim evaluation even suffering a small decline. From this it can be infered that activities which enable improvement of other student's works in particular were stimulated and positively accepted. The evaluation and monitoring of one's own work does not increase until the second phase.

Magdalena ŠVERC, Igor PESEK, Andrej FLOGIE. The Challenges of Complete Informatization of Education

PROBLEMS
OF EDUCATION
IN THE 21ˢᵗ CENTURY
Volume 61, 2014

127

Figure 4 presents the question about the frequency of use of the ICT for the listed activities that is included in the 3ʳᵈ chapter (the access to the ICT).
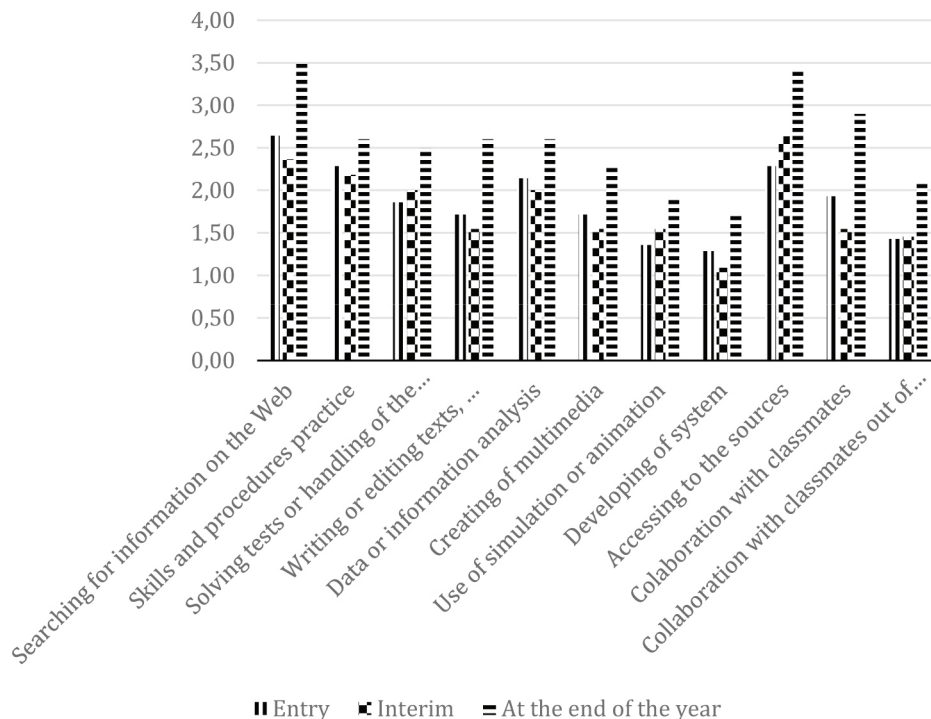
Figure 4: The use of ICT for the listed activities.

From the results presented in Figure 5 it can be concluded that activities connected to a search for information on the internet and accessing the sources in an online classroom which are considered to be from the lower categories of ICT use showed the greatest increase. Cooperation among students increased – this activity is one of the higher level activities of ICT use since it enables the development of cooperation competence. Other activities will have several opportunities to develop.

In evaluation teachers' six digital competences were observed. The development of the second digital competence, communication and cooperation at a distance, is presented in Figure 5.
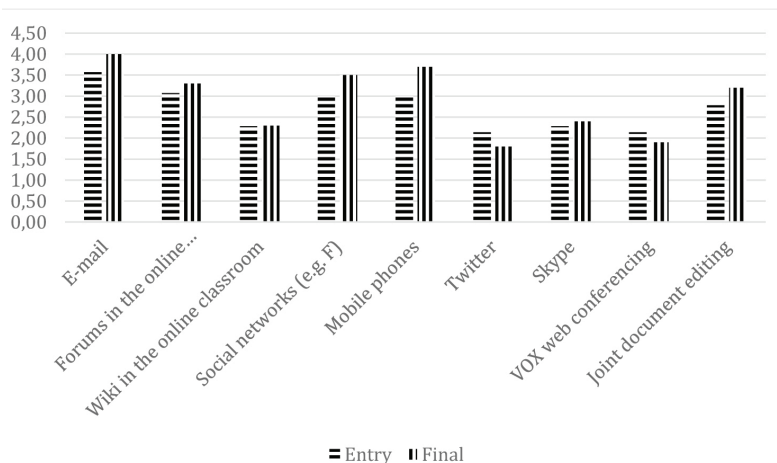
Figure 5: Use of ICT for communication.

The diagram shows that certain activities like VOX video conferencing and joint document editing increase. The increase of these activities can be credited to the fact that for these activities special training was provided.

The question presented for figure 6 refers to fulfilment of entry students' and teachers' expectations about an innovative class.
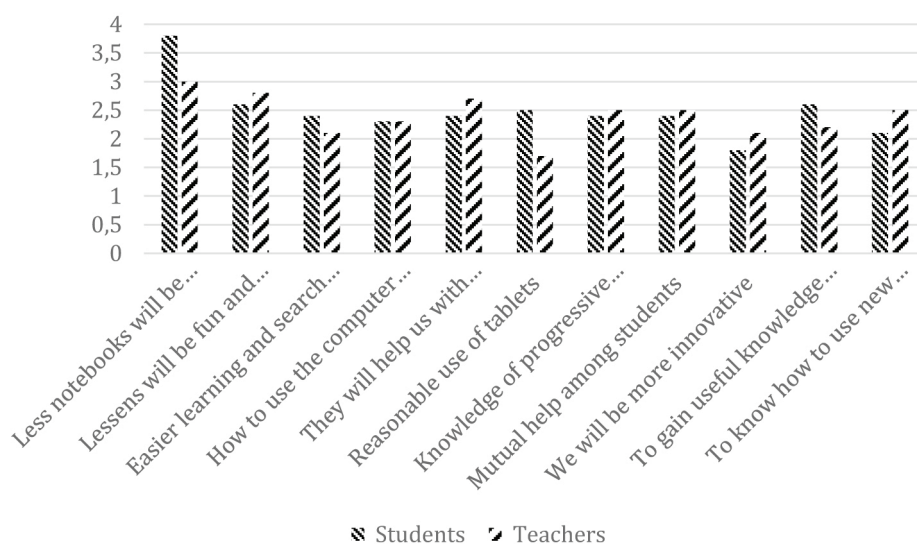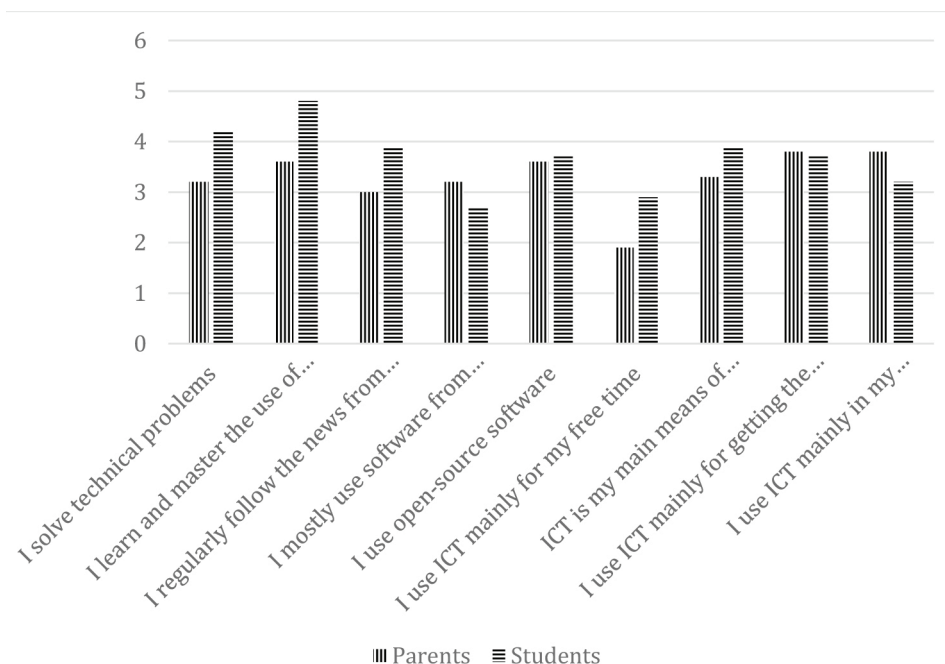

Figure 6: Comparison between students and teachers.

The results show that teachers are more critical than students regarding the reasonable use of tablets, which is good, as they try to find efficient didactic solutions that provides greater interactivity, flexibility and more options to express one's view.

Parents' Opinions of the Innovative Class

The parents were asked several questions about their use of ICT, what is their opinion of their children's use of the ICT, whether they know what their children do on the internet, about the use of regulations, about their expectations of the effect of ICT on the lessons, about their observations regarding lessons and learning in an innovative classroom using ICT. Only some questions and answers will be presented.

Magdalena ŠVERC, Igor PESEK, Andrej FLOGIE. The Challenges of Complete Informatization of Education

PROBLEMS
OF EDUCATION
IN THE 21ˢᵗ CENTURY
Volume 61, 2014

129

Figure 7: The use of modern ICT by parents and their opinion about their children.

Parents believe that the ICT is part of life for their children and that they easily gain new knowledge employing this field. They are also less convinced that ICT is main reason for gaining knowledge. Parents, when asked about their expectations, wrote: the use of tablet computers will increase motivation for work, the children will access information quicker, they will connect among each other and with others around the world more easily, they will use ICT effectively in school and as a result in professional life etc.

With parallel evaluation of this work with (Microsoft Educator Network, 2013) evaluation methodology and upgraded with The Acer-European Schoolnet Educational Netbook Pilot (Vuorikari, Garoia, Balanskat, 2011) methodology the following trends and observations of students, professors and parents can be identified:

- Improved school attendance or presence of students, higher motivation of students (the opportunity of independent work, the nature of tests, etc.),
- Improved communication among students, teachers and parents,
- An increase of learning outside school (every student has his own device),
- Increase in collaboration and team work at the level of planning, teaching, project work at school and outside,
- An opportunity for independent and individual learning as a consequence of improved access to the educational e-services and e-content; improved digital competencies,
- Efficient connection between formal and informal education,
- Permanent training of teachers for the modern teaching of 21ˢᵗ century competencies (17 organized trainings per school year at each EI, collegiate visitations, sharing of best practice examples among teachers, regular assessments, etc.),
- Improved technological learning environment (classroom equipment, each student has his own device, etc.),
- A change in the organization of pedagogical work as a result of new e-services,
- Development of innovative 1:1 pedagogy, the exchange of different teaching para-

digms (frontal, individual, collaborative, etc.), allocation of various individual assignments, monitoring of the progress of each individual student,
- Evaluation of the long term effect that accompanies the 1:1 pedagogy,
- Efficient management and implementation enables universality, durability, expansion and deployment of innovative 1:1 pedagogy in other EIs.

Conclusion

The process of informatization in education depends on a coordination of development of a different areas as indicated in the diagram as shown in Figure 1. The centre of change refers to the change of the pedagogical paradigm and consequently to the training of teachers and leading personnel. This is followed by a change of e-content that contains a high level of interactivity on higher taxonomic levels, since teachers do not always have enough time or knowledge to prepare all the material themselves. The third key emphasis is on a quality infrastructure and continuous technical support for teachers. All these changes combined lead to a modern school that is oriented towards the student who will develop 21st century competences.

Acknowledgements

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