COMPARISON OF THE USAGE OF ICT AMONG SOME COMPULSORY SUBJECTS IN THE SLOVENIAN PRIMARY SCHOOLS

Majda Cencič, Mara Cotič, Vida Medved Udovič, Bogdana Borota
University of Primorska, Slovenia
E-mail: majda.cencic@guest.arnes.si; mara.cotic@pef.upr.si;
vida.udovic@pef.upr.si; bogdana.borota@pef.upr.si

Abstract

The ICT occupies a central position both in the knowledgeable information society and in the development strategies of education systems. The ability of working with knowledge, technology and information is one of the three key competences determined by the European Common Principles for Teachers' Competences and Qualifications, as well as one of the eight key competences for lifelong learning as provided by the European Qualification Framework. Comparison with EU shows that Slovenian schools have, despite highly motivated teachers for using the ICT as well as good equipment and broad band internet access, quite low usage of ICT for instruction in general. Hence, it is a challenge to study the use of ICT for the instruction of some compulsory subjects in the Slovenian schools.

Our research involved 468 pedagogical workers. Teachers of lower grades classroom teaching level with higher education prevailed. The questionnaire they answered, and which was verified by the factor analysis and Cronbach coefficient alpha in regard to the measurements characteristics, was a combination of numerical rating scales and some open ended and closed questions. The results have shown that computer programmes are used the most for the instruction of mathematic and Slovenian language and the least for musical education. Similar results were obtained for the use of internet sites, which are used the most for teaching Slovenian language, as well as for teaching mathematics and the least for teaching music. The reasons could be found in the shortage of adequate didactic materials and weak equipment of classrooms.

The results on the relations among the above mentioned subjects concerning the use of ICT are quite interesting, too. We discovered a positive and a statistically significant correlation, which is the highest between the subjects of Slovenian and mathematics and the lowest between the subjects of mathematics and music.

Key words: *ICT, primary school, class teachers, instruction, Slovenian, mathematics, music instruction.*

Introduction

The modern information society demands informatisation of the education system, and the opinion that we can feel indifferent towards this technology is out dated (Jonassen, Peck, & Wilson, 1999). The need of inclusion of the information communication technology (ICT) into the instruction process or the need of using the ICT for instruction is becoming more and more urgent. Here we have the use of computers and computer networks (internet and intranet) in our mind as well as the use of multimedia, which normally is a combination of text, sound and video.

Slovenian schools started to provide ICT in the beginning of the seventies' and it got its full swing in the nineties' through the programme "Petra" and the project "Computer literacy". Schools were able to get adequate hardware and software and they provided organised training of teachers accompanied by the publication of scientific and expert literature from this area. The project "Computer literacy" is still going on and nowadays encourages internet connections and

the use of internet.

In connection with the organised introduction of ICT into the Slovenian primary schools we wanted to know what was the opinion of teachers of lower class level about the use of ICT for instruction, in particular for some compulsory subjects, how much computer programmes and internet sites (web pages) were used in schools as well as what is the correlation between the use of ICT and some compulsory subjects.

The Use of ICT for Instruction

ICT has an important place in the objectives for the future education and training systems where the emphasis is given to the knowledge and skills in the use of ICT ("The Concrete Future Objectives of Education Systems," 2001). Two objectives are specially exposed, i.e., everyone has to be provided with the access to ICT and the goal that teachers have to be trained for the use of internet and multimedia sources in order to be able to use ICT in their everyday work.

The capability of »working with knowledge, technology and information« is one of the three key teachers' competences and qualifications, where it is also stated that teachers should be capable of getting access, analysing, evaluating, considering and transferring knowledge by way of effective technology, and their knowledge of ICT should enable them to put in place an effective inclusion of ICT in the instruction. Teachers have to become capable of directing pupils and helping them with internet networks, where they have available information to be elaborated. This means that teachers have to develop new competences if they wish to teach pupils properly (Dawson, 2004) and also that they have to dispose of information literacy in order to be successful in the use of ICT. The research on the representative sample of primary schools in Slovenia has shown that the majority of schools (19.6 %) thought that there were between 76 and 80% of teachers who were trained for the use of ICT (Gerlič, 2005).

Brečko and Vehovar (2008) have found out that the inclusion of ICT into the instruction helps pupils develop skills which are necessary for their life in the 21st Century; it improves learning approaches and provides higher motivation as well as richer experiences of pupils for learning.

Teachers are no longer the only providers of knowledge. By computers pupils have unlimited access to information, which they have to carefully select and evaluate in accordance with the given problem and preset assignment. Pupils are taking over a more active role in the acquisition of knowledge and are becoming more responsible for their own learning. They even can become experts in certain areas. And teachers have to become more susceptible for individual needs of pupils and provide good leadership and help in the learning process and prepare them to become life long learners. It has been found out that pupils at schools which have a high index of lifelong learning perspectives reach statistically significant better results than pupils who attend schools which have that index at a lower level (Brečko & Vehovar, 2008).

Newhouse (2002) has, by studying the influence of ICT on learning in the schools of Western Australia, found out that learning through the modern technology supported environments improves, when researching reality, and also when being physically incapable for learning, in active learning and individual composition of knowledge as well as in independent, cooperative and logical learning.

Teachers interactively cooperate through ICT with other teachers and this way realise partnership cooperation. They communicate through internet, intranet, e-mail, forums, web pages etc. and demonstrate different opinions, views and aspects; they exchange various works and so simplify their administrative work. The creation of the so called social networks has an encouraging influence on the culture of schools and their achievements (Papert, 1995; Deal, Purinton & Weston, 2009).

ICT can be used for all teaching subjects (Cornu, 2006). We are mentioning only the use of ICT for learning Slovenian language, mathematics and musical education.

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ICT in the instruction of Slovenian language

Teaching of Slovenian language with the help of ICT may be more effective than classical teaching since it is supported both verbally and visually. It is from that reason that the "Proposal on the modernised curriculum for Slovenian language (2008)" contains in general objectives the aim of foreseeing teachers' to use the ICT in teaching Slovenian language as follows: developing personal, national and citizenship identity and key capabilities of life long learning – in particular communicating in Slovenian language, social, aesthetic, cultural and intercultural capability, teaching of learning, digital literacy, self-initiative, criticism, creativity, entrepreneurship etc.

The students' diploma projects (Gruden, 2007; Filipčič, 2005) proved that despite the availability of ICT equipment in schools and kindergartens there is a lack of inventive didactic-methodological strategies for the ICT use, especially audio didactic materials which are in the last decade normally attached as additional audio didactic materials in the renewed didactic packages for Slovenian language in all grades of primary schools published by different Slovenian publishing houses.

ICT in the instruction of mathematics

Several researches have been done in the last decade on the issue of the use of new technologies for the instruction of mathematics at all levels of schooling, and they showed a very positive influence of the ICT use on the development of mathematic instruction. As it is the case in every tool it is also the fact in the use of ICT that an improper use of ICT my cause the same amount of damage as an appropriate use of ICT can be positive. How the ICT should be used for the instruction of mathematics depends mostly on the objectives of the instruction of mathematics. Teachers have to be aware that any use of technology as a didactic tool requires from them a didactically well premeditated placement of the technology into the instruction of mathematics. If we focus only on the use of computers, we can identify two basic purposes of the use of computers for the instruction: as a tool for automation and as a tool for compensation. On the basis of these two types of usage computers represent an effective didactic tool for the establishment of mathematical concepts, above all in terms of trivialisation, experimenting, visualising and concentration (Kutzler, 2000).

The use of ICT in the instruction of mathematics is a big challenge for pupils who feel mathematics in this way much more interesting and much easier, and for teachers who by implementing it offer pupils a modern instruction, as well as for the didactic experts for mathematics whose task is to build and consider the optimal models of teaching and learning of mathematics (Kokol-Volč, 2001).

ICT in the instruction of music

Technology makes it possible that the production and reproduction of music is accessible for a wader range of users. Modern curricula for music establish their significance through the following findings. The current technology should individualize and expand music learning. Through the use of computers, electronic instruments, compact discs, CD-ROMs, and various MIDI devices, every student can be actively involved in creating, performing, listening to, and analyzing music. Computers in particular can be used to facilitate the learning of basic skills and information. Teachers should work with students toward a higher-level learning. Digital techniques make sound reproduction of the highest quality available in every classroom, while musical scores and resource materials also are quickly accessible. Advances in computer communications make possible the sharing of learning beyond school, state, and national boundaries (Rudolph, Richmond, Mash, Webster, Bauer & Walls, 2005, p. 16).

Modern researches are studying the inclusion of ICT into instruction from the point of view of the efficiency in reaching the pre-set teaching objectives and the standards of knowledge.

The results of the experimental studies, which have been carried out with the regular inclusion of CAI[1] programmes into the classic instruction of music, have shown certain positive influences on the development of musical skills (reading music notes), audio differentiation and musical memory (Bertz & Bowman, 1994; Rudolph, 2004) as well as the maintenance of motivation and encouragement for activities for pupils with less developed musical capabilities (Davidson, 1990).

The Proposal for the renewed curriculum for music education (2008) includes, as it is the fact for all other subject areas of nine-year primary school curricula, a modern technology as a cross-curricular theme. Its use has been advised in order to reach interactiveness, bigger clarity and effective informativeness. Along with it teachers expose the need for multimedia materials and modern computer environments as well as the need for the establishment of continuous education and information about the novelties (Borota, 2007).

On the basis of the above said we were interested in how is the ICT, according to the estimation of teachers of mostly lower class teaching, actually present in our schools. We have taken a look at the use of ICT in Slovenian language, mathematics and music instruction.

Methodology of Research

Method

Despite the above mentioned average infrastructure and highly motivated teachers for the use of ICT the comparison with the EU shows that Slovenia has slightly low level of ICT usage for the instruction and a worse proportion in the number of computers per pupil (Gerlič, 2005; Brečko et al., 2008).

In the centre of our interest was to find out, by using the survey based research, what was the situation in its practical use for the instruction, for what subjects it was used more and what teaching technology (computer programmes or web pages) was mostly used for the instruction of Slovenian language, mathematics and music instruction.

Sample

For this purpose we included a non-random sample of 468 pedagogical workers, although we did not get answers to all the questions. Up to 454 of pedagogical workers determined their profession, from which teachers of class level instruction prevailed (408 or 89.9%), some of them were teachers of subject instruction level (25 or 5.5%), fewer were male pre-school educators – only female educators (18 or 4.0%) and only 3 (0.7%) were male or female pedagogues. According to the prevalence of lower class level teachers, to whom the questionnaire was addressed, we spoke about class teachers, since the number of others was negligible and statistically not important.

As regards the level of education teachers with high education prevailed (251 or 55.9%), slightly smaller was the share of teachers with higher education (192 or 42.8%) and the fewest were those with secondary education, i. e., only 6 or 1.3% (from that number there was only one class teacher and five pre school educators). The results of the involved teachers have shown that at the lower class level of primary schools there are more teachers with high than higher education and that there are only exceptionally some with secondary education from which there are mostly pre-school educators.

As expected, the majority of questioned were of female gender (435 or 95.2%) and only a smaller number were men (22 or 4.8%). Men were employed at the class level (less than a half of all men) and at the upper subject level (more than a half), however they were not employed as pedagogues or pre-school educators.

The average age of the participants was 38.37 years, with the range from 23 to 60 years and

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[1] Computer assisted instruction. One of the most improved CAI programmes is Sibelius Education Suite, which gives support to the implementation of the American curriculum for music instruction in primary schools.

with the standard declination of 7.98. The average working period was 15.11 years, and the range from 1 to 40 working years in education; the standard declination here is a bit higher, i. e., 9.04.

Instrument and procedure

Teachers filled in a questionnaire which was a combination of numerical rating scale from 5 (wider use) to 1 (smaller use) or in relation with the frequency of use from 4 (very often use) to 0 (zero use), and some open ended and closed questions.

By the factor analysis we verified the factor validation and reliability of the questionnaire, since the Kaiser-Meyer-Olkim's measure was 0.83 which indicated an adequate level for factorisation. The factor analysis also proved that the first factor explains 22.5% of common variance, which is an adequate factor validation. And all factors together give an explanation for 74.3% of common variance, which indicates the reliability of the instrument. The reliability was also confirmed by the Cronbach's coefficient alfa, which was 0.95.

The results shown in the article are elaborated by the descriptive and interference statistics. Besides the mean (M), standard deviation (s), minimum (xmin) and maximum values (xmax), skewness and kurtosis, we also implemented the Pearson correlation coefficient for the establishment of the connections between the estimations on the use in the above stated subjects.

Results of Research

The results on the frequency of the teachers' use of computer programmes and web pages for the instruction of Slovenian language, mathematics and music instruction are displayed in the table 1 below. The study aimed at the frequency of the use of computer programmes and web pages, and not at various internet technologies, such as chat rooms, e-mail, internet conferences, internet notice boards, internet classrooms, electronic materials etc., which can be also used to promote creative and new learning communication (Jonassen et al., 1999), which would also be worth studying.

The results (table 1) show that teachers use ICT for all above enumerated subjects, although for certain more and others less. Teachers have estimated themselves that they use computer programmes and web pages the most frequently for the instruction of Slovenian language and mathematics, and the least for music instruction. Similar results were found in the research on the representative sample of Slovenian schools, where is was found out that in more than a half of the schools included in the study the most frequent use of computer was for Slovenian language and mathematics. Computers are used for music instruction only in less than one tenth of all schools. Schools also consider that they have the largest amount of equipment for the instruction of Slovenian language (86.0%), and fairly little for teaching music (77.8%) (Gerlič, 2005).

The results have confirmed that ICT may be included into all teaching subjects and into all educational activities (Cornu, 2006). And on the other hand we can read the opinion that ICT is more suitable for certain subjects and less for other teaching subjects. Among subjects being considered as adequate for using ICT we can count mathematics, physics, languages, geography (Papert, 1993; Batagelj, 1999).

The use of ICT for mathematics has been justified not only by administrative reasons, e.g., by mentioning the use in the curriculum, but they refer also the opinions of pupils (Oldknow & Tylor, 2003). Pupils see advantages in the use of ICT in a higher motivation, in the support to curiosity, imagination, result improvement, development of problem solving strategies. And teachers mention as advantages of the use of ICT for the instruction of mathematics the following: improved efficiency, reduction of administrative work, more time for individual work with pupils, and that ICT makes possible better monitoring of the pupils' progress, and it encourages thinking about their approaches, and thinking about their understanding of mathematics etc. (Oldknow et al., 2003).

The results of the frequency of the use of computer programmes for music education is relatively low (M=0.75) which is true also for the use of web pages in music (M=0.74). The comparison of the ICT use for music eructation between 1992 and 2005 shows the trend of decrease in the recent years. The reasons are ore to be found in the shortage of didactic materials and in weak classroom equipment (Gerlič, 2005). It has been found out that 35.8% of Slovenian schools have a computer in their classrooms available for their pupils, and 46.5% of schools have a computer for their teacher (Gerlič, 2005).

The findings that ICT is not equally used for the instruction of different subjects due to the lack of adequate programmes are supported also by our results since the teachers included in our research stated in their free replies that it would be necessary to develop more didactic materials which would be supported by the ICT and prepared in cooperation with teacher in practice and also that the strategies of the introduction of ICT into the instruction should be worked out.

Here is an example of the original statement of a teacher: *"ICT can make teachers' work much easier in the classroom if it is logically introduced into the instruction and when an adequate hardware and software is available. It enables a much more dynamic work, an easier adjustment to individuals and their interests – individualisation and differentiation. It contributes to a better quality of instruction."*

Table 1. **The results of descriptive statistics on the frequency of the use of ICT programmes and web pages for the instruction of Slovenian language, mathematics and music education (estimations are ranked form 4 – large use, to 0 – no use).**

Use of ICT and instruction subject	N	x_{min}	x_{max}	M	s	Skewness	Kurtosis
Computer programmes, mathematics	455	0	4	2.35	1.261	-0.522	-0.695
Computer programmes, Slovenian language	458	0	4	2.00	1.227	-0.150	-0.950
Web pages, Slovenian language	457	0	4	1.28	1.221	0.569	-0.709
Web pages, mathematics	453	0	4	1.19	1.265	0.724	-0.630
Computer programmes, music education	427	0	4	0.75	1.032	1.271	0.704
Web pages, music education	427	0	4	0.74	1.070	1.387	1.002

Web pages and internet can be considered as the store of thousands of documents. Teachers can find there all kind of information on a certain topic, it is therefore surprising to see such low usage of web pages both for mathematics (M=1.19), slightly higher for Slovenian language (M=1.28) and very low for music education (M=0.74). The research done in Slovenia, entitled Teachers and Internet (Vehovar et al., 2003), has shown that half of the questioned primary and secondary school teachers at least use internet occasionally together with pupils, and 12% of primary and secondary school teachers at least one hour per week. In that research (Vehovar et al., 2003) among the main obstacles for the use of internet are insufficient computer equipment in classrooms and internet access. Teachers have demonstrated a high level of interest for the use of internet and thought that the state should encourage better equipment of the classrooms (Vehovar et al., 2003).

Table 2 shows the results of the connections between the use of computer for Slovenian language, mathematics and music. Results show everywhere a positive and statistically significant connections of estimations on the use of computer, which is the highest for the subjects of Slovenian language and mathematics (r=0.455), and the lowest is the connection of the estimation on the use of computer between the subjects of mathematics and music (r=0.203). The positive

and statistically significant important correlation coefficients have confirmed the transfer of the use of teaching materials supported by ICT from the point of view of one subject to the other, an have proved the findings that certain subjects have more computer programmes and other electronic materials than others.

Table 2. **Results of Pearson correlation coefficients of the estimations on the use of ICT for the instruction of Slovenian language, mathematics and music education.**

Instruction subject		Instruction subject		
		Slovenian language	Mathematics	Music education
Slovenian language	Pearson Correlation	1	0.455(**)	0,397(**)
	Sig. (2-tailed)		0.000	0.000
	N	460	457	439
Mathematics	Pearson Correlation	0.455(**)	1	0.203(**)
	Sig. (2-tailed)	0.000		0.000
	N	457	457	439
Music education	Pearson Correlation	0.397(**)	0.203(**)	1
	Sig. (2-tailed)	0.000	0.000	
	N	439	439	439

** Correlation is significant at the 0.01 level (2-tailed).

The results have shown, as we mentioned, a positive connection of the ICT usage for instruction, which means that when teachers use ICT for one subject, they use it also for other subjects, should they have adequate programme equipment.

Also the integration function of ICT is often mentioned for instruction. In schools the instruction subjects, especially in the upper grades, are usually isolated form each other, and the ICT makes it possible to integrate different instruction subjects; hence the renewed curricula (proposal 2008) speak about digital competence and above all about the activities for their development as for example how to use critically the information – communication technology (computer programmes, e-learning, use of internet, use of e-mail, videoconferences etc).

Teachers use the ICT for their instruction and are fully aware of the importance of permanent training in this area, as they stated in their replies, such training of teachers is needed, in particular practical education and training for a qualified work with ICT. They also underlined that schools are inadequately equipped, which was also evident from other studies (Gerlič, 2005), and that each classroom should have a multimedia equipment. One of the questioned teachers stated: *"Teachers have an opportunity for qualification and training as for example, Power Point, digital photography, etc., however due to the restricted financial resources we are almost unable to use our knowledge during our instruction, or to pass it on to pupils, as classrooms are not quipped good enough with the modern technology."*

Similar results were obtained in the European research which covered 27 countries. Slovenian teachers have estimated that computers in classrooms are not used more frequently because of bad equipment and the shortage of computers in classrooms (61.3%), lack of didactic materials in general (14.2%), low teachers' competences for the use of computers (11.3%) and due to the lack of didactic materials in Slovenian language (6.7%). Common results of 27 EU states have shown similar results with the only difference that the teachers' incompetence is assessed a bit higher according to EU standards (22.5%) ("Benchmarking Access and Use of ICT in European Schools 2006*,"* 2006).

The teachers of our research have stressed that they miss more help and technical support, e.g., participation of computer experts in the use of ICT. Also the expert literature states, while mentioning the use of ICT, cooperation and team work, since teachers are expected to link themselves with teachers of other subjects as well as with the teachers of computer science. Also the European Schoolnet (2006) in their overview study on ICT states its positive impact on greater links between teachers when planning and carrying out their teaching.

The teachers who participated in the research said that they wanted to be better and systematically informed about the new trends in the use of ICT.

The efficiency of the ICT use for instruction depends on several inter dependent elements which Cradler and Bridgforth (2002) took over after the recommendations of The Office of Technology Assessment (OTA) on minimum requirements for the effective use of technology in education: suiting technology to education goals and standards; a vision of using technology, providing training, technical and administrative support, ensuring access to technology, providing time for teachers to plan and learn how to integrate technology.

Beside this experts have also found out that learning in the computer environment enables an effective establishment of conditions for blended learning by connecting different learning environments and provides opportunities for teaching transfer. Such approach to learning and teaching increases the efficiency of learning and teaching (Bonk & Graham 2006).

Conclusion

On the basis of the obtained results we found out the need for systematic development of multimedia didactic materials which would to a greater extent enable interactive learning and connections among various learning environments. Yet, we still need to continue with the effective education of teachers which is going to give a support to the acquisition and the development of the competences in the area of computer technology as well as in wider media literacy. And the new communication media require from teachers – users – to be capable of treating sensitive ethical actions and activities in the virtual environment and to understand the logic of its operation.

It will be necessary to consider the above said in the future planning of the inclusion of ICT into the instruction, so that schools and school classes shall be able to follow the developments in the information society.

We would like to make conclusions by the opinion of one of the teachers: *"In any case the use of ICT is nowadays necessary and has positive impacts. The use of ICT has a high motivation role, as children all the time strive for something new, they are extremely eager for knowledge. They are attracted to a different way of work and the collection of information through different research paths"*

In addition: *"Teaching and learning have to keep pace with the modern times and to follow new trends. The main objective of teaching is to train pupils how to search independently for the necessary and desired information and I think that the use of ICT gives an opportunity for that. For pupils the use of ICT is a challenge, a novelty and they are very motivated. This way they are involved in the teaching process themselves which contributes to a greater success."*

Information society requires competent teachers also in the area of ICT, which can be achieved only by permanent training, as the information technology changes very quickly. The changes of technology have to be followed also very quickly by the novelties in the equipment; and that is the area where more endeavours and financial resources should be assigned from the State. The continuation of the informatisation is clearly shown also in the amended curricula from 2008 which include the use of ICT for instruction. And it will be necessary, as teachers have stated, to prepare the strategy of the inclusion of ICT into instruction.

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Adviced by Amalija Žakelj, The National Education Institute, Ljubljana, Slovenia

Majda Cencič	Dr., associate professor, University of Primorska, Cankarjeva 5, 6000 Koper, Slovenia. Phone: 00386 5 66 31 275. E-mail: majda.cencic@guest.arnes.si Website: http://www.upr.si
Mara Cotič	Dr., associate professor, University of Primorska, Cankarjeva 5, 6000 Koper, Slovenia. E-mail: mara.cotic@pef.upr.si Website: http://www.upr.si
Vida Medved Udovič	Dr., associate professor, University of Primorska, Cankarjeva 5, 6000 Koper, Slovenia. E-mail: vida.udovic@pef.upr.si Website: http://www.upr.si
Bogdana Borota	Assistant professor, University of Primorska, Cankarjeva 5, 6000 Koper, Slovenia. Phone: 00386 5 66 31 275. E-mail: bogdana.borota@pef.upr.si Website: http://www.upr.si