MODEL OF ICT IMPLEMENTATION IN THE TECHNICAL EDUCATION

Mateja Ploj Virtič
University of Maribor, Slovenia
E-mail: mateja.ploj-virtic@uni-mb.si

Abstract

The operation of a modern university and its competitiveness on the knowledge market are becoming increasingly dependent on the implementation and use of information and communication technology (ICT) in its educational processes. The University of Maribor is entering the process of changes bringing new dimensions to teaching and learning. The present article presents a research that included students/student teachers of technical education at the Faculty of Natural Sciences and Mathematics of the University of Maribor and the Faculty of Education of the University of Ljubljana and design and technology teachers. This research was conducted with the aim to study four fundamental issues important for the implementation of ICT in the educational process on the entire vertical of technical education. These are the available computer equipment, beliefs of students/student teachers of technical education and design and technology teachers about the circumstances regarding the use of the computer and individual forms of e-learning in the educational process, their experiences with using the computer in the educational process and their opinion about the applicability of portals as social environments. One of our main findings was that the viewpoints of both students/student teachers of technical education and design and technology teachers regarding the use of the computer in class were positive. Both confirmed that in technical education different forms of e-learning were appropriate. A high percentage of teachers who regularly use educational portals indicate a great interest for the online social environment. The final finding that students/student teachers of technical education and design and technology teachers support the use of the computer for educational purposes importantly influenced further activities related to the implementation of e-learning into the study process and the preparation of an educational portal.
Key words: *technical education, ICT, e-learning, students/student teachers of technical education, design and technology teachers.*

Introduction

Over the past twenty years, the transformation of a relatively simple computer network used by a few researchers into a global Internet, involving hundreds of millions of people and generating a new economic order, took government, business and education, by surprise. The World Wide Web has changed over the years from a passive environment, where visitors receive only information, into an interactive, co-operating environment, where visitors have the opportunity to modify and create the content. We have witnessed a rapid development of information and communication technologies (ICT) over the last ten years. Social software enables people to meet, connect, create, share and cooperate through computer-assisted communication.

If the Internet is changing everything, will the Internet also have the power to change Universities? Organisations don't change automatically. Organisational development requires proactive human intervention.

In June 2007, the Ministry of Higher Education, Science and Technology adopted the Strategy for the Development of the Information Society in Slovenia through 2010. The strategy

aims to facilitate effective use of ICT to boost the country's competitiveness and productivity and provide a balanced social and regional development and improve the quality of life of the society as a whole and of each individual. The strategy also covers the sphere of education and research which are the main activity of universities.

At the University of Maribor, the implementation of e-learning is in a very active phase but the actual utilisation of e-learning depends on each individual faculty.

New technologies enable more modern forms of study and education. The general guidelines, such as professionalism, pedagogical and educational structure, and technology implementation, are necessary to consider when creating e-materials.

In order for the implementation of ICT into the school system to be of a high quality, appropriate teacher competencies need to be established. Faculties involved in teacher education are thus facing a great challenge.

The Department of Technical Education at the Faculty of Natural Sciences and Mathematics set a very broad scope for the implementation of ICT in the teaching process. By implementing ICT, we did not wish to merely establish e-learning and offer e-content to our students but to unite the entire vertical of technical education by using new technologies. Ever since the number of design and technology hours or any kind of technical content was drastically reduced in the curriculum of primary and grammar schools, a substantial decrease in enrolment in technical studies has been evident. The subject of design and technology is now available only to pupils in the sixth (2 hours a week), seventh (1 hour a week) and eighth (1 hour a week) grade of primary school (12 to 14 year old pupils). The curriculum of grammar schools does not include any technical subjects. It is our belief that an appropriate approach might allow us to call on teachers who have an opportunity to fill these children with enthusiasm for technology and design by using their knowledge and preparing interesting classes. Prior to the setting up of the ICT portal, a research was conducted within the framework of the *Analysis of Higher Education Technical Didactics and Creating the Application Framework for Transferring Technical Knowledge* project including students/student teachers of technical education and design and technology teachers. We were interested in their attitude towards e-learning, the use of the computer in education and types of ICT tools used for educational purposes.

Teacher Educators and ICT

As teacher educators, we are in a way responsible for the competencies teachers acquire during their study. One of the competencies that are necessary for effective teaching is to adequately include ICT in classes and to foster information literacy in children. This is why the faculty, which is responsible for educating teachers, represents the starting point of the educational vertical. Here, ICT needs to be implemented with due thought and systematically. Like in any user-oriented system or service, the satisfaction of users is one of the key factors in a successful implementation of e-learning programmes. High satisfaction reflects that learners are more willing to continue in online instructional programmes, resulting in lower attrition rates, more referrals from enrolled students, greater motivation, better learning achievement and increased commitment to the programme. For e-learning, learners are just like customers; they would demand both instructional quality and satisfaction. Prior to implementing changes, the available options and student interests need to be carefully studied and learning styles classified in order to adapt e-learning. Numerous studies on the use of ICT in education have been conducted. Chen (Chen, Lin, & Kinshuk, 2008) researched the satisfaction of users of e-learning by using the SAFE model based on negative critical incidents such as slow responses in accessing the content or if the teacher was not so helpful in answering questions during online discussions.

Macedo-Rouet (Macedo-Rouet, Ney, Charles, & Lallich-Boidin, 2009) compared the impacts of Web vs. paper to deliver practice quizzes that require information search in lecture notes and concluded that Web delivery imposed higher perceived cognitive load due to the need to read lengthy documents. She suggested possible ways to improve Web-based practice materials, such as simultaneous display of questions and lecture notes.

Numerous research works regarding e-learning have been done to enhance teaching quality in e-learning environments. Among these studies, researchers have indicated that adaptive learning is a critical requirement for promoting the learning performance of students (Brusilovsky & Maybury, 2002; Graf & Kinshuk, 2006; Sessink, Beeftink, Tramper, & Hartog, 2003). Adaptive learning provides adaptive learning materials, learning strategies and/or courses according to a student's learning style. The learning style is an indicator of how a student learns and likes to learn, and how an instructor teaches to successfully address the needs of individual students (Chang, Kao, Chu, & Chiu, 2009; Tseng, Chu, Hwang, & Tsai, 2008). Hence, the first step for achieving adaptive learning environments is to identify students' learning styles. Depending on one learning style model, numerous research works also have provided mechanisms to detect and identify learning styles for achieving an adaptive e-learning environment (Chen, Lee, & Chen, 2005; García, Amandi, No, S, & Campo, 2007; Xenos, 2004). These mechanisms need to be based on a large number of student's samples. Chang (Chang, Kao, Chu, & Chiu, 2009) has proposed the learning style classification mechanism that combines enhanced k-NN classification and generic algorithm.

Teachers and ICT

Despite their belief that ICT is a useful tool, some teachers still do not use it, as they believe that they are not competent to use ICT. Waite (Waite, 2004) ascertained that almost 75% of the teachers considered that when using computers and the Internet, they had to change the ways in which they planned their teaching. This may suggest another factor that may act as a barrier in using ICT in classrooms, as teachers may require extra time to prepare a class. A teacher may have to book the computer suite or a laptop, decide activities suitable for computer use, check software in advance and have a contingency plan etc.

In the past, teachers did not engage with ICT during their study as often as the teachers studying today and as a result, the already employed teachers often believe that they are not competent enough to use a computer in their classroom. A simple combination of hardware and software will not make ICT integration naturally follow (Earle, 2002). Teachers facing ICT implementation alone need to plan thoughtfully before they start ICT integration into a curriculum. For instance, they have to choose the correct ICT tools for particular learning objectives or contexts, modify existing resources or develop new learning environments to engage specific groups of learners, or decide scaffolding strategies for student-centred learning (Wang, 2008).

Numerous researchers, who have studied the use of ICT in education (Bitner & Bitner, 2002; Chen, 2008; Loveless, 2003), have predominantly shown that the decisive factor for a successful implementation of ICT into education is the teacher. There are numerous factors influencing the teacher's use of ICT. According to some authors (Ertmer, 2005; Watson, 2006; Windschitl & Sahl, 2002), the most important factor is the teacher's belief in the transformative nature of new technologies.

Student Teachers and ICT

Today's students are the so-called computer generation that grew up with computers and the rapid development of ICT. We therefore assume that the use of ICT in education should not represent a major problem. Nevertheless, prior to implementing ICT in the educational process, their eventual desires or even advice need to be heard.

Numerous studies of beliefs and attitudes of student teachers to ICT have been conducted (Chou, Yu, Chen, & Wu, 2009; Cuckle, Clarke, & Jenkins, 2000). In 2003, Taylor conducted longitudinal monitoring of students' learning with and about ICT (Taylor, 2003), where students reported that they consciously used a repertoire of learning strategies whilst developing their ICT skills. They perceived several factors as affecting their progress, including previous experience, match of learning opportunities with their preferences and software attributes. A later study by Taylor (Taylor, 2004) provides a helpful typology to explain the development of sophistication in student teachers' thinking about the use of ICT in teaching; this study highlights three factors – university-based teaching, assignments and teaching using ICT – as being significant in this

development. Student teachers are now required to not only show good ICT skills, but also to be able to include ICT in their teaching in a manner which enhances children's learning.

Sime (Sime & Priestley, 2005) dealt with perceptions of student teacher on the use of ICT in schools with a focus on learning to teach with ICT and on using ICT in teacher training. Student teachers associated the use of ICT with changes in the nature of classroom relations, as well as a reshaping of learning and teaching.

Methodology of Research

As part of the *Analysis of Higher Education Technical Didactics and Creating the Application Framework for Transferring Technical Knowledge* post doc project, Ploj Virtič conducted a research in Slovenia. This research included design and technology teachers, graduates of the Faculty of Natural Sciences and Mathematics and students – student teachers of technology education. The research was based upon descriptive casual method, non-experimental method of empirical pedagogical research.

There seem to be four major issues identified by research for introducing technology in teachers' practice. These are:

- Resources: available technologies in schools;
- Beliefs: personal ideas about the contribution that technology can make to the processes of teaching and learning and classroom management;
- Experience: own training and ICT skills, abilities to control ICT use in the classroom and actual use of ICT in classroom;
- Community: membership to a network of colleagues who can provide support, encourage use and constitute a learning community.

Participants

The research included 67 teachers teaching Design and Technology (D&T) at primary schools in Slovenia (Ploj Virtč & Pšunder, 2009) and 116 student teachers of technical education in Slovenia.

It needs to be stressed that Slovenian primary schools usually have only one teacher of D&T, which consequently means that the sample of respondents represents approximately 60% of all D&T teachers.

The sample of teachers was approximately equally divided by age (32.8% up to 40 years of age, 32.8% from 40 – 45 years of age and 34.3% above the age of 45) and period of employment (50.7% up to 20 and 49.3% more than 20 years). With regard to the location of the school, the sample covered teachers at rural schools (47.8%), followed by teachers at urban schools (34.3%) and teachers at suburban schools (17.9%). Just under two thirds of teachers (59.7%) have a higher education diploma and just over one third (40.3%) have completed post secondary education.

The sample of students/student teachers represents almost 80% of all student teachers of technical education. The sample of student teachers was divided by year of study: 18.1% first-year students, 25% second-year students, 22.4% third-year students, 29.3% fourth-year students and 5.2% candidates for graduation. 68.1% of the students came from the University of Maribor and 31.9% of the students from the University of Ljubljana. One half of the students or 50% reside at home during their study. In addition to technical education, students study mathematics (31.9%), followed by physics (24.1%), computer sciences (18.15), biology (10.3%) and chemistry (5.2%). 10.3% of the interviewed students study other subjects.

Data Collection

Data was collected using anonymous questionnaires that were developed by the author to be used in this study. The teachers were interviewed with the help of the National Education Institute that sent the questionnaires to D&T teachers who in turn filled them in and returned them by email, while student teachers were interviewed during classes and online.

The questionnaire consisted of two sections. The respondents were first asked to provide some general information (demography). The second part consisted of questions divided into four

sections (the questionnaire for teachers into three sections, as data on the availability of computer equipment and technologies in primary schools is known):

- the first section was aimed to establish the availability of computer equipment and technologies;
- the second section was aimed to establish the respondents' beliefs about the applicability of ICT;
- the third section was aimed to establish the respondents' experience with ICT and its actual use in class;
- the fourth section was aimed to establish the extent to which the respondents used online educational portals as a means of communication.

Statistical procedures of data analyses

Collected data were imported and processed with the programme SPSS (Statistical Package for the Social Sciences) for Windows. We calculated the frequency distribution and basic descriptive statistics.

Results of Research

Results of Research among Technical Education Teachers

The research conducted among teachers did not include questions relating to the availability of appropriate technological equipment in schools, as it is known that Slovenian schools are very well equipped and enable the implementation of modern forms of education.

• *Beliefs:*

Opinion of the respondents regarding the applicability of individual forms of e-learning in class

We were interested which forms of e-learning the respondents see as being the most applicable for use in the educational process. The respondents expressed their opinion on individual forms of e-learning on a five-stage scale. Statements relating to the applicability of individual forms of e-learning were appointed numeric values from 1 – I completely disagree to 5 – I completely agree. The more that the respondents agreed with an individual statement, the more they are convinced about the applicability of an individual form of e-learning in the educational process. We must however not ignore the fact that respondents answered with regard to the specifics of their subject, i.e. D&T which probably differs from other subjects. Their answers are presented in Table 1.

Table 1.   The Applicability of Individual Forms of E-Learning

Forms of e-learning	Mean	SD
Simulations	4.33	0.93
Interactive exercises	4.03	0.92
E-material	3.96	0.89
Educational portals	3.37	0.95
Forum	3.21	1.16
Online seminars	3.00	1.03
Blog	2.63	1.08

Table 1 shows that the respondents expressed a positive viewpoint about the majority of forms of e-learning with regard to their applicability in the educational process. The mean rating of online seminars indicates a neutral viewpoint regarding their applicability in the educational process, while the applicability of blogs received a negative viewpoint.

Table 1 indicates that respondents see simulations as the most applicable form of e-learning in the educational process. Such answers probably relate to the specifics of the subject that D&T teachers teach. The respondents are a little less (but still substantially) inclined towards interactive exercises and e-material that they have classified as the second and third most applicable form. Educational portals were classified as fourth and forums as fifth.

- ***Experience:***

Opinion of the respondents regarding the circumstances of using the computer in class

We were initially interested in the viewpoints of respondents regarding the circumstances of using the computer in class. We were interested if they see the circumstances as supporting or hindering the use of the computer in class. We were interested in what the respondents think about different circumstances that might be more or less favourable for the use of the computer in class.

The respondents used a five-stage scale to express their opinion on whether the circumstances for the use of the computer in class are favourable or not. Statements relating to individual circumstances were appointed numeric values from 1 – I completely disagree to 5 – I completely agree. Their answers are presented in Table 2.

Table 2.   The Circumstances regarding the Use of the Computer in Class

Circumstances regarding the use of the computer in class	Mean	SD
Use of the computer in class in necessary.	4.52	0.73
Pupils are interested in the use of the computer in class.	4.52	0.68
Additional education of teachers for the use of the computer in class is necessary.	4.19	0.78
The school's management facilitates the use of the computer in class.	4.12	1.00
The study of technical education contains sufficient practical training regarding the use of the computer in class[1].	1.48	0.66

[1] This question was answered only by respondents taking their undergraduate study at the Faculty of Education or after 2006 at the Faculty of Natural Sciences and Mathematics (n=59). In 2006, the Faculty of Education was divided into three faculties, one of them being the Faculty of Natural Sciences and Mathematics.

As evident from Table 2, the average response of teachers regarding four of the statements was positive, indicating their conviction that the majority of circumstances are favourable for the use of the computer in class. There was only one of the statements that received a negative attitude, i.e. the statement that the study of technical education at the Faculty of Education (today's Faculty of Natural Sciences and Mathematics) provided sufficient training regarding the use of the computer in class. The opinions of the respondents regarding this statement show a decisive negative contrast in relation to all other statements.

Table 2 also shows that the respondents were most inclined towards two of the statements, i.e. that the use of the computer in class is necessary and that pupils are interested in using the computer in class. The respondents were equally positive about both statements.

The fourth position regarding the favourability of individual circumstances regarding the use of the computer in class was taken by the statement regarding the inclination of the school's management towards the use of the computer in class.

The use of the computer among D&T teachers

The respondents were asked in which parts of the study process they use the computer. Their answers are presented in Table 3.

Table 3.   The Purpose of Using the Computer in the Educational Process

The purpose of using the computer	f	f%
Support in class	58	86.6
Simulations of more complex technical systems	52	77.6
Independent acquisition of knowledge and information	48	71.6
Practical part	19	28.4
Homework	5	7.5
Other	3	4.5

As evident from Table 3, the majority of respondents use the computer as support in class. A somewhat smaller number of respondents (but still a substantial percentage) use the computer for simulations of more complex technical systems. The respondents rather often use the computer for independent acquisition of information and knowledge.

Something less than one third of respondents said that they use the computer in the practical part and only 7.5% of respondents that they use the computer also for homework. Some of the respondents stated that they use the computer also for other purposes, i.e. planning and technical drawing.

• ***Community:***

The use of educational portals among D&T teachers

The last set of questions in the questionnaire related to the use of educational portals among respondents. We were first interested in whether respondents even use educational portals or how often they use them. The respondents answered this question by choosing answers among the provided possibilities.

The majority of the respondents (92.5%) stated that they use educational portals. Among the respondents answering that they do not use educational portals, 4 of the teachers were over the age of 40. Such answers might relate to the fact that the older generation in general has more difficulties adapting to new computer technologies than the younger one, as these see computer technology as an intrinsic part of their lives.

The majority of the respondents (50.7%) stated that they use the educational portals a few times a month; these are followed by respondents who use these portals several times a week (28.4%). Only 10.4% of respondents said that they use the portals less than once a month and only 3% of respondents use these portals every day. It is recalled that teachers positioned educational portals as fourth regarding the applicability of forms of e-learning in the educational process.

We were further interested which educational portals the teachers use most often. The answers are presented in Table 4.

Table 4.   Educational Portals Used by the Respondents

Educational portals	f	f%
Moodle	22	32.8
School portal[1]	21	31.3
Uciteljska.net exchange of material[2]	33	49.3
Portal of the National Education Institute[3]	42	62.7
Svarog.org[4]	11	16.4
Other	8	11.9

[1] Educational portal provided by individual schools
[2] Website enabling communication among teachers and the exchange of different materials
[3] Educational portal maintained by the National Education Institute
[4] Website enabling the exchange of professional literature for teachers

As evident from Table 4, respondents use rather different portals. Most commonly, this is the portal of the National Education Institute, followed by the uciteljska.net exchange of material portal, Moodle, the school portal and Svarog.org. Apart from the provided portals, respondents stated also other portals: Virtual school, Rokus, CPI, TZS, praktik.si. All the stated portals enable the exchange of material for educational purposes.

A Discussion of Research Results among Teachers

The respondents' viewpoint about the majority of forms of e-learning with regard to their applicability in the educational process might allow us to conclude that D&T teachers are open to different possibilities of using the computer in class. The diverse use of individual forms of e-learning is of course necessary, so as to allow the teacher to prepare an interesting and attractive class. The prevalence of individual forms of e-learning in class might result in the pupils quickly growing weary of the use of the computer in class. There are numerous specific programmes available for the field of design and technology, facilitating simulations that might otherwise be difficult or even impossible to witness in the natural environment (e.g. simulation of operation of an individual machine). From this point of view, the computer in D&T classes seems a necessary and indispensible part of a quality educational process as indicated by the answers provided by the respondents.

Although, this was not the subject of our study it was indicated by the positive attitude of the respondents towards the statement, that additional education of teachers regarding the use of the computer in class is important. The respondents' answers indicate that the teachers are open to further education, as they see it as important and necessary.

We regard the answers about inclination of the school's management towards the use of the computer in class as satisfactory, but are however convinced that the school's management might do even more in this field. The school's management is namely that subject which has an important impact on whether the school as an institution and its employees will be inclined towards novelties arising from the continual development and resulting changes and whether these novelties will be implemented in school work or whether the practice will hinder them. We therefore believe that it is essential for the school's management to first be aware of the importance of the use of the computer in class, to use computers themselves and at the same time stimulate their colleagues to do the same.

The respondents' answers that they rather often use the computer for independent acquisition of information and knowledge indicate that for D&T teachers, the computer represents an important source of knowledge and information. Such acquisition of knowledge and information is fast and enables access to different types of information while at the same time requires the teacher

to display critical reflection regarding the suitability and adequacy of the acquired information. The low percentage regarding the use of the computer for homework is somewhat expected, as teachers cannot expect all pupils to have a computer to do their homework. On the other hand, we cannot ignore the fact that numerous schools have modern computer classrooms but the question remains to what extent the pupils are able to use these classrooms outside classes.

Research Results among Students/Student Teachers of Technical Education

• *Resources:*

Opinion of the respondents regarding the suitability of computer and ICT equipment in their study of technical education at the faculty

All of the respondents stated that they have internet access at their place of study.

The next set of questions contained individual claims. We were interested in the degree to which the respondents agreed with the claims (on a scale of 1 to 5, whereby 1 means I completely disagree and 5 I completely agree).

We were interested in the respondents' evaluation of the applicability of hardware and software and the conditions for using ICT in the study of technical education at the faculty. The software was evaluated better than hardware. With regard to the question whether conditions for using ICT meet the respondents' expectations, we calculated the share of those answering that they agree with the claim and ascertained that 75% of respondents *agree, very much agree* or *completely agree* with the claim (Table 5).

Table 5.   Adequacy of Conditions for the Use of ICT in the Study of Technical Subjects

	f	f%	Valid Percent	Cumulative Percent
I completely disagree	1	0.9	0.9	0.9
I partially disagree	27	23.3	23.3	24.1
I agree	48	41.4	41.4	65.5
I very much agree	34	29.3	29.3	94.8
I completely agree	6	5.2	5.2	100.0
Total	116	100.0	100.0	

• *Beliefs:*

Opinion and beliefs of the respondents regarding the efficiency of educational portals in the study process

With regard to the question whether educational portals are very efficient, the respondents encircled the appropriate number on a scale from 1 to 5, whereby 1 means that they completely disagree with the claim and 5 that they completely agree with the claim. The average mark was 3.29 so the respondents *agree*. We were further interested (Table 6) in the share of respondents who agree with this claim and ascertained that 76.7% *agree, very much agree* or *completely agree* with the claim that educational portals are very efficient.

Table 6.   Efficiency of Educational Portals

Portals are very efficient	f	f%	Valid Percent	Cumulative Percent
I completely disagree	5	4.3	4.3	4.3
I partially disagree	17	14.7	14.7	19.0

I agree	53	45.7	45.7	64.7
I very much agree	32	27.6	27.6	92.2
I completely agree	9	7.8	7.8	100.0
Total	116	100.0	100.0	

Frequency of Using Educational Portals

With regard to the question on how often they used educational portals, the major part of the respondents answered that they used these portals *very rarely, less than once a month* with a slightly smaller share of respondents answering that they used the portals *a few times a month*. One quarter of the respondents *does not use* these portals at all (Table 7). A very small share of respondents use educational portals *every day*.

Table 7. Frequency of Using Educational Portals

Frequency of Using Educational Portals	f	f%	Valid Percent	Cumulative Percent
every day	4	3.4	3.4	3.4
several times a week	11	9.5	9.5	12.9
a few times a month	35	30.2	30.2	43.1
very rarely, less than once a month	37	31.9	31.9	75.0
I do not use educational portals	29	25.0	25.0	100.0
Total	116	100.0	100.0	

Opinion of the respondents regarding the need for computers, ICT forms and their applicability in education in the technical field

The need for the use of a computer in the study process of technical subjects received an average grade of 4.35 (on a scale of 1 to 5) which means that respondents agree with the claim *very much*. We were further interested in the share of the respondents who agree with this claim and ascertained that 94.7% *agree, very much agree* or *completely agree* with the claim (Table 8).

Table 8. The Need for the Use of a Computer

The need for the use of a computer	f	f%	Valid Percent	Cumulative Percent
I completely disagree	1	0.9	0.9	0.9
I partially disagree	4	3.4	3.5	4.4
I agree	15	12.9	13.2	17.5
I very much agree	28	24.1	24.6	42.1
I completely agree	66	56.9	57.9	100.0
Total	114	98.3	100.0	
Missing	2	1.7		
Total	116	100		

The question *Which forms of ICT do you see to be the most useful in education in the technical field* provided several possible answers for the respondents. Their answers are presented in Table 9.

Table 9. **Forms of Information and Communication Technologies and their Applicability in Education in the Technical Field**

Forms of ICT	N	%	Percent of Cases
e-material	95	35.2	82.6
forum	59	21.9	51.3
simulations	52	19.3	45.2
interactive exercises	38	14.1	33.0
webinars	16	5.9	13.9
blog	10	3.7	8.7
Total	270	100.0	234.8

The respondents marked *e-material* as being the most useful in education in the technical field on the entire vertical of education, from educating pupils to additional and lifelong education of teachers. A smaller applicability is contributed to *forums*, followed by *simulations, interactive exercises* and *webinars* with the least applicability being contributed to *blogs*.

- *Experience:*

The use of the computer in the study of design and technology

This set of questions related to the actual use of the computer in the study of technical subjects. The results are presented in Table 10.

Table 10. **Frequency of Using the Computer in the Study of Technical Subjects**

Frequency of using the computer	f	f%	Valid Percent	Cumulative Percent
a few times a month	40	34.5	34.5	76.7
once a week	32	27.6	27.6	42.2
very rarely, less than once a month	22	19.0	19.0	95.7
for all classes	17	14.7	14.7	14.7
never	5	4.3	4.3	100.0
Total	116	100.0	100.0	116

With regard to the question on how often they used the computer in the study of technical subjects, the respondents answered that they used the computer *a few times a month,* followed by those who use it *once a week* then *very rarely, less than once a month* and those who use it *for all classes.* There were also individual respondents who *never* used the computer in the study of technical subjects.

We were also interested for which parts of the study process the respondents used the computer. The results are presented in Table 11.

Table 11.   Parts of the Study Process of Technical Subjects where the Computer is Used

Use of computer in the study process	N	%	Percent of Cases
Independent acquisition of knowledge and information	79	26.6	68.7
Support in the study process	78	26.3	67.8
Homework	64	21.5	55.7
Practical part	44	14.8	38.3
Simulations	29	9.8	25.2
Other	3	1.0	2.6
Total	297	100.0	258.3

The question for which part of the study process of technical subjects the computer is used provided respondents with several options to choose from. They answered that they mostly used the computer for *independent acquisition of knowledge and information* and for *support in the study process,* slightly less for *homework* and even less for the *practical part* and *simulations*. The answer *other* was chosen the least times.

Use of the computer in demonstration lessons and during practical training in technical subjects

The respondents answered that 65 (56%) from a total of 116 already held demonstration lesson and from that 49 of the respondents used computers as a teaching aid. This means that over 75% of respondents used the computer as a teaching aid in the implementation of demonstration lessons and during practical training.

• *Community:*

The use of educational portals

The last set of questions in the questionnaire related to the use of educational portals among the respondents. The results are presented in Table 12.

Table 12.   The Use of Educational Portals

Which educational portals do you use	N	%	Percent of Cases
Uciteljska.net	48	34.0	41.7
Svarog	34	24.1	29.6
I do not use educational portals	31	22.0	27.0
Moodle	14	9.9	12.2
other portals	14	9.9	12.2
Total	141	100.0	122.6

Most commonly, the respondents use the *Uciteljska.net* exchange of material followed by *Svarog* and those who *do not use educational portals*. The respondents use *Moodle* and *other educational portals* the least.

A Discussion of Research Results among Students

Even though all students have internet access at their place of study, the sample of respondents indicates that they rarely use it directly for study purposes and if so than most often for independent acquisition of knowledge and information and for support in the study process.

Conditions for using ICT at faculties meet the students' expectations. Here, they see the

software as being better than the hardware. This information is surprising, as in light of the high demands of the majority of the young population most students bring their own laptops to the faculty.

The use of an active membership in educational portals represents a great opportunity for student teachers: from acquiring new knowledge, exchange of experiences, different information, networking support and a communication tool.

The answers provided by the majority of the respondents (three quarters) indicate that teacher students are aware of these opportunities but nevertheless rarely use these portals. The students who do use these portals mostly choose those that enable exchange of material. We assume that with regard to communication and networking, students prefer to use online portals of a non-educative nature. There is nothing wrong with that as it enables them to acquire the competencies needed to use online portals that they can later utilise for educational portals when the interest and need arise.

On the basis of the positive evaluation of students, it can be ascertained that students are inclined towards using the computer in education in the technical field. The students see e-material as being the most useful in education in the technical field on the entire vertical of education, from educating pupils to additional and lifelong education of teachers, while blogs are considered to be the least useful. The low utilisation value of the blog in the study process was anticipated, as the blog has so far not been used for these purposes, while teacher educators see the utilisation value of the blog in education especially in writing different reports and record books of practical training.

Three quarters of students, who have already conducted demonstration lessons and practical training, used the computer as a teaching aid in these processes. This information indicates that students see the computer as a teaching aid as being an advantage and this is a good indicator for the use of the computer among teachers in the educational process in the future.

The respondents' answers indicate that student teachers are open to computer use in the education process, as they see it as important and necessary.

Conclusion

The present study was conducted with the aim to identify four major issues for introducing technology in student teachers' and teachers' practice. These are resources, beliefs (what student teachers and teachers think about the circumstances regarding the use of the computer and the applicability of individual forms of e-learning in the educational process), experience (to examine how the computer is actually used in the educational process) and community.

This research has shown that the available computer equipment and conditions for the use of ICT at faculties meet the students' expectations. The same applies to resources of all schools.

One of the fundamental findings of this study is that the viewpoints of both, student teachers and teachers regarding the circumstances of using the computer in class are positive.

Teachers stressed the problem of knowledge and experiences acquired during undergraduate study. Such results indicate that in the future, education of especially D&T teachers regarding the use of the computer in class will have to provide more practical training and more knowledge for the actual use of the computer in class.

With regard to student teachers, it stands out that despite their inclination towards and a good knowledge of the computer, the students rarely use it directly for study purposes.

The study further showed that student teachers and teachers see various forms of e-learning as being applicable. The most applicable form of e-learning is simulations for teachers and e-material for student teachers, while applicability is recognised also to other forms of e-learning. Such information is encouraging, as the inclination towards individual forms of e-learning represents also a potentially better starting point for the actual use of these forms in practice.

Another important finding of this study is that almost all D&T teachers stated that they use the computer in class. This might be the reason why the majority of student teachers used the

computer in their demonstration lessons and practical training. D&T teachers are namely student mentors in their teaching assignments in schools.

Important information acquired by this study is the applicability of educational portals among teachers and students. A surprisingly high percentage of teachers using these educational portals indicate their great interest in acquiring new information, exchanging experiences and socialising with other teachers with the same interests.

The present study has shown that students see educational portals as efficient but nevertheless more often visit online portals with non-educative content. This information is not alarming as in the long-run it is only important for them to learn how to use online portals. When they start teaching, their interests will change and they will be able to search for appropriate information and people in the right place. It is the role of teacher educators to inform the students and to motivate them for cooperation in and use of educational portals.

The finding that student teachers support the use of the computer for educational purposes importantly influenced further activities related to the implementation of e-learning into the study process.

References

Bitner, N., & Bitner, J. (2002). Integrating technology into the classroom: Eight keys to succes. *Journal of Technology and Teacher Education*, 10, 95–100.

Brusilovsky, P., & Maybury, M. T. (2002). From adaptive hypermedia to the adaptive web. *Communications of the ACM*, 45 (5), 30–33.

Chang, Y., Kao, W., Chu, C., & Chiu, C. (2009). A learning style classification mechanism for e-learning. *Computers & Education*, 53 (2), 273–285.

Chen, C. H. (2008). Why Do Teachers Not Practice What They Believe Regarding Technology Integration. *The Journal of Educational Research*, 102 (1), 65–75.

Chen, C. M., Lee, H. M., & Chen, Y. H. (2005). Personalized e-learning system using Item Response Theory. *Computers and Education*, 44 (3), 237–255.

Chen, N., Lin, K., & Kinshuk. (2008). Analysing users' satisfaction with e-learning using a negative critical incidents approach. *Innovations in Education and Teaching International*, 45 (2), 115–126.

Chou, C., Yu, S., Chen, C., & Wu, H. (2009). Tool, Toy, Telephone, Territory, or Treasure of Information: Elementary school students' attitudes toward the Internet. *Computers & Education*, 53 (2), 308–316.

Cuckle, P., Clarke, S., & Jenkins, I. (2000). Students' Information and Communication Technology skills and their use during teacher training. *Journal of Information Technology forTeacher Education*, 9, 9–22.

Earle, R. S. (2002). The integration of instructional technology into public education: Promises and challenges. *Educational Technology*, 42 (1), 5–13.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53 (4), 25–39.

García, P., Amandi, A., No, S., S, & Campo, M. (2007). Evaluating Bayesian Networks' precision for detecting students' learning styles. *Computers and Education*, 49 (3), 794–808.

Graf, S., & Kinshuk, P. (2006). An approach for detecting learning styles in Learning Management Systems. In. *Proceedings of the sixth international conference on advanced learning technologies* (ICALT 06) (pp. 161–163).

Loveless, A. (2003). The interaction between primary teachers' perceptions of ICT and their pedagogy. *Education and Information Technologies*, *8* (4), 313–326.

Macedo-Rouet, M., Ney, M., Charles, S., & Lallich-Boidin, G. (2009). Students' performance and satisfaction with Web vs. paper-based practice quizzes and lecture notes. *Computers & Education*, 53 (2), 375-384.

Ploj Virtč, M., & Pšunder, M. (2009). The Computer as a Modern Form of Communication in the Educational Process from the Teachers` Point of View. *Informatologia*, 42 (1), 10–17.

Sessink, O., Beeftink, R., Tramper, J., & Hartog, R. (2003). Author-De ned storage in the next generation Learning Management Systems. In. *Proceedings of the 3rd IEEE international conference on advanced learning technologies* (Vol. 03, pp. 57–61).

Sime, D., & Priestley, M. (2005). Student teachers' first reflections on information and communications technology and classroom learning: implications for initial teacher education. *Journal of Computer Assisted Learning*, 21, 130–142.

Taylor, L. (2003). ICT skills learning strategies and histories of teacher trainers. *Journal of Computer Assisted Learning*, 19, 129–140.

Taylor, L. (2004). How student teachers develop their understanding of teaching using ICT. *Journal of Education forTeaching*, 30, 43–56.

Tseng, C. R., Chu, H. C., Hwang, G. J., & Tsai, C. C. (2008). Development of an adaptive learning system with two sources of personalization information. *Computers and Education*, 51 (2), 776–786.

Waite, S. (2004). Tools for the job: a report of two surveys of information and communications technology training and use for literacy in primary schools in the West of England. *Journal of Computer Assisted Learning*, 20, 11–21.

Wang, Q. (2008). A generic model for guiding the integration of ICT into teaching and learning. *Innovations in Education and Teaching International*, 45 (4), 411–419.

Watson, D. (2006). Understanding the relationship between ICT and education means exploring innovation and change. *Education and Information Technologies*, 11 (3-4), 199–216.

Windschitl, M., & Sahl, K. (2002). Tracing teachers´use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal*, 39, 165–205.

Xenos, M. (2004). Prediction and assessment of student behaviour in open and distance education in computers using Bayesian networks. *Journal of Computers and Education*, 43 (4), 345–359.

Adviced by Boris Aberšek, University of Maribor, Slovenia

Mateja Ploj Virtič	Asistent at the Department of Technical education, Faculty of Natural Sciences and Mathematics, Koroska cesta 160, SI-2000 Maribor, Slovenia. Phone: +386 2 229 37 85. E-mail: mateja.ploj-virtic@uni-mb.si Website: http://tehnika.fnm.uni-mb.si/default.aspx