

Experimental Model for Instruction of Pre-Service Teachers in ICT Tools and E-learning Environments

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Abstract—This article describes the implementation of an experimental model for teaching ICT tools and digital environments in teachers training college. In most educational systems in the Western world, new programs were developed in order to bridge the digital gap between teachers and students. In spite of their achievements, these programs are limited due to several factors: The teachers in the schools implement new methods incorporating technological tools into the curriculum, but meanwhile the technology changes and advances. The interface of tools changes frequently, some tools disappear and new ones are invented. These conditions require an experimental model of training the pre-service teachers. The appropriate method for instruction within the domain of ICT tools should be based on exposing the learners to innovations, helping them to gain experience, teaching them how to deal with challenges and difficulties on their own, and training them. This study suggests some principles for this approach and describes step by step the implementation of this model.

Keywords—ICT tools, e-learning, pre-service teachers.

I. INTRODUCTION

THE technological changes in the last few decades affected education in all its facets. One of these changes is new attitudes towards teaching and towards the role of the teacher. The teacher today can no longer be the sole source of knowledge, since the extent of the knowledge is almost endless [6], [17]. It continues growing and changing so fast that the teacher cannot - and should not - get all of this vast information to be able to deliver effective instruction. E-learning environments and ICT tools also change often. However, the guidance of the teacher is still required. New attitudes and methods of teaching are required today.

It seems logical that the change must begin in teachers training. To make the necessary changes we have to identify the main problem and suggest a model that offers a better and more effective method for learning and teaching in digital environments.

This study describes the problem of teaching ICT tools to pre-service teachers and suggests an experimental model for instruction in teachers training. In addition, the article describes a first pilot in which a group of students was taught using this model.

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II. LITERATURE BACKGROUND

A. *The Digital Divide and Its Expressions in the Teacher-Student Learning Process*

A problem that is related to this question deals with the technological gap between teachers and students. Most of the students today were born into a technological world and into the information revolution. They feel free in technological environments. In fact, they almost don't know how to function without the technological tools. These students learn new tools very quickly, whereas their teachers sometimes struggle with outdated technological tools with lack of confidence. All this happens in the same environment in which the students feel "as fishes in the water" [20], [15]. Tapscott [20] calls today's young generation "The Net Generation".

The divide and the different attitude towards ICT tools cause complicated situations in the teaching and learning process. The psychological implications of the technological gap are therefore variable and should be taken into account while developing new educational programs [16], [18].

Prensky [15] distinguishes between the generation of the young people and the adult generation. He calls the generation of the people who were born into the digital world "Digital Natives". Most of the teachers, on the other hand, belong to the generation which he calls "Digital Immigrants". Prensky claims, that the single biggest problem facing education today is that the 'digital immigrant' instructors, who speak an outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language. Prensky also argues, that the current educational system is ill-prepared for this new generation of students. Another trait that is ascribed to digital natives, is that they are multitaskers, Technology, he says, encourages this multitasking. Dede [3] as well as Frand [8] claims that this students' generation differs from the past generation of students, and that the instruction must change.

Koutropoulos [12] reviews several studies about the knowledge of students of the "digital age". Some reported that over 80% of first year students reported a "slight confidence" and "basic skills" with presentation software and online library tools, like blogs and wikis, these students reported that they did not feel confident using them. According to this research only a minority of students felt that it was important for them to share and upload content. Koutropoulos claims that even when students use a certain technology for personal use, it doesn't mean that they know how to use it in an educational context. He concludes following Dresang [4] that the digital natives are missing out on this rich environment because they have poorly developed information-seeking

skills. In other words, they default to sources that they are already acquainted with. Koutropoulos is critical of grouping this whole generation together into one group called "digital natives". He argues that there is no one monolithic group that we can point to and say that those are "digital natives". Rather the individuals who would fit the stereotype of the digital native appear to be the minority of the population. This claim is supported by the research of Bennet [1] who shows significant diversity in the technological skills, knowledge and interests of young people, and suggests that there are important "digital divides" which are ignored by the digital native concept. We can conclude, based on these findings, that students today perhaps belong to the "digital age" but they are not one group and have a variety of skills and several different levels. However, it appears that the divide between the generation of the teacher and the generation of the students does exist, and forces us as educators to give consideration to the implements of teaching and to the learning process. Lim [14] claims that a sociocultural approach towards the study of ICT in education rejects the view that ICT can be studied in isolation; it must be studied within the broader context in which it is situated.

Kula [13] argued that the use of ICT in the learning-teaching process makes learning more effective. The best way to take advantage of ICT is by integrating these tools into the learning-teaching process. The author reviews several research studies in education which show that ICT integration into the learning-teaching process encounters some barriers, including: lack of confidence, lack of competence, and lack of access to resources. The author concludes that confidence, competence and accessibility have been found to be the critical components of technology integration in schools. Therefore, ICT resources including software and hardware, effective professional development, sufficient time, and support - all need to be provided to teachers [13].

Many educational programs have tried to bridge the gap following the principle by which the teacher must be the leader of the learning process, and where there is a gap between him and his students – which must be bridged by educational programs.

B. Educational Programs to Bridge the Digital Divide

In most educational systems in the Western world new programs were developed in order to bridge the digital gap between teachers and students [2], [20], [19]. Some programs focus on digital communities of teachers that are being increasingly visited by teachers for professional support, guidance and inspiration [5], [10]. Educational programs with such goals include teaching new software, introduction to interactive websites and digital content. The idea was to give the teacher skills to help him/her guide his/her students in the vast space of the Internet where they can move and research to build their knowledge. The assumption of these programs was that the students – despite their abilities to learn technological tools very fast – do not always choose them or use them in a way that contributes to their development. They often lack the skills or the knowledge to evaluate what they use. Also they

are not familiar with many tools and environments which could help them to understand how to study contents, or to develop their knowledge in various disciplines. The students, therefore, need the teacher who can help them to use learning environments and technological tools wisely. Here we can see the need for "mediated learning" which was mentioned in previous theories and researches [7].

C. The Problem in Training Pre-Service Teachers for Teaching in a Technological World

In spite of their achievements, these programs are limited due to several factors: The teachers in the schools implement new methods blending technological tools but meanwhile the technology changes and advances. The interface of tools changes frequently, some tools disappear and new ones are invented [18].

The changes are very quick and only a small part of the teachers advances fast enough to keep up with this pace. The problem also exists at teachers training colleges. The study of ICT tools is often far behind the technological development and the ICT tools which the students learn often become obsolete.

Once the students end their training, they will often encounter new or different tools and new digital contents. Some of them will update their knowledge and continue studying, but a large part of them may withdraw and give up on new learning, or may continue using and teaching obsolete tools, even if there are better, effective and updated ones. Teachers - and this holds also for pre-service teachers – that wish to be up to date shouldn't stop learning and developing, especially in all that relates to ICT tools because of all the factors which were mentioned previously.

Hare, Howard & Pope [9] mention that a gap also exists between what we teach pre-service teachers about technology and what we expect them to do with technology as classroom teachers. Teaching pre-service teachers how to integrate specific technologies into their teaching methods helps to increase their level of confidence. Kirkwood & Price [11] claim that environmental changes (societal, educational, and technological) make it necessary to adapt systems and practices that are no longer appropriate.

The situation in which the teachers in the classroom continue teaching obsolete ICT tools only because these are the tools they are familiar with, and they feel comfortable and confident to teach, is similar to the situation in which one is taking driving lessons, and meanwhile the traffic laws are changing. Would we advise the driving instructor to continue teaching by the old laws because these are the laws he is used to? Of course, we would demand an adjustment of the driving lessons to suit the new conditions. Moreover – we expect the driving instructor to learn by himself the new laws and adjust the lessons to them. The same should be with the change in the education field when new ICT tools accrue and other tools and technological environments frequently change. Of course – it is much more complicated than the example about the driving lessons. The reason for this difference lies in the training

towards teaching in this ever-changing environment and "frenetic" world.

The query which rises from the problem which was described before, is as follows: How can we adjust the education - in the area of ICT tools and technological environments - especially in teachers training, to these changing and "frenetic" conditions?

D. An Experimental Model to Teach ICT Tools and E-Learning in Teachers Training

1) Assumptions:

The appropriate method for instruction within the domain of ICT tools should be based on exposing the learners to innovations, helping them to gain experience, teaching them how to deal with challenges and difficulties on their own, and training them how to develop teaching materials following all the stages below.

As it is impossible to teach how to ride a bicycle without actually riding on one – it is impossible to teach ICT tools and technological environments with a method that does not contain experience and also temporary "tumbles" and failures from time to time.

A bike rider, who has just started learning how to bike, will fall and lose his balance from time to time. Nevertheless, he will continue trying in order to achieve good riding skills. We should expect something similar also in the process of learning ICT tools. We shouldn't fear "losing balance" nor fear failure from time to time. Only dealing with innovations, failures and disruptions can lead to a great level of skill in functioning in advanced technologies environments.

The successes after dealing with difficulties will be valuable and will certainly enhance the teacher's confidence even among pupils with advanced technological capabilities.

2) The Principles

Each curriculum for teacher training and a program for using ICT tools should be based on several principles. The following principles are for pre-service teachers. They are also suitable for teachers:

1. Pre-service teachers should recognize their current shortcomings in knowledge and in their ability to use ICT tools. The purpose is to develop awareness to the fact that despite these limitations they can still become able to lead their future students to achievements in this area. Moreover, there is no need to hide the extent of the teacher's knowledge from the students, but rather to instruct them while pointing out this fact or even express interest and willingness to learn from them if they are facilitating the learning process. The same principle applies to the learning and teaching process between the lecturer/instructor in teachers training college and the pre-service teachers.
2. It is advisable to expose the pre-service teachers to several new and varied ICT tools. Often the same principles of use apply. As the pre-service teachers become more experienced in using varied tools, their confidence will

increase, and they will not be afraid to encounter new tools and environments.

3. The pre-service teachers should gain experience in searching new ICT tools and new environments.
4. The pre-service teachers ought to gain confidence in self-learning and in acquainting themselves with several ICT tools which they have not learned before. They should deal with challenges and difficulties during the learning process. After they succeed, they develop written tutorials combined with screenshots, or they will create video tutorials with specialized software, aimed for the pupils' level.
5. The pre-service teachers document the process including turning points and types of obstacles throughout their learning period. The lecturer who guides them in this process invests time to analyze their comments and to discuss with them several possible solutions. He/she also includes discussion about psychological aspects such as frustration and satisfaction.
6. The students have to experience collaborative learning. For example, mutual teaching of ICT tools and new environments, giving constructive criticism to the tutorials of their friends, and so on. If necessary, they then improve their tutorials and learning materials based on their conclusions and following the group's discussion and recommendations. If possible, the students are directed to experience teaching the tools which were learned, to their pupils at school. They write a report describing their experience, and summarize their conclusions.
7. The students are partners in the assessment of the process.

III. THE PILOT STUDY

The process will be demonstrated by describing the experience in a course taught in teachers training. In this course we tried to implement these principles. Before presenting the experimental model it is important to know how the old course's model worked.

A. The Previous Model

The old model for training pre-service teachers had changes in the contents but not in its principles.

During the years before the study, the students took a course about e-learning. They became acquainted with ICT tools and digital environments, and they built products and educational websites following a process of thinking and planning. However, in this model, they were not required to search and learn the environments and tools on their own, but the lecturer taught them this content.

The curriculum in the traditional course was adjusted to the students' specialization. Thus, for example the students in the pre-school department learned to use software, websites and tools which are suitable for children up to 6 years old. In the special education department the students focused on tools to help students with special needs, in the mathematics department the students learned to use software and tools for learning mathematics, and so on. This model worked in the college for the last 15 years.

B. The Experimental Model (The Pilot)

The pilot included 31 students who studied the course "E Learning Environment and ICT Tools in Education". The students started to learn in the experimental model of the course after they took a basic course which included computer usage and Internet usage and they passed the exam successfully. At this stage of their studies, most of the students are in their second year. They are already proficient in computer and Internet usage, especially in the use of open software such as Office. Some of them started their degree with this knowledge. In this case, if they succeed in a preliminary exam, they are exempt from taking the basic course.

The experimental model lays the responsibility of learning the needed skills on the student. The course deals with e-learning in education. The course's purpose is, among others, to train the students to a wise use of ICT tools in their future work as a teacher. The course promotes acquaintance with several types of tools, websites and software for the teacher's use:

- A. Tools that help the teacher alone or help mostly the teacher.
- B. Tools for the students only.
- C. Learning environments that the teacher develops and edits and the students learn there with his guidance.

Every learning plan combines pedagogical and didactic considerations. The course is not mainly technical. Thinking, consideration and planning precede each unit.

So far, the experimental model is similar to the previous ones. The innovation lies in the second part of the course - after the students accumulated experiences and gained acquaintance of e-learning environments and ICT tools.

At this stage, they were asked to seek and to choose a digital learning environment or ICT tool. They were presented with a list of tools but were asked to look for more.

The first part of the process was, then, a search. The students added the tools which they found to the list in the course website. Each student chose one tool and added the name of the tool to the forum in the website. The reason for that was to avoid duplications. The Internet contains many tools so there wasn't any difficulty if a student found that another student already chose "his" tool.

After that, each student was asked to explore the tool he had chosen, to become familiar with all its components and to be able to use it. Each student actually became an expert of his/her tool.

The difficulties encountered during the process were discussed with the other students and with the lecturer. We should notice this consulting process was between equals. In several cases the lecturer was also not familiar with the tool. He dealt with the difficulties just like the student; nevertheless, he had more experience and knowledge. This is a very important point in this model: The way in which the teacher deals with the difficulties while he learns a new tool can be a source of emulation. The student receives a feeling of confidence in his abilities after he sees the instructor also needing to deal with difficulties and technical problems and

yet being able to overcome. He realizes that this is a part of the process. During the pilot sometimes, the lecturer and the students sat and learned the tool together, at other times the students learned only with other students. In both ways they functioned as a team. This process is of great importance for building the professional confidence of the pre-service students.

It should be noted that some environments have a different interface for student and teacher. The students who chose this type of environment had to gain experience both as teacher and as student. Of course, the cooperation with peers in the course who signed in as his/her pupils was necessary to complete the learning of the environment by the student.

The need of cooperative learning develops among the students the recognition of the values of team work and cooperation. This objective has both learning and social value. Achieving this purpose contributes also to the student by better equipping him for personal and professional life in his continuing path, since studies show that people who can work effectively in a team have more success [21], [22].

Sometimes the student experienced with several tools before he/she reached a decision about the preferable tool on which he would prepare his tutorial. Thus, at this stage of the process, the students already experienced and learned to use some new ICT tools and new environments, which weren't learned in class. He/she may know some of them basically and would be able to use them in the future. Of course - the tool or the environment which was "his/her chosen one" he/she would end up having a deep knowledge of. After this long stage of thorough learning, the student was ready to prepare his/her tutorial.

The tutorials which the students prepared were of two types: a written tutorial with screen scans, and a tutorial that was made with specialized software and the product was a video file. When the students prepared their tutorials, they had to prepare them step by step, thinking and functioning as if they were new users. Often, while producing the tutorials the students discovered new properties and so they deepened their knowledge further. Once a tutorial was ready, the student who built it uploaded it to a database in the course website. The database was open to all the students. Soon the students could see a database of tutorials for a variety of ICT tools.

At this stage, the tutorials were tested. Every student was asked to choose at least two tools or environments - not including his/her own. He/she learned them with the help of the tutorials which his/her friends had built. When he/she faced some difficulties, he/she could consult with the "expert" - another student. Outside class the questions appeared in a forum in the course website and included directions to correct parts of the tutorials when needed.

C. The Instructor's Role in this Model

What was the instructor's role in this process? The instructor led the whole process. In the first stages, he taught the students several ICT tools and digital environments. Once the process of exploring new tools began, the instructor left the place of being central to the learning process and guided

the overall process, but the students had to learn the tools by themselves. When problems arose, the role of the instructor was to lead towards a solution by advising /consulting. This way the students could see a demonstration of a learning process in which the student and not the teacher was in the center. The student could also learn the value of celebrative learning and this understanding will hopefully influence his teaching in the future.

D. Assessments

How can the lecturer evaluate the learning process? The pilot did not include a new evaluation method. The assessment was traditional and included submission of assignments and exams at the end of the course. However, there is one more step possible in this model. The new process of instruction, when applied instead of the traditional model, demands a new assessment of the students' achievements, instead of the traditional model of "one size fits all" content [3]. This stage should be also done with the students' cooperation. A class discussion defines the criteria. The major principle that the lecturer should emphasize is the importance of the process. The reflections which the students have written describe part of the process and the documentation in the forum describes another part. The lecturer can also add a description from his point of view. The other students can describe their point of view with regards to the work of their peers. Of course – the student's description in the end of the process is an important part of the evaluation process.

Beside the evaluations of each individual's work, it is recommended to evaluate the group's work. Did everyone receive the help he/she needed? Did everyone feel that they were available to help others, and that their help was valuable? Do they think that they have become richer in knowledge and skills? Do they think that more criteria are needed?

IV. SUMMARY

This paper's purpose was to present a suggestion for a new course model for pre-service students. The course's goal is to train the students toward teaching in digital environments and with ICT tools. In the traditional model the students study tools and environments that the lecturers have chosen from the variety that exists in the period of learning and may soon change or disappear. Unlike this approach, it is recommended to adopt a new approach in teachers training, in which the students will experience, with guidance, new tools and environments and teach them to the other students in a process which includes consulting and evaluation components.

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