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PRESERVICE SCIENCE TEACHERS' FIELD EXPERIENCES WITH EDUCATIONAL TECHNOLOGIES AS PART OF PORTFOLIO DEVELOPMENT: A TURKISH PERSPECTIVE

Hünkar Korkmaz *, Berna Gücüm* and Meral Hakverdi **

Hacettepe University
College of Education
Department of Elementary Education
Division of Science Education

Hacettepe Universitesi
Eğitim Fakültesi
06532 Beytepe/ ANKARA/TURKİYE

* Assistant professor at the Hacettepe University
** Instructor with a Tenure Track at the Hacettepe University

hunkar@hacettepe.edu.tr
gucum@hacettepe.edu.tr
meralh@hacettepe.edu.tr

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Contact Person: Hünkar Korkmaz

Address:

Hacettepe Universitesi
Eğitim Fakültesi
06532 Beytepe/ ANKARA/TURKİYE

e-mail: hunkar@hacettepe.edu.tr

Phone: 90 (312) 297 6138

PRESERVICE SCIENCE TEACHERS' FIELD EXPERIENCES WITH EDUCATIONAL TECHNOLOGIES AS PART OF PORTFOLIO DEVELOPMENT: A TURKISH PERSPECTIVE

Abstract: The purpose of this study is to assess the usage of educational technology of pre-service science teachers in their field experiences. This study was carried out on 45 pre-service science teachers taking School Experience and Practice Teaching courses at Hacettepe University in Turkey. The data were obtained from the evaluation of pre-service science teachers' portfolios. In this study were used reflective forms, performance criteria, sample forms and strategies for keeping records which are all used by the students were developed by the researchers. The data was analyzed according to qualitative and quantitative research techniques. It is supposed that the results of the study will be able to use for the organization and development of pre-service teacher education programs.

Literature Review

Over the past two decades, technology has become increasingly prevalent in school science. Science education has generally involved teaching not only a body of knowledge but also the processes and activities of scientific work. This view has linked the scientific uses of technology with hands-on experiences (Flick, 1993). The explosion of technology has created a revolution similar to the "hands-on" movement of the 1960s. The flexibility, speed, and storage capacity of contemporary desktop computers is causing science educators to redefine the meaning of hands-on experience and rethink the traditional process of teaching (Flick & Bell, 2000).

Science as inquiry is parallel to technology as design. Observation, measurement, intervention, monitoring, diagnosis, and treatment rely extensively on technology. Therefore, how we study, learn about and teach science must change to maintain relevance and effectiveness for researchers, practitioners, teachers, and lifelong learners (International Society for Technology in Education [ISTE], 2000; Odom, Settlage & Pederson, 2002). As consequences, the use of technology by pre-service science teachers becomes an important link in efforts to infuse technology into the broader educational system.

In this context; science teachers and pre-service science teachers must (a) become and remain proficient at using technology, (b) understand the social, ethical, and human issues surrounding technology, and (c) be aware, capable, and able to teach technology that can enhance productivity, research, communication, problem solving, and decision-making. The challenge is to integrate technology into the classroom and make it an integral tool for learning within the context of science and science education (ISTE, 2000; Odom, Settlage & Pederson, 2002).

The impact of technologies on science teacher education is more pervasive than any curricular or instructional innovation in the past. The impact can be felt on two fronts. First, as with the hands-on science movement, technologies are changing the ways teachers interact with students in the classroom. Psychological theories (Borich & Tombari, 1997) based on the importance of language to learning, the ways organizing and relating information facilitates understanding, and the influence of social factors in the classroom are all impacted by technologies. Second, teacher education courses are not only influenced by new K-8 curricula, they are also influenced by instructional approaches, fueled by the National Primary Science Education Standards (Ministry of Turkish Education [MEB], 2004), that incorporate a variety of technologies.

Educational technologies provide the potential for new methods of teaching and learning in school science. Technology integration in K- 8 institutions has had a direct impact on a vast majority of educational reform initiatives (Willis, Thompson, & Sadera, 1999). At the same time, field experience courses are designed to help pre-service teachers get acquainted with the school, pupils, and teaching profession from various perspectives at an early stage in the training program. These courses include observations and practices relating classroom management, lesson planning, and use of textbooks, group work, and organization of classroom environment, preparing and using worksheets, and micro-teaching applications in class. With the aid of the educational technologies, pre-service science teachers time facilitates the areas of being able to experiment, to share their experiences with others, to prepare lessons and worksheets using the technology, to communicate with parents, other pre-service teachers, and educators.

As another perspective, recent initiatives in teacher education reform are emphasizing performance-based assessment of candidate outcomes. Portfolio assessment has often been

proposed as one method to address this challenge. Portfolios provide a way to compile authentic assessments of candidate knowledge and skills (Williams, Davis, Metcalf, & Covington, 2003). Also, researchers suggested that portfolio development has an important contribution to the development of the reflective thinking capacities of the pre-service teachers (Tucker, Stronge, Gareis & Beers, 2003; Ellsworth, 2002; Heath, 2002). During a study in Hong Kong, Klenowski (2000) observed the following trends in the reports of preservice teachers who developed a portfolio: a) an impact on the development of presentation, questioning, and teaching skills; b) increases in self-evaluation skills; and c) improvements in independent learning. In addition to the benefits for candidates, Klenowski reported that portfolio assessment might also benefit course instructors. The use of portfolio assessment not only influenced the pedagogical skills of pre-service teachers in his study, but the pedagogical and reflective skills of the instructors in the program were also improved (Williams and *et. all,* 2003). Portfolios in teacher education are collection of a pre-service science teacher's work products over time, arranged so that they and others can see how their skills have developed and progressed. In field experience context, works can not be measured well through traditional tests. Instead of final exams, Pre-service teachers should prepare a professional portfolio when they graduated to demonstrate their level of accomplishment in their field. With this way, it can be observe how pre-service teachers used educational technologies in their field experiences and gather information about their reflective ideas.

Similar educational movement was started in Turkey since 1990's. Meanwhile, with the same trend, Turkish educational authorities has also encouraged Turkish education faculty to integrate educational technologies in their program and create learning environment for their pre-service science teachers. It is thought that 800 000 individual and institutional computers are connected to the internet (State Planning Office, 2001). Eighty to percent of primary school students have access to computers at their schools. Forty-five percent of primary schools connected to the Internet (MEB, 2006). In support of primary education project by funding European Union, most of the schools have got educational technologies such as data projector, computers, overhead projector, photocopy machine, and video.

Literature review suggests that pre-service teacher education, teaching instruction, and student learning and technology interrelated to each other. Teacher training institutions must prepare undergraduate teacher education students to effectively integrate technology into their teaching. The purpose of the educational technology course at pre-service science educational

program should help their students to develop skills in using and applying various educational technologies to meet instructional needs. Research on the integration of the educational technologies in development of portfolios is limited in Turkey. This study will provide a valuable information in attempting to create a learning opportunities for pre-service science teachers to learn how to create a portfolio and integrate educational technologies in their portfolios.

Research Questions

This study is focused on three questions:

1. What were pre-service science teachers' reactions to the available educational technologies in today's schools?
2. What were pre-service teachers' reactions to students' use of educational technologies in contemporary classrooms?
3. What impact did the field-based experience have on pre-service teachers' professional development as users of the technology?

Methodology

The purpose of this study is to provide a rich descriptive picture of the process and procedures of integrating technology into a primary science methods course in pre-service science teacher education. This study used a research designed by Balli, Wright and Foster (1997) for the questions mentioned above.

Participants

Participants in the fourth year of the program included 45 pre-service science teachers who were randomly assigned to this study. The age range of the pre-service science teachers were between 20-22. Though all of the students had taken required computer course within the Faculty of Education, eleven of the 45 pre-service science teachers had e-mail accounts. Only seven students had an Internet connection on their personal computers. Eleven students had access to computers at their homes which could be used as word processors. At the beginning of the study we asked to pre-service science teachers: "When you hear the term 'educational technologies, what do you think of it?'' The majority of pre-service science teachers (93.3%) gave fairly narrow definitions that focused on computer-based or electronic products. During this study, all of the participants of this study attended educational technology workshops, learned how to plan and conduct a technology supported lesson through K-8

classrooms. All of the participants learned how to create professional portfolios during this workshop.

Data Collection and Analysis

At the end of the academic year, created portfolios of the participants were collected. The research questions were investigated by reading the portfolios. Qualitative analysis was used to analyze the data. It was conducted a content analysis of the written portfolio comments, categorizing the comments based on research questions. After generating categories, it was used percentage and frequency analysis as quantitative analysis techniques. In this study, data collection and analysis based on suggestions by Berliner (1992), Seidman(1991) and Balli, Wright and Foster (1997). As mentioned by Balli, Wright and Foster (1997), Berliner (1992) suggested that some people prefer ‘’stories’’ over numbers to increase the accessibility and meaningfulness of research findings. Thus the stories pre-service teachers related in their portfolios were examined for patterns and connections that could be called common themes (Seidman, 1991).

Findings

It was found recurring themes in the written portfolio reflections, which addressed research questions. Data were categorized the themes occurred repeatedly in the 45 portfolios researchers examined. Researchers categorized the themes as follows: (1) surprise at the educational technology available in contemporary science classrooms; (2) contrast between pre-service science teachers' images and the reality of K-8 students' educational technology usage in science class; and (3) the professional development value of this experience for the pre-service science teachers.

Educational Technology in Contemporary Classrooms: Surprises

One of the purposes of this study was to alert pre-service science teachers to the educational technology available in contemporary classrooms. In investigated portfolios, most students (~65 %) described computers as “a great invention for education” and “easy to use to prepare worksheets and other instructional materials”. Also, pre-service science teachers compared today's schools and their own early school days experiences. The following are three examples of how pre-service science teachers expressed the comparison.

> Before this course, I did not think computer in education was that important. However, now I feel that it is a great invention for education. It provides teachers with lesson plans, activities, and resources that are very helpful in organizing their teaching and learning environment. When I saw a computer in my school, I was in high school. We couldn't use it well. But now, Almost there was a computer in every classroom as well as DVD player, VCD player, Video, television in my application school got a lot of computers. Today's students have an advantage over us. I support the use of technology in the classroom. I believe that incorporating technology into science instruction helps student learn.
>
> I think that today's students are very luckier. I just started to use computer and Internet in the past year. But, they have got computer and Internet access when they were primary school. Today, they can acquire more information at less time as compared to our primary school days. Consequently, I believe that student motivation increases when technology is integrated science curricula.
>
> Thank you for having e-mail and Internet use as a requirement for our cohort. I hope to learn so much! I hope to communicate so fast! Using these technologies was an excellent experience for me. I expected that the students would know less about computers and the Internet than they actually did. But I was wrong. They know and use them.

Other pre-service science teachers indicated some reservations or fears. One pre-service science teacher (~2%) suggested "Internet is new for our schools. I think that we should control and limit the use of it. Sometimes Internet can be threat for our children". Five pre-service science teachers (~11%) explained surprise at the advanced computer labs. Examples of how pre-service teachers expressed feelings about computer lab:

> My school computer lab is amazing! The high quality computers and other educational technologies equipment are here. They are from European Union Project. Using this equipment was exciting. But I noticed insufficient educational software such as Inspiration for concept mapping, Dictionary for learning scientific concepts. Educational software is very important tool in a computer based educational setting.
>
> The computer lab is a chance for this school. But teachers are not aware of this chance and new technologies. I fear that this computers and equipment will become old without using them.
>
> Some equipment in computer lab is interesting and amazing for me. I saw them for the first time such as opaque projector. I don't know how can I use them?

Contrasting Images

Another purpose of this study was to alert pre-service science teachers to how students in contemporary classrooms understand and use technology. Thirty- of the forty-five portfolios

(~71%) two discussed the pre-service science teachers' surprised by the primary science students' knowledge and their level of technology use in the classroom. For example:

> I was surprised that most of the students already knew so much about computers and use it by the first grade.
>
> It is unbelievable that how the students knew so much about computers. Some of the students teach me about the instructional resources and softwares. I learned a lot from them.
>
> Actually, I knew that today is completely different than when I was a student at the primary school. But I couldn't image this kind of gap between my primary school years and today. Most of the students were aware of a lot of advantages which computers brought their life.

Several pre-service teacher teams conducted science fair projects in their application school. They compared their own knowledge and student's knowledge related with how they integrated technology in their portfolios.

> Internet is a wonderful resource tool. It is like an electronic library. Most of the students took advantages of the Internet. My science project student told me how to use Netscape. He said me that Netscape was an Internet browser. He also showed me his web page. I couldn't believe how he prepared this kind of web page at this grade level. He had prepared a personal web page to introduce his science fair project. This amazed me because I don't have a personal web page.
>
> The students really knew how to use computers at the lab. They knew what softwares were available for them and how to use them. It was amazing to see at six grade level student's preparation of a PowerPoint presentation for his project of science unit. I learned how to add sound and video film to the Powerpoint presentation from him.

Professional Development: Possibilities

Forty of forty-five portfolios (~88%) indicated that the field experiences with educational technology enhanced their professional growth. For example:

> Thank you for your contributions to my professional growth. At the beginning of the semester, I was worried about my grade for this course because I don't have a computer and Internet access. I thought everything would be so hard to get a hold of because it was on computers and other educational technologies. I didn't know anything about how to integrate technologies in science course. Although I didn't know how to use some of those technologies. I really improved my knowledge on how to use

> educational technologies and how to integrate those technologies in science teaching but my skills in integrating technology needs to be improved
>
> Thanks so much for everything. When I was at the beginning of this course, I was confused in my mind such as: How can I find and search information on web that would be helpful in teaching science in the classroom? How can I receive an e-mail address? How can I use and select key words for fast and easy search on the search engines? I did not understand how to use the Internet. In course of time, I saw how much information is available on the web pages. I started to have fun. I found so many resources. I also got a lot of ideas for lesson plans and activities to use in my classrooms. This course helped me to gain more confidence in using the computer and other educational technologies.
>
> I'm glad too much because I had the experience to integrate educational technologies in science curricula. Now, I am aware of educational technologies and softwares relating to my field. I hope that I can use data projector, computer, video, DVD player, VCD player successfully in my future class. I decided to buy a computer for me. I didn't know the computers were that much important for teachers.
>
> I observed through my field experiences that computer facilitates my job. I can easily make papers and other assignments very presentable.

A pre-service teacher noted that;

> Clearly, I think that the teacher's competence and confidence in using educational technologies is an important factor in the success of pupils' learning, but it is not enough on its own. I believe that an understanding of how the technology supports and enhances the learning task may be even more vital.

Another pre-service teacher commented;

> If educational technologies are to ever reach their potential to support and enhance learning in our classrooms, the teachers must create new instructional environments and change their old learning and teaching styles.

The investigated portfolios showed that most pre-service science teachers were used word processing for creating course worksheets or for general use in terms of their use of computer softwares. Overhead projector, computer, data projector, and video camera were ranked as the most essential items for teaching and learning in pre-service science teachers' lesson plan. By the end of the course, most pre-service science teachers expressed considerable confidence and gratefulness for the technology skills they had gained. In addition, they confessed that they would continue to make efforts toward increasing their knowledge of technology-based education a part of their professional growth. For example;

> I valued the experience of developing realistic educational technology applications as part of my teaching. At the beginning of the process, I was confused because I didn't know what I need to do. In the course of the time, I gave a meaning to this experience and discovered new educational

technologies. My students in application school and I found more resources for effective teaching and learning environments. I really do believe I started to learn how to maximize learning experiences with educational technologies. In the future, I will continue to learn about it.

Implications for teacher education

In spite of some limitations such as sample size and limited scope of the study, the results provide descriptive information regarding pre-service science teacher's experiences with educational technologies as a part of portfolio development. The portfolio comments in this study indicated that these pre-service teachers hold classroom images were affected by what they experienced. This result is similar with Balli, Wright and Foster's (1997) studies. During a study in Texas, Thomas and Eunyoung (1998) observed common patterns and themes with our studies. They defined three themes in their studies. Themes were suprise, frustrations, and possibilities define as the group experiences regarding the implementation of a web-connection within an elementary science methods course. In this study, an educational technologies tutorial program was designed to respond to the need to integrate the best classroom practices. Many students experienced unexpected problems through their field experiences. We have learned to appreciate change while integrating instructional technology in to teacher education. In next semester, we will rich our learning environments with new educational technologies, for example, digital microscope, laboratory equipment, educational software and hardware, and enable to gain more experience in a science teaching setting.

In this study, the multidimensional insights of pre-service science teachers about teaching and learning environment with educational technology provide an extended picture of the future use of technology in teacher education. Over the next decade we will recruit and hire more teachers for our schools. More than half the teachers who will be teaching 10 years from now will be hired during the next decade. As the quality and quantity of educational technologies continues to increase, the pressures on science teachers to utilize technologies is also increasing. These pressures are morphing the role and the responsibilities of science teachers and the education faculty who prepare them. Today's science teachers have to have more knowledge and skills about educational technologies. No teacher should below his/her students.

Consequently; more long term research and varied designs will help to define an optimal model or framework for integrating educational technologies into teacher education for future.

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