



The Impact of Technology Based Learning on the Beliefs and Attitudes of Pre-service Teachers

Hasan Özgür Kapıcı¹, Hakan Akçay² and Tufan İnaltekin³

Abstract

The purpose of study is to examine the effectiveness of the computer and internet-supported science lesson in terms of pre-service science teachers' attitudes toward computer and internet-based learning. Participants were forty-seven pre-service science teachers who were enrolled in the Computer class. The computer attitude scale and the attitude scale toward internet-based learning were used as data sources. The instruments were administrated to the pre-service science teachers at the beginning of the semester as pre-tests and again at the end of the semester as post-tests. Data gathered from pre- and post- administration were analyzed for each of the instruments. The results indicate that such learning experiences have positive effects on pre-service science teachers regarding enhancing more positive attitudes toward computer and internet-based learning and teaching.

Key words: Computer and internet based learning, pre-service teachers' attitudes toward technology, teacher education

Introduction

Developments in technology have strong impacts in learning environments. Smart boards, online learning materials and computer based modeling tools are just a few examples of technology from educational contexts. Using information and communication technology (ICT) in classrooms has positive effects on student' learning (Hawkins & Rudy, 2008; Mumtaz, 2000). In order to integrate the technology into a learning environment, it is important to take consider the junction point of tools with curriculum, students' learning needs, schools' opportunities and realities (Harris and Hofer, 2011). The views that include these factors known as technological pedagogical content

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¹ Res. Asst., Yıldız Technical University,
E-mail: hokapici@yildiz.edu.tr

² Assoc. Prof., Yıldız Technical University,
E-mail: hakcay@yildiz.edu.tr

³ Assist. Prof., Kafkas University
E-mail: inaltekintufan@gmail.com

knowledge (TPACK) (Harris and Hofer, 2011; Mishra and Koehler, 2006; Thompson and Mishra, 2007). This framework proposes that the desirable use of technology in the classroom requires a complex form of teacher knowledge that integrates contents, pedagogy and technology (Lee and Lee, 2014, p.122). Many studies concluded that teachers' increasing ability in TPACK have played a major role in order to improve students' learning (Palak and Walls, 2009; Harris and Hofer, 2011).

Technological Literacy and Teachers

One of the other crucial necessities to take advantage of technology is being technological literate person. Technologically literate person understands what technology is, how it is created, and how it shapes society, and in turn shaped by society (ITEA, 2000). Technological literacy is defined in an educational context especially in science education as to help students and all citizens in order to develop a meaningful and greater understanding and appreciation for some of the fundamental concepts and processes of technology and engineering (Bybee, 2000, p. 24). International Technology Education Association (ITEA) published 20 technology content standards in seven sub-title. These topics are nature of technology, technology and society, design, abilities for a technological world and the designed world. All these standards aim that each student should know and be able to do in order to be scientifically literate.

It is indispensable fact that teachers should be technologically literate people and their roles and attitudes towards technology also have crucial effect so as to take advantage of technology in classrooms efficiently. Mumtaz (2000) determined seven factors which prevent teachers to use technology in their classrooms. These are

- lack of teaching with ICT,
- lack of on-site support for teachers using technology,
- lack of help supervising children when using computers,
- lack of ICT specialist teachers to teach students computer skills,
- lack of computer availability,
- lack of time required to successfully integrate technology into curriculum,
- lack of financial support (p. 320).

These factors show that there are mainly two sources that affect teachers' attitudes towards technology negatively, one of which is teachers' limited self-efficacy about how to use technology

in classrooms and school organizations. Attitude and self-efficacy have a strong influence on computer usage in classrooms (Herman, 2002). For this reason, enhancing self-efficacy of teachers may help to increase technology usage in learning environments plentifully (Delcourt and Kinzie, 1993). Furthermore Teo, Lee and Chai (2008) collocate the variables which have an effect on teachers' computer attitudes. These are perceived usefulness, computer confidence, training, gender, knowledge about computers, computer anxiety and liking and computer experience (p.129). Within this respect, the Internet Society for Technology in Education (ISTE) established three fundamental standards for teachers about technology in education as following:

- Firstly, teachers should be able to facilitate and inspire student learning and creativity.
- Secondly, teachers should be able to design and develop digital age learning experiences and assessments.
- Thirdly, teachers should be able to familiar with model digital age work and learning.

On the other hand, pre-service teachers are not adequately prepared in educational technologies as well as they have high anxiety in the use of technology in their future classrooms (Doering et al., 2003). In another studies (e.g. Gunter, 1999; Roblyer and Edwards, 2000) concluded that most of pre-service teachers continue their education at higher institutions with lack of positive attitudes toward technology and knowledge about how to use it appropriately (Gunter, 2001). Researchers generally focus on three main reasons based on critiques of teacher preparation programs. The first is that teacher educators do not sufficiently emphasize on how to use computers and internet for teaching and learning in classrooms (Bosch and Cardinale, 1993). Second one is that teacher education programs do not incorporate technology across their curriculum and thus, pre-service teachers do not face with technology sufficiently (Walters, 1992). Thirdly, the instruction that is provided to pre-service teachers generally tends to focus more on the older and simpler instructional applications which based on computer and internet supported technology and less on exposure to and practice with newer, more sophisticated tools (e.g., electronic networks, integrated media, problem-solving applications) which support development of students' higher-order thinking and problem-solving skills (Baron and Golman, 1994; Office of Technology Assessment, 1995).

Researchers has been published studies that related to pre-service teachers' attitudes toward technology. For example Teo, Lee and Chai (2008) did their study with 239 pre-service teachers

and concluded that perceived usefulness and perceived ease of use have direct effect on teacher candidates' attitudes toward computer. In another study done by Abbitt (2011) with 45 pre-service teachers, it was found that knowledge in TPACK domains may be predictive of self-efficacy beliefs about technology integration into educational context. Gute (2001) concluded her study, which was done with 171 pre-service teachers that providing all pre-service teachers with skills that will enhance their abilities to not only use technology, but also teach their students with technology is imperative. Most of these kinds of studies indicate that if pre-service teachers get familiar with technology as much as possible and become aware of how to take advantage of it for teaching process through courses at higher education institutions, it may affect their attitudes toward technology.

ICT in Science Education

It is indispensable fact that science education involves a lot of abstract concepts (e.g. Kenan and Özmen, 2011; Özalp and Kahveci, 2011). Because of this, concretization of such concepts may make easier students' understanding. Within this respect, ICT might be helpful tool in order to make the concepts in a tangible form. Hennessy et al. (2007) state that ICT tools enable students to actively engage scientific process skills and to visualize the consequences of their own reasoning. Kubiack (2005) advocates that computer technology contributes to better understanding of non-visible concepts and it increases cognitive connections between data and the real world it attempts to represent. Furthermore there are consistent results in literature which advocate that ICT provides collaboration learning and knowledge building (Juuti et al., 2005). In addition, it can also assist science teachers to practice inquiry teaching and nature of science in their classrooms by supporting resource networks (Kubiack, 2005). On the other hand, in their studies, Juuti and friends (2005), say that although ICT has many advantages in science classrooms, there are several problems that hinder appropriate usage of it. They define these problems as teachers' lack of knowledge about computers, lack of time to learn about ICT and its applications in science classrooms and negative attitudes toward ICT in science teaching.

McFarlane and Sakellariou (2002) developed a model (Fig. 1) that represents functions of ICT in science education. It was developed based on the premise that the approach to science is essentially

investigative, with students learning about both scientific theory and process simultaneously (McFarlane and Sakellariou, 2002, p. 221).

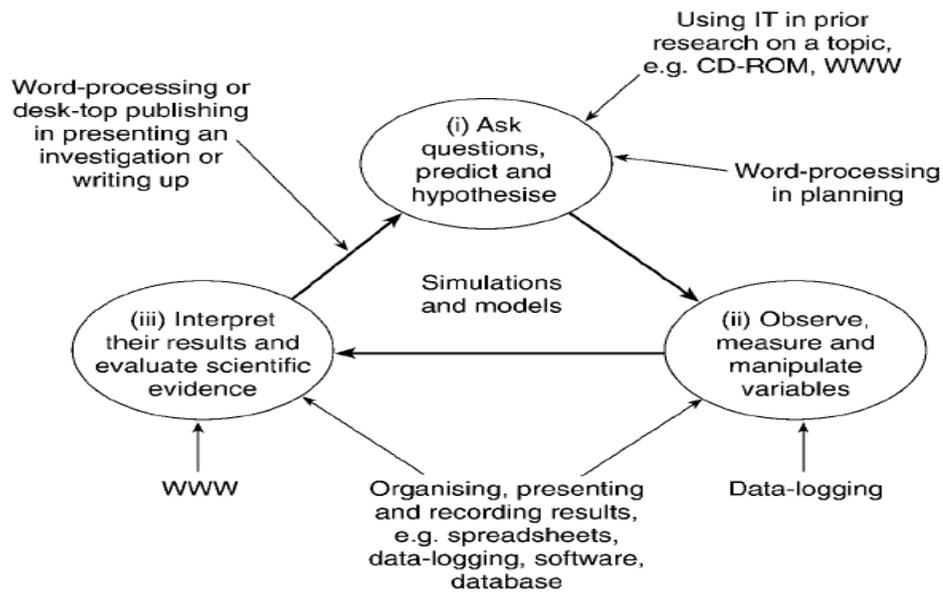


Figure 1. A model Which Indicates Functions of ICT in Science Education (McFarlane and Sakellariou, 2002)

To sum up, in their reports, Osborne and Hennesy (2003, p. 5) listed some of the pedagogy for using ICT effectively as following:

- Structuring activity while offering pupils some responsibility, choice and opportunities for active participation,
- Prompting pupils to think about underlying concepts and relationships; creating time for discussion, reasoning, analysis and reflection,
- Focusing research tasks and developing skills for finding and critically analyzing information,
- Exploiting the potential of whole class interactive teaching and encouraging pupils to share ideas and findings.

Importance of the Study and Research Question

In international case, there are a lot of studies (Harris, Mishra and Koehler, 2009; Teo, Lee, Chai and Wong, 2009; Holden and Rada, 2011) which investigate in-service or pre-service teachers'

attitudes or beliefs about technology in related literature. In national case, there are also some studies (Deniz, Görgen and Şeker, 2006; Köse, Savran Gencer and Gezer, 2007; Cüre and Özdener, 2008) which aim to examine students' attitudes towards computer and internet. On the other hand, current study will contribute to literature so as to indicate whether the structured courses about ICT have an effect on pre-service teachers' thoughts and attitudes towards technology. Within this respect, this study was designed to investigate whether there is any significant difference between pre-service teachers' pretests and posttests scores, which measure their attitudes toward teaching with computer supported education and internet-based learning, with respect to the course implementation.

Method

Quantitative research method was used as a research design in this study. In such kind of studies, variables can be measured so that (numbered) data can be analyzed by using statistical programs (Creswell, 2014). One group pretest-posttest design was used in the current study. Pretest-posttest designs are widely used in behavioral research, primarily for the purpose of comparing groups/or measuring change resulting from experimental treatments (Dimitrov and Rumrill, 2003, p.159). In this respect, the effect of ICT course on pre-service teachers' attitudes toward computer and Internet based learning was examined.

ICT Courses for Pre-Service Science Teachers

In Turkey, teacher education programs involve two courses about computers which are compulsory for each teacher candidate. The objectives of courses include increasing computer literacy, bringing experience on the use of office programs and Internet, and generalize usage of information technologies in educational context. Through the courses, students learn some basic computer programs and how to use them for instruction through the courses.

The course in this study was structured for sophomore students at the department of science education. In the course program, students were promoted to use computer and internet for satisfying all course requirements. For example, they prepared science lesson plans, unit plans, activities and created their own web sites that are related to science topics from different disciplines

such as physics, chemistry, biology, life science, and environmental science. In addition, students were assigned weekly readings from the related literature.

Participants and Data Collection

Participants were forty-six pre-service science teachers (16 male, 30 female) among from sophomore students at department of science education in a public university in Turkey. The data for this study was collected from two instruments. The instruments measured pre-service science teachers' attitudes concerning computer, Internet and Internet based teaching and learning. The instruments were administered to the sample at the beginning of the semester as a pre-test and at the end of the semester as a post-test. The instruments consist of positive and negative statements. For positive items, responses ranges from 'Strongly agree' to "Strongly Disagree" with respect to 5, 4, 3, 2, and 1 respectively. For negative items, responses ranges from 'Strongly agree' to "Strongly Disagree" and scored as 1, 2, 3, 4 and 5 respectively. Data gathered from pre- and post-administration was analyzed for each of the instruments.

The first instrument was *the Attitude Scale towards Making Computer Supported Education*. It was developed by Arslan (2006). The scale consists of 20 five-point Likert scale items (10 positive items and 10 negative items). For current study, Cronbach-alpha value was found 0.82. The second instrument was *the Attitude towards Internet-based Learning (IBL)* which was developed by Tekinarslan (2008). It has been modified from several instruments developed by Maushak and Ellis (2003), Mayzer and Dejong (2003), Brinkerhoff and Koroghlanian (2005) and Walker and Fraser (2005). The IBL has 21 items (12 positive and 9 negative items). The IBL consists of three subcategories, which are: Perceived Characteristics, Affective and Communication. The internal consistencies reliability (Cronbach alpha coefficient) for all subscales ranged from 0.72 to 0.87. The Perceived Characteristics (10 items) subscale measures the learners' perceptions about the general characteristics of IBL. The Affective (5 items) subscale measures the learners' likings and feelings toward the IBL. The Communication (6 items) subscale measures the learners' thoughts and reflections about communication and interaction with others in an IBL environment in comparison to face-to-face education.

Findings

Table 1 indicates comparison of pre- and post-test average scores for pre-service science teachers concerning attitude toward computer and computer supported learning and teaching. As can be seen in Table 1, there is a positive improvement in pre-service science teachers' attitudes toward computer during the course. However, no significant differences found between pre- and post-test scores for attitudes toward computer. Table 1 also indicates pre-service science teachers' attitudes toward computer and computer based learning and teaching with respect to their gender. Male students have higher mean scores than female students for both pre and post-test. No significant differences were found between male and female students for attitudes toward computer.

Table 1. Comparison of Pre- and Post-test Scores for Pre-service Science Teachers Attitudes toward Computer over the Course Period

| | Pre-test (n=46) | | Post-test (n=46) | | F | Sig. |
|---------------------------|-----------------|------|------------------|------|-------|-------|
| | Mean | SD | Mean | SD | | |
| Attitude towards Computer | 3.83 | 0.54 | 3.99 | 0.31 | 3.918 | 0.054 |
| | GENDER | | | | | |
| | Mean | SD | Mean | SD | F | Sig. |
| Male (n=16) | 3.95 | 0.53 | 4.03 | 0.35 | 1.022 | 0.318 |
| Female (n=30) | 3.77 | 0.52 | 3.97 | 0.30 | | |

Table 2 indicates change of pre-service science teachers' mean scores on the three scales of the IBL questionnaire. The perceived characteristics was the highest mean scores and the communication score was the lowest mean score among the IBL subscales for both pre- and post-test scores. A comparison of the pre- and post-test analysis shows a positive change in pre-service science teachers' attitudes toward internet-based learning. Pretest and posttest scores for the perceived characteristics, the affective and the communication were compared. For repeated measures, multivariate analysis of variance (MANOVA) were conducted on each subscale of IBL. The result revealed that there is a significant difference between the pretest and posttest scores for all of the three subscales -the perceived characteristics, the affective and the communication.

Table 2. Comparison of Pre- and Post-test Scores for Pre-service Science Teachers Attitudes toward Internet-Based Learning

| <i>Subcategories</i> | Pre-test (n=46) | | Post-test (n=46) | | F | Sig. |
|---------------------------|------------------------|-----------|-------------------------|-----------|----------|-------------|
| | Mean | SD | Mean | SD | | |
| Perceived Characteristics | 3.58 | 0.41 | 3.75 | 0.39 | 10.708 | 0.002* |
| Affective | 3.45 | 0.62 | 3.76 | 0.41 | 12.745 | 0.001* |
| Communication | 1.94 | 0.59 | 2.13 | 0.59 | 4.302 | 0.044* |

Table 3 indicates comparisons between male and female pre-service science teachers' attitudes toward internet-based learning. Male pre-service science teachers had higher mean scores than female pre-service science teachers for both pre and posttests. Both male and female students on the subscale of the perceived characteristics resulted the highest mean scores and the communication resulted the lowest mean score among the IBL subscales. No significant differences found between male and female students for attitudes toward internet-based learning.

Table 3. Comparisons between Male and Female Pre-service Science Teachers Attitudes toward Internet-Based Learning

| GENDER | Subcategories | Pre-test | | Post-test | |
|---------------|---------------------------|-----------------|-----------|------------------|-----------|
| | | Mean | SD | Mean | SD |
| Male | Perceived Characteristics | 3.61 | 0.47 | 3.85 | 0.42 |
| | Affective | 3.67 | 0.69 | 3.97 | 0.48 |
| | Communication | 1.96 | 0.60 | 2.21 | 0.69 |
| Female | Perceived Characteristics | 3.57 | 0.37 | 3.70 | 0.37 |
| | Affective | 3.34 | 0.56 | 3.64 | 0.32 |
| | Communication | 1.93 | 0.59 | 2.08 | 0.62 |

Results and Discussion

This study was investigated that whether the course about technology has an impact on pre-service teachers' attitudes toward technology, Internet and technology based teaching and learning. The results of study support the idea that when pre-service teachers have engaging and experience in computer and internet-based learning, they have more positive influence on their attitudes toward IBL and CBL. Similar findings were found by Teo (2009) and Teo et al. (2009). In these studies, researchers concluded that perceived usefulness, attitude toward computer use and computer self-efficacy have direct effect on behavioral intention to use technology in classrooms. Abbitt (2011) also reached similar conclusion in the study in which done with pre-service teachers. Students'

computer and internet based learning experiences raised their confidence to teach and to use computer and internet-based science. In the study done by Chen, Lambert and Guidry (2010) revealed that there is a positive relationship between the usage of learning technology and student engagement and learning outcomes. The results also revealed that if pre-service teachers expose to use computer and Internet frequently, their thoughts to teach by using computer and internet developed. On the other hand, Palak and Walls (2009) reached that teachers in technologically equipped schools continue to use technology in ways that support their already existing teacher-centered instructional practices. Furthermore Russell et al. (2003) found that teachers generally use technology more for preparation and communication than for delivering instruction or assigning learning activities that require the use of technology. Because of such findings it is important to emphasize pedagogical aspects of computer based teaching and learning which enable teachers to take advantage of it not only for preparation and communication but also use it through teaching process.

As a conclusion, it can be said that the more involvement with computers and Internet, the more gains might be established for pre-service teachers. Furthermore most of pre-service science teachers might become aware of importance of using computer and internet-based teaching theoretically through the courses but sometimes they are uncertain about how to apply these strategies in their future classrooms. In other words, there is lack of pedagogical considerations on planning, implementing and classroom management process in these courses' objectives. Such inefficiencies may have impacts on pre-service teachers' attitudes toward technology negatively. In order to deal with such situations, a suggestion can be teaching with technology should be practiced frequently in related courses. In this way, pre-service teachers may understand the process of teaching and learning based on web and the needed techniques for using the process in their own classrooms. Students who experience this type of courses can easily repeat activities in their classrooms. In addition, it is also enable students to discuss appropriate pedagogical techniques for teaching web and computer based science.

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