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ORIGINAL RESEARCH ARTICLE

Pre-service primary teachers' views and use of technology in mathematics lessons

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Pre-service teachers who are future practitioners of the curriculum cannot be considered independent of their views on education and technology. The goal of this study is to determine the use of technology and the opinions of pre-service primary teachers (PPTs) regarding the use of technology in classroom activities in mathematics lessons. The research was conducted with 62 PPTs studying in a state university. The study is based on a case study. The PPTs designed and implemented activities with respect to the objective(s) in the primary school mathematics-teaching programme. These activities were observed and recorded in video. At the end of the semester, the opinion form prepared by the researchers was applied to the PPTs. Descriptive statistics, descriptive analysis and content analysis methods were used in the analysis of the data. According to the findings of the research, almost all of the PPTs expressed opinions about the positive and negative aspects of technology usage related to education. Furthermore, while 83.86% of the PPTs indicated that they wanted to use technology effectively in their professional lives in the future, only 19.35% of the observed activities benefited from the technology. PPTs advocated two main reasons for not using technology in classroom activities. The first was that concrete material is more effective where physical conditions are inadequate and the difficulty in accessing materials, especially at schools in rural areas. The second main reason concerned time constraints while following the curriculum.

Keywords: primary mathematics education; technology; teacher education; classroom activity; technology integration

Introduction

The continuous change in the field of technology has influenced applications in different areas. Nowadays, technological tools are used in many areas such as security, health, industry, economics and in almost all institutions. It is an indispensable fact that technology has become a prerequisite for the quality of a job (Ertmer and Ottenbreit-Leftwich 2010). There is almost no day for an individual where she/he is not dealing with technology. Mathematics education is also influenced by these developments

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because of the relationships between mathematics and mathematics education, with technological developments (Aydın 2005). Integration of the technology into an educational context is becoming more important every day (Kim *et al*. 2013; Smith, Kim, and McIntyre 2016; Taimalu and Luik 2019). Most educators, teachers and researchers have an opportunity to develop new perspectives on students' learning concerning mathematics with advances in technology (Drijvers *et al*. 2016).

One of the ways to achieve high quality in teaching is to enrich educational environments with technology (Taimalu and Luik 2019). Many countries have made large investments for the use of technology in education (The Organization for Economic Co-operation and Development [OECD] 2013), so many schools have access to different technological tools used for mathematics courses or general purposes (Hoyles 2018). The National Council for the Teachers of Mathematics [NCTM] (2014) emphasised the idea that technology will support effective teaching and facilitate meaningful learning and that technology could be used appropriately to help students understand mathematics, carrying out reasoning and improving communication skills. Studies have shown that the use of technology in mathematics classrooms is beneficial for students' conceptual learning, positive attitudes and the development of metacognitive skills (Drijvers *et al*. 2016; Harju, Koskinen, and Pehkonen 2019; Olkun, Altun, and Smith 2005; Sinclair 2004). In this regard, it was stressed that technology should be used in primary mathematics education (Higgins, Huscroft-D'Angelo, and Crawford 2019; Kersaint *et al*. 2003). Sarama *et al*. (2012) stated that if activities are designed and implemented well, computers provide many benefits for young children both psychologically and pedagogically. Teachers as practitioners have a great responsibility in order to integrate technology into education. Today, teachers need to be informed about how to use technological tools in educational environments, how it affects students' conceptual knowledge and skills, and the potential problems that may arise. In other words, today's teachers should have technological skills in their repertoire to use in educational settings (Kersaint *et al*. 2003) because the potential of technology only emerges with the effective use of teachers (Galbraith 2006). However, despite the positive views towards technology, it cannot be considered that it could be fully integrated into learning environments (Angeli and Valanides 2009; Cheok *et al*. 2016; Ertmer and Ottenbreit-Leftwich 2010; Kim *et al*. 2013; Martin 2018; Taimalu and Luik 2019). This is mainly due to the traditional and teacher-centred understanding of education, as well as too much focus on technical skills (Angeli and Valanides 2009; Atasoy, Uzun, and Aygun 2015; Avci and Coskuntuncel 2018; Aydin 2005; Ertmer and Ottenbreit-Leftwich 2010). Before these barriers, it was emphasised that teachers should have positive beliefs and opinions about the use of technology (Lin 2008; Sedoyeka 2012). The examination of beliefs is thought to be determinant in the decision-making process of teachers in order for technology to successfully operate in teaching environments (Ertmer and Ottenbreit-Leftwich 2010).

Ertmer and Ottenbreit-Leftwich (2010) pointed out that four key components, including teacher knowledge, self-efficacy, school-subject culture and pedagogical beliefs, are essential for the integration of technology. Among these components is first of all, it is necessary that teachers believe that the activities with educational technology carried out in teaching environments are beneficial (Ertmer and Ottenbreit-Leftwich 2010). Taimalu and Luik (2019) and Ertmer (2005) considered the belief factor as the 'root concept' and described it as the basis for all other factors. Beliefs, according to Rokeach (1972), are defined as phrases beginning with 'I believe that...' (as cited in Ertmer and Ottenbreit-Leftwich 2010). It is emphasised that beliefs which deeply affect individuals' knowledge, thinking processes and behaviours, are resistant to change (Pajares 1992). In this respect, the beliefs carried by teachers are one of the major obstacles for the integration of technology into learning environments (Mama and Hennesy 2013), so it has been seen as one of the first problems to overcome in order to integrate technology into educational learning environments (Taimalu and Luik 2019; Wachira and Keengwe 2011). Ertmer (1999) also classified the barriers for the integration of technology as external barriers, which are related to technical problems, and internal barriers such as teachers' opinions, thoughts and beliefs. Ertmer (1999) stressed that internal barriers are more important because they are more difficult to overcome.

The teachers' undergraduate education periods have been considered important in the development of teachers' technological skills and beliefs about the use of technology (Kersaint *et al*. 2003). Because it was seen that pre-service teachers who did not have enough experience in teaching with technology in their undergraduate years did not feel comfortable using technology in an educational context in their future careers (Lin 2008). It is not likely that these pre-service teachers use technology in educational situations in their profession effectively. Technological tools such as computers, smart phones, tablets and different applications have become more and more widespread recently. However, pre-service primary teachers (PPTs) need to be competent in how these technologies should be transformed in the context of specific educational objectives because it may not be possible to create a specific learning environment suitable for every class, every purpose, every student or every school (Mishra and Koehler 2006). Being good at the use of technological tools may not guarantee technology integration. Different approaches have been suggested in order to offer insights into technological integration in an educational context. Hooper and Rieber's (1995) theoretical framework, which is one of the initial suggestions, describes the basic steps needed to be considered for integrating technology into instruction. This theoretical framework attempts to provide simpler explanations about technology integration when compared to others (Jang 2019). For this reason, Hooper and Rieber's framework was thought to be appropriate for the current study. In this respect, Hooper and Rieber (1995) distinguished between educational technology and technology in education. They emphasised that the quality of technological tools or how they are used (educational technology) in the classroom is important, and not the quantity (technology in education). Similarly, Drijvers (2013) stated that teachers have a key role for the effective use of technologies in educational contexts . Hooper and Rieber (1995) proposed a five-stage theoretical framework for the use of technology in educational environments. In this framework, there are five different phases of technological use from simple to complex. These phases are familiarisation, utilisation, integration, reorientation and evolution, and are described as follows:

> The familiarization phase involves basic knowledge to learn how to use simple programs for technology. In the utilization phase, the teacher attempts to use technology in the classroom. This type of usage is simple and limited. During the integration phase, the teacher uses technology consciously in the teaching phase. However, when encountering some negativity unexpectedly, it cannot continue to be taught in a planned manner. This stage can be perceived as the equivalent of the blackboard in the electronic environment. In the reorientation phase, the teacher can integrate technology with the teaching environment consciously and purposefully. If the teacher is in a redirection phase, students are able to be in

> the guide position when creating their own information. In other words, students in the classroom can be called the driver's seat during the learning phase. For a teacher in the final stage of development, change is not a frightening feature. By considering the conditions, the learning environment is integrated with technology in a student-centered manner. (Hooper and Riebers 1995, pp. 156–158).

As mentioned earlier, it has been noted that the experiences of pre-service teachers in their undergraduate years will affect their future educational activities (Unlu and Sarpkaya Aktas 2017). In this sense, teachers and their professional development play a key role in the effective use of technology in educational learning environments (Hoyles and Lagrange 2009; Pamuk *et al*. 2013). Most of the studies conducted with teachers and pre-service teachers have been aimed at determining attitudes, opinions or beliefs towards technology (Aktas *et al*. 2014; Ertmer 2005; Pamuk *et al*. 2013; Smith, Kim, and McIntyre 2016; Usta and Korkmaz 2010). It was emphasised that pre-service teachers should be given opportunities to carry out their own technology-supported instructions (Willis 2001). Shin *et al*. (2009) stated that there are many studies on technology in a teacher's education, and the emphasis on the studies in classroom observations and interviews can be useful in this area because more study is needed to understand how pre-service teachers use technology in their teaching processes (Liu 2016). Similarly, in this study, the aim is to reveal the opinions of the PPTs in the use of technology in their classroom activities. Additionally, the other goal of this research is to determine how PPTs use technology in instructional settings. Besides, if the PPTs are not using technology in classroom activities, then the probable reasons underlying this are the focus of the current study. This aspect of the study is thought to contribute to the literature. For this purpose, the following research questions were determined:

1. What is the current status of PPTs' technology usage in classroom activities?
2. What are the opinions and beliefs of the PPTs on the use of technology in classroom activities for mathematics lessons?
3. What are the reasons of PPTs concerning the non-use of technology in classroom activities during mathematics lessons?

Method

In this study, the case study model was adopted. The case study is a research methodology that investigates a contemporary phenomenon in depth and within its own context and provides researchers the opportunity to make an in-depth and holistic examination of a phenomenon (Yin 2015).

Participants

This research was conducted on 62 PPTs enrolled in the Mathematics Teaching II course, who were from a state university in Turkey. The PPTs received education in Turkey for 4 years at the university. According to the faculty programme, the PPTs take Basic Mathematics 1–2 and Teaching Mathematics 1–2 courses related to mathematics education. The participants were in third grade at the time of the study. They took the Teaching Mathematics 1 course in the fall semester of that academic year. The PPTs are expected to put into practice theoretical knowledge, which they have taken from Teaching Mathematics 1, into the Teaching Mathematics 2 course.

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The Teaching Mathematics 1 course consists of strategies used in mathematics teaching, basic skills in mathematics education, problem solving and the development of number sense; and the teaching objectives of the curriculum such as natural numbers, fractions, decimals and the operations with them. Moreover, there are Computer 1 and Computer 2 courses, which focus on basic and simple technological knowledge such as the introduction to information technologies, the history of computers and the basic components of computers in the pre-service teacher training programme. The participants of the study were determined through the convenience sampling method. According to this sampling method, the researcher prefers easy-to-access and inexpensive to study (Patton 2001). A total of 80.64% of the PPTs participating in the study were female and 19.35% were male.

Instruments and data collection

For the first research question, the observation notes were taken by the first author, and the video recordings of the activities were performed in respect to their voluntariness.

For the second and third research questions, a structured interview form with six open-ended questions was developed by the researchers. The interview form was examined by a linguist and two faculty members. After the necessary arrangements were completed, a pilot application was carried out with three PPTs from different classes. The form was administrated to the PPTs at the end of the semester. It was assumed that the PPTs responded sincerely to these questions.

The implementation continued for 14 weeks in total. The PPTs were informed at the beginning of the semester. They were asked to design activities for any objectives in the primary school mathematics curriculum and to practice this activity in the classroom for 15–20 min. Every week, —four to five PPTs implemented activities that were designed by themselves in the classroom. During the video recordings, the first author was involved as a participant observer and field notes were taken. No intervention was carried out during the activities. Throughout the implementation of the activities, the PPTs performed their activities as in a real primary school class, with the rest of the class including the researcher assuming the role of the student.

The distribution of the objectives in the curriculum determined by the PPTs according to their wishes is presented in Table 1, according to the class levels and learning domains.

Table 1. Objectives of the activities by classes and content areas.

Class level	*f*	%
1st grade	13	20.96
2nd grade	20	32.25
3rd grade	15	24.19
4th grade	14	22.58
Total	62	100
Learning domain		
Numbers and operations	38	61.29
Geometry	7	11.29
Measurement	17	27.41
Data processing	0	0
Total	62	100

Data analysis

Descriptive analysis and content analysis were used for the analysis of the data obtained through the observation notes, video recordings and interview forms. While the findings related to the first research question were analysed by using the descriptive analysis method, the analysis of the findings of the second and third research questions were conducting using the content analysis method. The answers of the PPTs' were encoded and collected under certain themes. For example, the opinions of the advantages and disadvantages of technology were categorised as 'visualisation', 'saving', 'easy accessibility', 'concretisation', 'reinforcement', 'technical difficulties', 'course content', 'lecture process' and 'attitude'. In determining codes and themes, the studies of Aktas *et al*. (2014) and Ocal and Simsek (2017) were utilised.

The analysis of the observations and videos was done based on the theoretical framework for the use of technology in educational environments developed by Hooper and Rieber (1995). After the PPTs completed their activities, a structured interview with six open-ended questions was administrated. Video recordings, observation notes and responses to the interview were examined by the authors separately. The observation notes of the first author were checked by the second author. After this procedure, comparisons were made with the findings and the analyses were clarified (Figure 1).

To ensure the validity and reliability of qualitative research, it is necessary to take different precautions from quantitative research (Creswell 2009). The following precautions were taken to ensure internal validity and external validity in the study:

1. To increase the validity and reliability in qualitative research, it is important to spend considerable time gathering information (Creswell 2009). For the current study, the duration of the study lasted 14 weeks, so it is assumed that the time was sufficient to gather knowledge.
2. Triangulation (observation notes, video recordings and interview form) was done to confirm the findings obtained from the different sources.
3. The answers to the interview form of the PPTs were transferred without any changes.

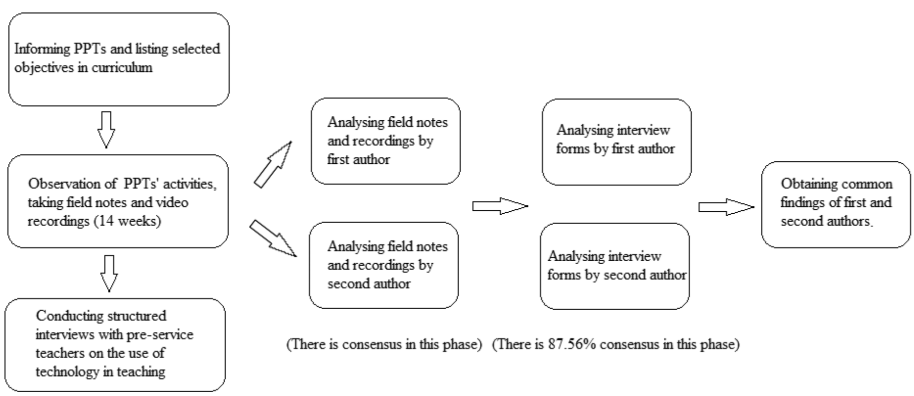

Figure 1. Data collection and analysis process.

4. The findings were evaluated by different researchers and consensus between the researchers was found to be 87.56% for the interview. There was a consensus between the authors about the levels of PPTs according to the theoretical framework of Hooper and Rieber (1995).
5. The technology dimension of the research was mentioned in order for the PPTs not to feel pressure to use technology during the activity planning and implementation process.

Results

PPTs' usage of technology in classroom activities for mathematics lessons

During the implementation of the activities, it was observed that 19.35% of the PPTs used technology, but 80.64% did not use technology. Seven of the participants (11.29%) used a PowerPoint presentation, four (6.45%) used music playback and one (1.61%) used a video demonstration.

The PPTs stated that they used the music playback or video demonstration at the beginning of the activity in order to raise students' interests and motivate them in the activities. It can be said that the participants intended to use these technologies consciously when designing the event. The PPTs, who used the PowerPoint presentation in their activities, were observed to use technology like a blackboard. In Figures 2 and 3, images from the participants using the PowerPoint application in their activities are presented.

Table 2. PPTs' use of technology in classroom activities.

Was technology used during the activity?		*f*	%
	PowerPoint Presentation	7	11.29
Yes	Music playback	4	6.45
	Video presentation	1	1.61
No		50	80.64
Total		62	100

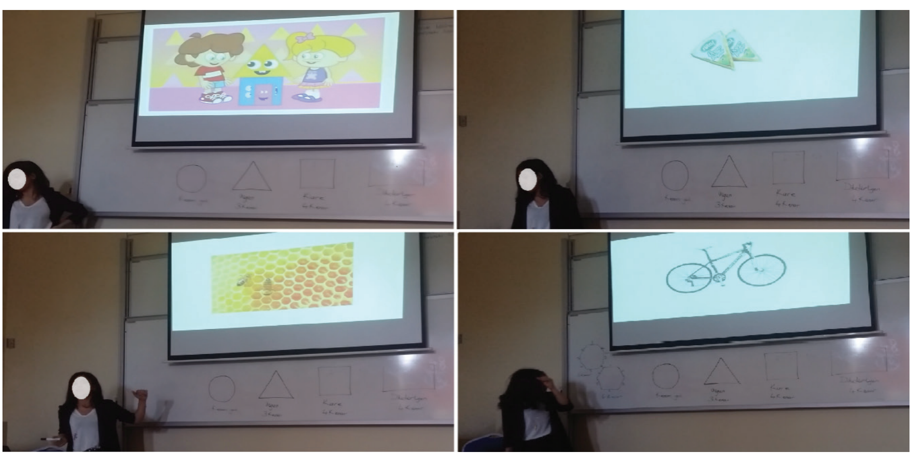

Figure 2. Activity footage from PPT 8.

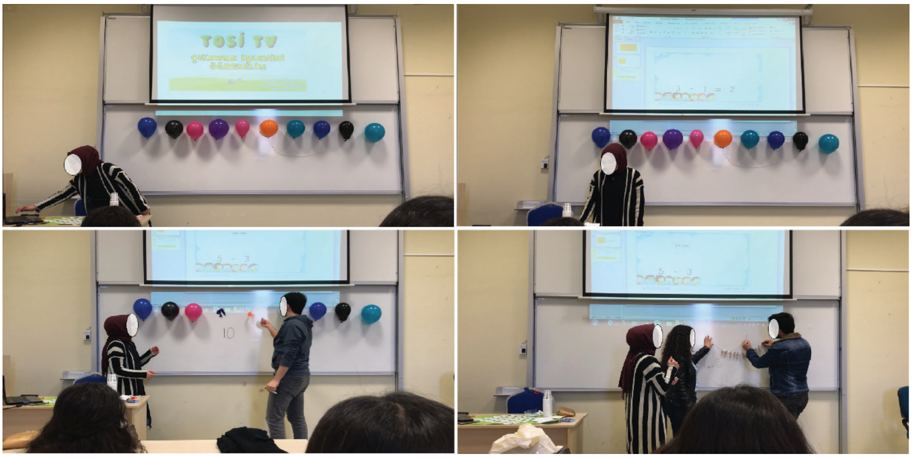

Figure 3. Activity footage from PPT 58.

Table 3. PPTs' responses concerning the use of technology in their professional lives.

Category	*F*	%	Examples of PPTs' answers
Yes	44	70.96	Yes. I think it would be useful for the students. Yes. I definitely think so. Yes. The positive side of technology is quite high. I'm thinking it will definitely yield results. For students' permanent and effective learning, yes. It's the technology age so, for that reason, I think so.
When required, yes.	8	12.90	In some situations, yes. I'm thinking about using it as required. Depending on the topic, yes. Yes, if necessary. But I would not use technology in every lesson.
No	3	4.83	I don't think it would be effective in mathematics. Yes, but not in math.
No opinion	7	11.29	I have no idea.
Total	**62**	**100**	

The answers to the question 'Do you plan to use technology effectively in your profession?' from the interview form are presented in Table 3.

Table 3 shows that 70.96% of the participants stated that they would benefit from technology effectively in their professional lives, 12.90% will use it in necessary situations, 7% have no idea and 4.83% will not use technology in mathematics lessons.

PPTs' opinions on the use of technology in classroom activities in mathematics lessons

The data obtained from the participants are displayed in two separate categories: 'advantages' and 'disadvantages'.

According to Table 4, the participants mostly indicated the following advantages of technology; time savings (50.00%), attention-catching (41.93%), permanent learning

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Table 4. Opinions of PPTs on the advantages of technology.

Categories	Codes	*f*	%
Opinions about course content	Provides visualisation.	17	27.41
	Facilitates understanding/learning.	10	16.12
	Situations that are not possible in the class environment can be shown.	16	25.80
	Provides concretisation.	10	16.12
	Provides persistent learning.	21	33.87
	It makes reinforcement easier.	8	12.90
Opinions about the instruction process	Saves time.	31	50.00
	It appeals to a wider audience.	7	11.29
	It allows you to provide various activities and examples at the same time.	10	16.12
	It appeals to multiple senses.	8	12.90
	Complements the teacher's shortcomings.	2	3.22
	Enables active participation.	4	6.45
	Provides opportunities for interactive environments.	7	11.29
	It facilitates individual learning.	5	8.06
Opinions about attitudes	Attention/attraction.	26	41.93
	It is motivating.	7	11.29
	It makes the lesson fun.	6	9.67
Other opinions	It provides easy and quick access to information.	20	32.25
	It contributes to creativity.	4	6.45
	Contributes to media literacy.	1	1.61
	It allows socialisation.	2	3.22

(33.87%), rapid and easy access to information (32.25%), visualisation (27.41%) and a simulation opportunity (25.80%).

Examining Table 5, the lack of technological knowledge concerning the disadvantages of technology (27.41%) was the most cited reason, followed by the cost of technology (22.58%); and the inability to provide sufficient opportunities in all environments (19.35%), difficulties in classroom management (19.35%) and non-purpose usage (19.35%) were cited.

Reasons for not using technology in classroom activities in mathematics lessons

If the data in Tables 2 and 3 are handled together while most of the PPTs (83.86%) would like to use technology in their teaching professions, only 12 PPTs (19.35%) used technology in the activities. These findings show that there is an inconsistency between the opinions and practices of the PPTs. The findings of the third research question are presented in this section to indicate the underlying reasons for the activities, which do not involve technology, performed by the PPTs.

According to Table 6, the prominent idea by the PPTs is that 'concrete material is more effective for teaching' (54.83%) as the reason for not using the technology in the activities. Also, it was found that the PPTs reported that they used technology during the preparation phase (14.51%) and they think that they will work in schools in rural areas (9.67%) in their professional lives.

Table 5. Opinions of PPTs on the disadvantages of technology.

Categories	Codes	*f*	%
Views on the technical aspect	It can lead to a loss of time.	9	14.51
	Electronic devices may break down	7	11.29
	Expensiveness	14	22.58
	There may be no technology in every environment.	12	19.35
Opinions about teacher	Class control can be difficult.	12	19.35
	The teacher may not be fully able to use the technology.	17	27.41
	Passivates the teacher/The teacher may cut corners	12	19.35
Opinions about student	Could passivate the student	5	8.06
	Can be distracting	12	19.35
	May cause health problems	6	9.67
	May cause non-purpose use	12	19.35
	It can lead to technology addiction.	9	14.51
	Could cause laziness in the student	7	11.29
	It may not be appropriate for every subject and in every situation.	2	3.22
Other	There may be issues related to the security of the information source.	7	11.29
	It can adversely affect socialisation.	4	6.45

Table 6. Reasons of PPTs for not using technology.

Category	*f*	%
The view that using concrete material is more effective	34	54.83
Utilising technology in lesson preparation	9	14.51
To serve in village schools	6	9.67
Limited time	3	4.83
Classroom management	3	4.83
Technical problems	3	4.83
Not to cut-corners	2	3.22
Not feeling competent about technology	1	1.61
No views	2	3.22

Some of the answers from the PPTs with respect to the third research question are as follows:

> *PPT 28: I did not use technology. I don't think it could be very useful in a math class. I believe that children will learn better from more tangible, hand-held, and real life examples.*
> *PPT 52: I did not prefer to use technology because I'm going to have trouble accessing a computer and the Internet in the village. For this reason, I made materials from equipment that I could easily access.*
> *PPT 22: I did not want to use technology because my subject was the number patterns listed within a certain difference. I don't think I can just use slides in the classroom to keep the attention alive.*
> *PPT 39: I didn't use technology in my presentation. However, when I was preparing for the presentation, I took advantage of technology. I did some research.*

PPT 35: I did not use it because I thought there was no need for technology in the subject, and I can get away from the classroom when I'm connected to technology.
PPT 55: I didn't use it. My materials were adequate. I thought the materials I prepared would be more effective.
PPT 7: I took advantage of technology in the research phase. I made my presentation in the teaching environment with the materials I prepared. The reason for this is that I think that the more concrete things we convey, the more permanent they will be.

Discussion

Based on the findings, for the first sub-problem of the study, it can be said that the use of technology in activities was low (19.35%). Batane and Ngwako (2017) revealed that even though pre-service teachers had different technological competencies and positive attitudes towards using technology, the majority of them did not use it in their lesson practices. The other studies in the literature reached the same conclusion, which is technological integration into learning environments, which cannot be fully achieved (Angeli and Valanides 2009; Cheok *et al*. 2016; Ertmer and Ottenbreit-Leftwich 2010; Higgins, Huscroft-D'Angelo, and Crawford 2019; Kim *et al*. 2013; Martin 2018; Taimalu and Luik 2019). The teachers who benefited from technology were seen as being in the 'utilisation' and 'integration' stages of the phases that were developed by Hooper and Rieber (1995). The PPTs stated that they intended to save time by reflecting the problems and examples in the classroom environment. For this reason, it can be said that the PPTs who benefited from the PowerPoint presentation were in the transition from the utilisation phase to the integration phase. Because the participants used technology by projecting printed resources such as images and problems, as Hooper and Riebers (1995) pointed out, while also consciously planning to use technology. Hooper and Rieber (1995) stated that most educators use technology in the 'integration' phase. Stobaugh and Tassell (2011) expressed this situation in another way and concluded that teachers in their study had the ability to use technology in educational settings, but they had difficulties in using technology in contextual situations. Aslan and Zhu (2016) found that pre-service teachers use technology for demonstrative purposes at basic level. PPTs used technology like blackboard as Hooper and Riebers (1995) stated. The results of the current study show consistency with ones done by Aslan and Zhu (2016), Hooper and Rieber (1995) and Stobaugh and Tassell (2011).

It was obtained that while a large majority of the PPTs want to use technology in their professional lives, a small group of the PPTs used it in their instructions. The difference between the opinions of the PPTs and their practices is noticeable. This result is consistent with the results of the studies done by Smith, Kim and McIntyre (2016) and Liljedahl (2009). Smith, Kim and McIntyre (2016) revealed that teachers believed that technology is useful for students, but they needed help about how to use it. Therefore, teachers are not able to reflect what they believe in their practices. Liljedahl (2009) pointed out the tension between ideal and real about use of technology in education in his study also. Unfortunately, the PPTs are not given training at the undergraduate level to use technology effectively in their professional lives (Ciftci *et al*. 2013; Tondeur *et al*. 2013). The difference between what participants think and what they put in practice may be related to the learning experiences of participants, especially with the education they receive at the undergraduate level, there are limited courses and opportunities for technology integration in teacher training institutions. The PPTs were asked to express their opinions about technology, and the answers were examined under the heading of advantages and disadvantages. Concerning the advantages of technology use in an educational context, in the study of Atasoy, Uzun, and Aygun (2015), pre-service teachers' thoughts were revealed as permanent learning, improving students' thinking skills, making the lesson enjoyable and simplifying. In addition, Ciftci and Tatar (2014) found that pre-service teachers had opinions that technology is interesting and easily accessible. The PPTs have views that technology enables visualisation, concretisation, making connections between mathematics and real world, and thus, saving time (Ocal and Simsek 2017). Smith, Kim and McIntyre (2016) reached parallel findings in relation to what pre-service teachers have opinions on technology use also. Considering the disadvantages of technology use in educational context, similar to the current study, it was seen that the PPTs presented opinions related to technical issues, classroom management, misuse and teachers' lack of technological knowledge in the other studies (Atasoy, Uzun, and Aygun 2015; Ciftci and Tatar 2014; Ocal and Simsek 2017). In light of these results, it can be said that the results obtained from the current study are in line with those obtained from other studies in the literature. Besides, the studies conducted with in-service teachers reached similar findings (Aktaş *et al*. 2014; Avci and Coşkuntuncel 2018; Birisci and Calık Uzun 2014; Ciftci *et al*. 2013; Delice and Karaaslan 2015; Drijvers *et al*. 2016). It is noteworthy that the opinions of the PPTs are in accordance with the opinions of the in-service teachers.

In the third sub-problem of the study, the aim was to reveal the reasons why the PPTs did not use technology in their activities. The beliefs of individuals for mathematics, mathematics teaching and the role of technology influence the decisions they make in educational learning environments (Smith, Kim, and McIntyre 2016). In mathematics classes, the abstract structure of the concepts cannot be embodied in every situation or any environment (Birisci and Calık Uzun 2014). Therefore, technology is one of the tools used for the concretisation of concepts or situations that cannot be shown in the classroom environment (Aktaş *et al*. 2014; Ocal and Simsek 2017). While participants indicated that technology is advantageous for visualisation and concretisation, the idea that concrete materials are more effective than technology appears to be more dominant. This situation may be related to the learning experiences they exposed, which have an impact on the decisions they make in their teaching environment (Stickles 2011; Van Dooren, Verschaffel, and Onghena 2002). The PPTs enrolled in courses mainly taught by using concrete materials. Using technology in learning environments was a relatively new situation for them. That is why it is possible that they are still eager to use hands-on activities during their teaching activities. Unfortunately, teacher training institutes are not adequate to prepare pre-service teachers for the future in order to use technology (Aslan and Zhu 2016). Even if the PPTs have positive opinions about technology, due to not having enough experience with technology, it can be said that they do not have in-depth knowledge of how to concretise or visualise any objective by using technology. Thus, PPTs used technology in their teaching at utilisation and integration levels as benefiting from power point, music playback and video demonstration. Secondly, it may be related to the fact that PPTs will teach in elementary classrooms. Students in elementary classrooms are aged 6–10 and they are at the concrete operational stage according to Piaget's framework. For this reason, the PPTs may have the opinion that concrete materials are more effective than technology. Besides, Maschietto and Trouche (2010) stated that despite developments in digital tools, the tendency to use physical tools in mathematics education still exists. PPTs also reported that because they have benefited from technology during the preparatory stage, they did not need to utilise technology in classroom activities. This result is similar to the results of Aslan and Zhu's (2016) study in which teachers attended to use search engines to seek and evaluate information. In addition, it was seen that the PPTs were concerned that they would serve in rural schools, and therefore, they thought that the lack of physical conditions would constitute an obstacle to the use of technology. Similarly, Batane and Ngwako (2017) concluded that lack of technological tools and inadequate physical conditions are two major reasons for not using technology in classes. In this study, in parallel with the findings of Wachira and Keengwe (2001), other reasons, which were categorised as external or internal barriers, reported by the PPTs as follows: limited time, classroom management issues and technical problems.

Conclusion

In this study, the aim was to determine the use of technology and the opinions of PPTs regarding the use of technology in classroom activities in mathematics lessons. In addition, there was an attempt to reveal the reasons underlying the PPTs' not using technology in mathematics teaching. Based on the findings, it was seen that the PPTs have positive views about using technology and they are willing to use technology in their future classes. Nevertheless, the issue of technology integration in elementary mathematics education still remains current as a problem. The major reasons for not using technology were seen as the notion that concrete materials are more effective than technology, and using technology in the preparation phase, and technical-physical inadequacies.

Suggestions

It is noted that new educational institutions should be intertwined with the ever-changing technological world (Martin 2018). For example, the Increasing Opportunities and Improving Technology Movement (FATIH) project in Turkey was launched in 2010, and interactive boards were provided for 54 000 schools, and approximately 1 million teachers and 18 million students were affected by this project (YEGITEK 2017). Most of the schools in Turkey were equipped with technological tools via the project. That is why most of the PPTs have an opportunity to use technology in their future careers. In this respect, the coordination of faculties of education at universities and public schools is important in terms of educating pre-service teachers as individuals who are able to integrate technology into learning environments. By offering practical opportunities to pre-service teachers about technological integration, their thoughts, attitudes and beliefs should be encouraged positively.

Limitations

The study is thought to have some limitations. One of them relates to the working group. The study group had PPTs from only one state university. It would be better to involve PPTs from various universities. In addition, the research was limited to the primary school mathematics curriculum. Therefore, research can be proposed for pre-school, middle and high school teaching programmes with different objectives.

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