The Correlation between Pre-service Teachers' Attitudes towards Technology and Achievement in Material Design Course

Fuat Findikoglu[1], Bulent Alci[2] and Hakan Karatas[3]

*Yildiz Technical University, Faculty of Education, Department of Educational Sciences,
Esenler, Istanbul 34220, Turkey
E-mail: [1]<fuatf@yildiz.edu.tr>, [2]<alci@yildiz.edu.tr>, [3]hkaratas@yildiz.edu.tr*

ABSTRACT This study aims to specify the correlation between pre-service teachers' attitudes towards technology and achievement in material design. The participants of the study consisted of 127 pre-service teachers from different disciplines. To determine the attitudes of pre-service teachers, data was collected using the "Technology Attitude Scale". The achievement scores of pre-service teachers in material design were obtained using the material evaluation form developed by the researchers based on the principles of designing material. While evaluating the data, analyses of Pearson correlation and t-test were conducted, the results revealed a positive correlation between pre-service teachers' attitudes towards technology and achievement in material design. Also, significant differences were found according to pre-service teachers' disciplines. These findings and implications for educational researchers were also further discussed.

INTRODUCTION

For a considerably long enough time, it has been inevitable not to acknowledge that rapid advances in technology have revolutionized not only the way people lead their lives but also the way they teach and most importantly the way they learn. Without doubt, these advances are changing the work culture and teachers must acknowledge that classrooms must be equipped with technology and the learning experience must be supported technologically (Angers and Machtmes 2005).

It can be said that teachers have always been aware that learners, that is to say, the way students learn, must shape the way teachers teach. In other words, the methods of teaching used by teachers should be determined in tune with the learning styles of the targeted students. It can also be said that although the needs of today's students and their styles of learning are urging the introduction of new technology to the classrooms, just the opposite can also be true as well, new technology is at the same time trying to make its way into the field of education which has always been very broad and open to continuous development.

It is crucial that curriculum be designed to include teaching situations incorporated with contemporary instructional techniques so that teachers can raise students who are accustomed to modern technology (Karamustafaoglu et al. 2012). To accomplish this, teachers need to be educated as part of their undergraduate education. According to Teo (2006), students' achievement in computer assisted classrooms is fostered further by the teacher's attitudes towards technology and by the teacher's eager interest in using it. On the other hand, it today seems obvious that addressing the needs of students resulting from new technology can be challenging for some teachers. According to Rehmat and Bailey (2014), deploying technology in instruction is sometimes difficult for most teachers and technology provides a wide range of means and opportunities to bridge the gap between the content and the advanced teaching methods. Teachers are responsible for designing and carrying out the courses. That can be interpreted in two ways: teachers will adopt technology to better organize the content and to better address the students' changing needs and not doing this would mean ignoring the students' expectations. This fact demonstrates that teachers' attitudes towards deploying technology will bring about completely different consequences and also shows the effect that teachers' attitudes has on technology adoption and thus teaching itself. Bozdogan and Ozen (2014) claim that teachers should be aware of both technology and novel

methods of teaching in order for them to pass this knowledge to the learning of the students, which makes the ground for successful technology integration. This being the case, as long as technology continues to evolve, teachers' attitudes towards the latest technology will be in question.

According to Besoluk et al. (2010), teachers will have to abide by the rules of educational technology, thus preparing themselves and acquiring the related skills and knowledge. Even though it is widely perceived without question that teachers' technology adoption will guarantee achieving the preset goals, it is never a matter of question whether the teacher is qualified enough, has positive attitudes and is willing and motivated to design and deploy materials in implementing lessons and reinforcing students. As stated by Huang and Liaw (2005), although computer technology is very far advanced and state of the art, the effectiveness and accuracy of deploying it in teaching depends largely on whether the teacher have positive attitudes towards technology or not. However, it should be taken into account that there are many factors affecting the perceptions of teachers regarding technology and it can be said that these factors go back as far as to their undergraduate education. It only depends on the teacher to decide whether to integrate technology in one of his classes or at some point on his ability to deploy technology in material design. Therefore, it can be inferred that having positive or negative attitudes towards deploying technology in material design is closely related to the level of teachers' knowledge on the means of technology to be used in material design. In other words, the extent to which a teacher integrates technology into designing materials and shaping the course plan is limited to how qualified, skillful and eager he is in terms of technology use.

Bullock (2004) states that teachers' attitudes play a great part in making their integration of technology into their teaching possible or impossible. If teachers have the necessary knowledge and skills, they will be able to deploy technology; if not, they will not be able to use technology in planning their educational activities. In a very close relation to attitudes, the main obstacle to the integration of technology to instructional environments is the lack of knowledge, skill and confidence as to how and what for are they going to do that integration (Zhao

2007; Bingimlas 2009). Apart from instructional technology, as Robertson (2004) suggests, for the professional instructional practice, teachers tend to be inspired by former experience and personal theories. This being the case, if a technologically supported approach is to be taken towards education besides the perceptions of teachers towards technology, their perceptions of its use in education also matters a great deal (Kahveci et al. 2011). At this point, Usta and Korkmaz (2010) suggest that raising technologically competent individuals depends on the proper use of technology and positive attitutudes towards technology by teachers, which, in turn, will be a positive impact on the quality of the educational system of the country. For this reason, a teacher's education curriculum must incorporate technology and must enable pre-service teachers to carry out technology enhanced classes and to design materials that deploy technological content (Keating and Evans 2001). Besides taking a positive approach to technology, a teacher should take into consideration that bringing technology to the learning environment can make a difference. In a study carried out by Can (2010), it has been found that pre-service teachers are of the opinion that using technology in the teaching settings brings some kind of diversity to the teaching, makes it more attractive and keeps the students attentive.

Technology and Pre-service Teachers

Murley et al. (2013) have stated that efficient implementation of teaching and attracting information age individuals, are two good reasons why teachers should incorporate technology into their practice. Today, it can be said that classrooms are being equipped with a number of technological devices that lead to enhanced teaching. However, it is not certain whether teachers can make good use of them in classrooms. According to Zammit (1992), the shortage of ability and self-confidence teachers have were factors that prevent a meaningful integration of technology to the classroom environment. As a result, it can be said that, when teachers start teaching, their decision of whether or not to deploy technology in the classroom setting will be determined by how much confidence they have and what attitudes they have, and this will have an important role in academic achievement of students (Christensen 2002; McGrail 2005). Refer-

ence for this is made to the insufficiency in the pre-service education of teachers in terms of preparing them to work in a technology enriched classroom (Willis and Mehlinger 1996; Yildirim 2000; Kay 2006). Notwithstanding, this does not mean that pre-service education isn't good enough for pre-service teachers to be well-equipped for the job. It can be said that technological advances are a constant phenomenon and require constant individual update. For example, smart boards, when they were first introduced, were totally a breakthrough in the classrooms. However, they are not as exciting as they were at the time, though they are still a very sound multimedia provider to the classrooms. The point here is that smart boards weren't and couldn't have been included in the pre-service teachers at the time they were first introduced.

Today, also a great number of different and novel means of educational technology exist although they haven't yet been included in the curricula. Thus, a focus should be on the pre-service teachers' training system (Yurdakul and Coklart 2014). Here, regarding the technology adoption of the individuals, Wei et al. (2011) state that while people are taking steps in adopting new technology, at the same time technological advances will continue to take place causing each individual with different levels of achievement in technology adoption. The pace at which technology advances is hard to keep up with. Another important factor affecting the attitudes of pre-service teachers towards the use of technology, according to Kay (2006), is the attitudes of the faculty members who teach them in the first place. If they do not promote the integration of technology to their teaching practice and actually use it in their teaching, the pre-service teachers will already have a negative attitude towards the incorporation of technology in the classroom or will think that it is unnecessary; since, it is not that easy to develop a theory to incorporate technology into the classroom environment as it differs in context and purpose greatly (Mishra and Koehler 2006).

Spotts (1999) stated that the extent to which faculty members use technology is questionable despite the classes being equipped with necessary tools. It is also important regarding this issue that we should look at the repertoire of teachers in terms of the variety of the instructional technology methods they utilize (Wozney et al. 2006). Kay (2012) mentions about four challeng-

es for pre-service teacher programs and teaching with technology in his research. He simply explains that, (1) using technical software, (2) ever changing technology, (3) the difference between the pre-service teachers who are the Net Generation and their faculty, and (4) problems arising in practical use, are the main difficulties encountered in pre-service teaching programs and embedding technology into the classroom setting. Here, it can be said that integrating technology into the classroom setting is by nature difficult in that content, student needs, learning styles and many other factors are in question. Bauer and Kenton (2005) contribute to this idea stating that teachers still didn't make a full-scale technology integration although they had enough qualifications, because there are also other factors such as extra time for lesson plans, lack of student skills, proper software, outworn and hardware. At this point, having positive attitudes towards and being willing to incorporate technology will facilitate the planning and material design processes. As well as having positive attitudes, for the incorporation of technology teachers should know about instructional technology materials and how to utilize them in a professional way to enhance student learning (Ertmer and Ottenbreit-Leftwich 2009).

Pre-service Teachers and Instructional Technologies and Material Design Course (ITMD)

So far, it has been discussed how attitudes and perceptions of teachers towards technology are related to the integration of technology into the classroom setting and in some part, the undergradute curriculum has been referred to for any obstacle that is in the way of this integration. Here, it should be mentioned that pre-service teachers havean Instructional Technologies and Material Design (ITMD) course in their curriculum to equip them with initial necessary skills and this course has been in the pre-service teacher education curricula since 1998 (Gunduz and Odabasi 2004). The ITMD course and its equivalents reinforce pre-service teachers to adopt instructional technology in their future classes (Collier et al. 2004; Pope et al. 2005). As Ates (2002) stated, ITMD course provides pre-service teachers with basic principles of instructional technologies, and when and where to deploy them in the process of material design. As the

name suggests, this course seems to be a solution to the obstacle that prevents full-scale technology integration that is the ultimate goal of enhanced classrooms. It is by nature the result of the pressing need of technology to be used in instructional activities despite not being a permanent solution (Kirschner and Selinger 2003), which is also a pressing need for teachers to ingrate their content knowledge with technology (Akkoyunlu 2002). This fact also happens to be a fundamental reason for why ITMD courses should be in the curriculum. Whetstone and Carr-Chellman (2001) concluded that although pre-service teachers are of the opinion that technology integration is important, they do not realize that they have a pedagogical part in this. This being the case, the ITMD course is also a chance for pre-service teachers to utilize their pedagogical knowledge in integrating technology into the design process of the materials and to the content knowledge. In doing this, like many other teacher education courses (Zhao et al. 2002), technical abilities and positive attitudes will be at the center of interest. In the ITMD course, factors such as creativity, addressing to learning styles, deploying methodological aspects apart from the technical skills will be the matters in question. But above all, pre-service teachers need to be willing to develop effective materials and make them count, which requires a positive attitude towards deploying instructional technologies. Tezci (2009) puts forward that technology alone does not comprise any instructional use, on the contrary, he is of the opinion that it is valuable when deployed by teachers for instructional purposes. It is acknowledged that teachers haven't had positive attitudes toward technology integration since the introduction of technology into classrooms (Lei 2009). If teachers are going to integrate technology into their practice, they must have confidence in themselves to do so (Ropp 2009). The importance of positive attitudes and willingness is also a contributing factor in the effectiveness and success of the learning materials. If students are contented with the learning materials, the learning experience will become more comfortable for them.

ITMD course provides pre-service teachers with a wide range of instructional technology means and a repetoire of learning materials from worksheets to computer-based applications. Sahin and Yildirim (1999) stated that by familiarizing themselves with strenghts and weaknesses of different materials, teachers will be able to determine and design the best and the most effective teaching material. In addition to what is mentioned earlier about the positive attitudes and professional knowledge, Lemlech (1995) views attitudes as integral to professional knowledge.

In learning environments, during the instructional activities, using instructional technology and effective materials is of great importance. This study carries a considerable significance, in that it provides faculty members and pre-service teachers mutual feedback and benefits for instructional purposes and it provides pre-service teachers a permanent learning experience in which they took part both as active learners and as prospective teachers.

Purpose of the Study

In the light of the theoretical framework provided above, this study aims to specify the correlation between the pre-service teachers' attitudes towards technology and achievement in ITMD course. Research has investigated the attitudes of pre-service teachers towards technology and instructional technology, this study investigates whether positive attitudes really contribute to success in practice in real life. Due to the teachers' role in integrating technology to the classrooms, it is the pre-service teachers' responsibility to adopt the advances in technology and adapt them to their teaching (Gur and Karamete 2015). Instructional Technologies and Material Design Course is an initial real life indicator of pre-service teachers' positive attitudes in action.

In this context, answers to the following questions were sought.
1. Is there a correlation between the pre-service teachers' attitudes towards technology and achievement in ITMD course?
2. Are the departments of pre-service teachers significant predictors of their attitudes towards technology?
3. Is gender a significant predictor of pre-service teachers' attitudes towards technology?

METHODOLOGY

This study investigates the correlation between pre-service teachers' attitudes towards technology and achievement in material design. This research was carried using the quantitative research method and descriptive survey model using 5-score Likert scale. In quantitative research, a researcher identifies a research problem and explains relations among variables. With

this research design, results indicate a large group of individuals' views on a problem and various views (Creswell 2012).

Participants

The participants of the study consisted of 127 pre-service teachers from different disciplines. Among these 127 pre-service teachers, 94 of were females and 33 of them were males. To determine the attitudes of pre-service teachers, data was collected using the "Technology Attitude Scale" developed by Yavuz (2005). The achievement scores of pre-service teachers in material design were obtained using the material evaluation form developed by the researchers based on the principles of designing material.

Research Procedure

Prior to this study, the study group was told about the aim of the study. During the study, participants were told that they were going to prepare 3 different materials including, (1) a PowerPoint presentation, (2) a worksheet, and (3) a mind map. Before the pre-service teachers started working, they were given the "Technology Attitude Scale". The first four weeks, the pre-service teachers attended lectures on theoretical framework within the scope of Instructional Technology and Material Design course. During these four weeks, sample materials were studied. For the remaining 12 weeks, the pre-service teachers prepared the three instructional materials in groups on a weekly basis. At the end of each work, the students were given feedback about the outcome. To evaluate the materials prepared by the pre-service teachers, a "Material Evaluation Form" was designed in accordance with the basic principles of designing instructional materials and with the expert opinions by three faculty members from the department of Computer Education and Instructional Technology. The achivement grades of the pre-service teachers were assigned according to the criteria on the "Material Evaluation Form".

Data Collection Tool

In this study, data was collected using the "Technology Attitude Scale" (Yavuz 2005) where pre-service teachers' attitudes towards the use of technological devices in instruction were studied. This scale comprises 19 items and 5 factors regarding "not using technological devices in instruction", "using technological devices in in-

struction", "the effects of technology on educational life", "teaching how to use technological devices" and "evaluating technological devices". There are 13 positive and 6 negative attitude items on the scale. In this study, the reliability coefficient has been calculated through Cronbach's Alpha and the result was .92. Each item on the "Technology Attitude Scale" was evaluated through a 5-point Likert scale in the form of "strongly agree, agree, undecided, disagree and strongly disagree". In this context, the data collected was coded from 5 to 1 for positive items, and 1 to 5 for negative items.

Data Analysis

A total of 127 pre-service teachers participated in the "Technology Attitude Scale". Mean scores of items in Technology Attitude Scale were computed to determine attitudes of pre-service teachers. Pearson Correlation analysis was performed to determine whether technology and achievement information were significant predictors of their attitudes. ANOVA was performed to see whether there were any significant differences between the means of departments and attitudes of pre-service teachers towards technology. t-test was also conducted to see whether there are any significant differences between genders towards technology.

RESULTS

Regarding the level of university students' academic procrastination, personality traits and academic achievement, Table 1 summarizes the following findings,

Table 1: The correlation between pre-service teachers' attitudes towards technology and achievement scores in ITMD course

		Attitude	Achievement
Attitude	Pearson Correlation	1	.38
	Sig. (2-tailed)		.00
	N	127	127
Achievement	Pearson Correlation	.38	1
	Sig. (2-tailed)	.00	
	N	127	127

P<.01

Looking at Table 1, it can be seen that the correlation between pre-service teachers' attitudes towards technology and achievement scores in ITMD course is r=.38 and this value has significance at a level of .01. In this context, the more postive attitudes pre-service teachers have towards technology and use of instructional technology in education, the higher they achieve in the ITMD course. On the other hand, the less positive attitude they have towards technology and use of instructional technology in education, the lower they achieve in the ITMD course. Therefore, it can be said that the attitudes of pre-service teachers towards technology are in direct correlation witht their achievement inthe ITMD course. For this reason, it should be prioritized that studies should be targeted at cultivating more positive attitudes into pre-service teachers.

Table 2: ANOVA results

	Sum of squares	Df	Mean square	F	Sig.
Between groups	732.85	2	366.43	6.94	.00
Within groups	6544.96	124	52.78		
Total	7277.82	126			

P<.01

When Table 2 is taken into consideration, it is seen that pre-service teachers have a significant difference at a level of .01 (F=6.94) in their attitudes towards technology according to their departments. The attitudes of pre-service teachers towards technology are significantly different in terms of their department, this could be due to the fact that the use of technology in education differs according to pre-service teachers' departments. Therefore, instead of including a standard instructional technologies and material design course in the curriculum, department specific content should be tailored for each department's curriculum. To determine which departments reflect this difference, the Bonfer-

Table 3: Post Hoc test results (Multiple comparisons)

(I) group	(J) group	Mean difference (I-J)	Std. er.	Sig.
Math	Social	5.21	1.54	.00
	Turkish	4.71	1.59	.01
Social	Math	5.21	1.54	.00
	Turkish	-.49	1.61	1.00
Turkish	Math	-4.71	1.59	.01
	Social	.49	1.61	1.00

P<.05

roni test was applied. Bonferroni test results were given in Table 3.

As seen in Table 3, there is a significant difference at a level of .05 between the attitudes of Math pre-service teachers towards technology and the attitudes of Turkish Language and Literature and Social Science Education pre-service teachers. Besides this fact, there is no significant difference between the attitudes of Social Science Education pre-service teachers and Turkish Language and Literature pre-service teachers. At this point, besides the use and availability of instructional technologies in the pre-service teachers' departments, it can be said that pre-service teachers' individual needs to use instructional technologies have a predictive effect on their attitudes. The results of this study suggest that there is a significant difference between natural sciences department and social sciences department. In this context, it can be said that this why pre-service teachers from natural sciences department are more interested in technology.

The data in Table 4 shows the significant difference between the attitudes of pre-service teachers towards technology and their gender. As seen above, there is no significant difference (t= .04) between the attitudes of female and male pre-service teachers.

DISCUSSION

The information age and the learning styles of the new generation has urged the need for

Table 4: Independent groups t-test results

	Gender	Number	Mean	Std. dev.	Sig.	t	df
Attitude	Female	94	76.79	740	.33	.04	125
	Male	33	76.72	8.25		.04	51.24

P<0.5

technology to be adapted for use in the classroom setting. Besides integrating technology into teaching, technology integration has also become a reality in designing instructional materials. In the process of education, this integration goes as early as back to pre-service teacher education and to the Instructional Technologies and Material Design course. In this study, the correlation between pre-service teachers' attitudes towards technology and their achievement in the ITMD course was investigated. As a result of this investigation, a significant difference was found between pre-service teachers' attitudes towards technology and achievement in the ITMD course. However, there is no significant difference between pre-service teachers' attitudes towards technology and achievement in ITMD course according to gender. On the other hand, according to pre-service teachers' departments, there is a significant difference between the attitudes of Math pre-service teachers towards technology and the attitudes of Turkish Language and Literature and Social Science Education pre-service teachers. This study aimed at investigating the correlation between the pre-service teachers' attitudes towards technology and their achievement levels in ITMD course. To develop technology effective materials and classes, as a considerable majority of the literature suggests, having a positive attitude is a precondition. In addition, although there is a wide accumulation of research regarding the correlation between the attitudes of pre-service teachers towards technology and deploying technological devices in the classroom setting and teaching (Dexter and Riedel 2003; Sahin 2003; Pala 2006; Özgen and Obay 2008; Teo 2008; Yavuz and Çoskun 2008; Öksüz and Ak 2009; Usta and Korkmaz 2010; Uyangör and Ece 2010; Eren et al. 2015), studies investigating the correlation between the attitudes of pre-service teachers and their achievement in the ITMD course aren't as many. Yavuz and Çoskun (2008) found in their study, where they investigated pre-service teachers' attitudes, that project works assisted technologically had a positive impact on students' attitudes as well. The studies where they investigated the attitudes of pre-service teachers, show that they had positive attitudes regarding the teaching of the use of technological devices in instructional settings (Yilmaz et al. 2010; Ozer and Tunca 2014). Akkoyunlu (1996) found that pre-service teachers who are knowledgeable about technology tend to have more positive attitudes so as to use it in instruction. Apart from having positive attitudes towards technology, Mullen (2001) suggests that unless they are provided with proper experience, pre-service teachers may not be able to integrate technology effectively. This study, by the nature of its procedure, has provided pre-service teachers guided experience through ITMD course and the pre-service teachers have also designed material and were given feedback on their work. If pre-service teachers learn how to make use of instructional technology during their undergraduate study, they will develop positive attitudes and self-confidence towards the use of technology in their practice of teaching (Metin et al. 2013; Shin 2015). Al-Ruz and Khasawneh (2011) also concluded that the university environment and real life experiences have an impact on the technology adoption habit of pre-service teachers. Pope et al. (2005) found that pre-service teachers' confidence and use of technologies became higher when they were provided with experience where they develop materials and found opportunities to see models of instructional technologies. Moreover, scaffolded experience and models of technology-enhanced instructional materials are highly efficient in strengthening the skills of pre-service teachers for designating and deploying the relevant technology and materials (Collier et al. 2004; Tokmak 2014). This study, both, provided pre-service teachers with hands-on experience and urged them to choose when and how to use instructional technology in material design and deploying such technology, they had the opportunity to discover the good sides and bad sides of each aspect they chose. The results were also in tune with a similar study carried out by Morrison and Jeffs (2005) where they carried out a similar procedure and attained similar results. The results of this study also provided new evidence to the literature in that it investigates the correlation between attitudes and achievement in the Instructional Technologies and Material Design course demonstrating that positive attitudes will make ground for good quality materials.

CONCLUSION

With the use of technology in education growing rapidly, teaching methods and learning styles are also undergoing a transition in tune with the advances in technology. This, in turn,

makes it inevitable that the teachers keep themselves up to date and adapt to the ever-changing world of technology. In addition, this study provided academicians, pre-service teachers and teachers with data that having positive attitudes towards technology actually contributes to designing better technologically enhanced classrooms and activities. It is evident that teachers would be more willing to include technology in their practice simply because they can do so, or vice versa, just because they are not good at deploying technology and designing technologically-enhanced courses, they can be reluctant to include technology in their practice. This study showed that teachers' use of technology in classrooms is as crucial as teachers' having positive attitudes towards technology.

RECOMMENDATIONS

During pre-service teacher practice at schools, they must be exposed to the productive and efficient aspects of the use of technology in classrooms where they would have opportunities to develop positive attitudes towards technology and value technology use when they see well-developed and effective examples. In Turkey, today, within teacher training curricula, there is a standard ITMD course, which includes principles of basic material design and technology use for all teacher training programs from all fields. In the teacher training curriculum, the ITMD course should be tailored so as to fit in each programme from social sciences to natural sciences. Studies and research in this should be organized in order to develop field specific courses. All in all, pre-service teachers' needs, interests, tendencies and departments can be fundamentals of the ITMD course in teacher training programs. Also, as the age of technology requires, in teacher training programs, use of technology and instruction should be encouraged and in addition to the ITMD course, courses such as technology and instruction, and innovation and instruction, should be added to the teacher training curricula.

REFERENCES

Akkoyunlu B 1996. Ögrencilerin bilgisayara karsi tutumlari. *Egitim ve Bilim,* 20(1): 15-29.

Akkoyunlu B 2002. Educational technology in Turkey: Past, present and future. *Educ Med Int,* 39(2): 165-174.

Al-Ruz JA, Khasawneh S 2011. Jordanian pre-service teachers' and technology integration: A human resource development approach. *Educational Technology and Society,* 14(4): 77-87.

Angers J, Machtmes K 2005. An ethnographic-case study of beliefs, context factors, and practices of teachers integrating technology. *The Qualitative Report,* 10(4): 771-794.

Ates A 2002. Instructional technologies and material design course evaluation through lecturer's and students' responses. *International Journal of New Trends in Arts, Sports and Science Education,* 1(1): 10-20.

Bauer J, Kenton J 2005. Toward technology integration in the schools: Why it isn't happening. *Journal of Technology and Teacher Education,* 13(4): 519-546.

Besoluk S, Kurbanoglu NI, Önder I 2010. Educational technology usage of pre-service and in-service science and technology teachers. *Elementary Education Online,* 9(1): 389-395.

Bingimlas KA 2009. Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science and Technology Education,* 5(3): 235-245.

Bozdogan D, Ozen R 2014. Use of ICT technologies and factors affecting pre-service ELT teachers' perceived ICT self-efficacy. *Turk Online J Educ T,* 13(2): 186-196.

Bullock D 2004. Moving from theory to practice: An examination of the factors that pre-service teachers encounter as they attempt to gain experience teaching with technology during field placement experiences. *Journal of Technology and Teacher Education,* 12(2): 211-224.

Can S 2010. Attitudes of pre-service teachers from the department of elementary education towards the effects of materials use on learning. *Turk Online J Educ T,* 9(2): 46-54.

Christensen R 2002. Effects of technology integration education on the attitudes of teachers and students. *Journal of Research on Technology in Education,* 34(4): 411-434.

Collier S, Weinburgh MH, Rivera M 2004. Infusing technology skills into a teacher education program: Change in students' knowledge about and use of technology. *Journal of Technology and Teacher Education,* 12(3): 447-468.

Creswell JW 2012. *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research.* 4th Edition. Boston: Pearson.

Dexter S, Riedel E 2003. Why improving pre-service teacher educational technology preparation must go beyond the college's walls. *Journal of Teacher Education,* 54(4): 334-346.

Eren E, Avci Yurtseven Z, Kapucu Seckin M 2015. Pre-service teachers' competencies and perceptions of necessity about practical tools for content development. *International Journal of Instruction*, 8(1): 92-103.

Ertmer P, Ottenbreit-Leftwich A 2009. *Teacher Technology Change: How Knowledge, Beliefs, and Culture Interest.* American Educational Research Association (AERA).

Gündüz S, Odabasi F 2004. The importance of instructional technologies and material development course at pre-service teacher education in information age. *Turk Online J Educ T,* 3(1): 43-48.

Gur H, Karamete A 2015. A short review of TPACK for teacher education. *Educ Res Rev,* 10(7): 777-789.

Huang HM, Liaw SS 2005. Exploring user's attitudes and intentions toward the web as a survey tool. *Computers in Human Behaviour,* 21(5): 729-743.

Kahveci A, Sahin N, Genc S 2011. Computer perceptions of secondary school teachers and impacting demographics: A Turkish perspective. *Turk Online J Educ T,* 10(1): 71-80.

Karamustafaoglu O, Çakir R, Topuz FG 2012. The Investigation of the Attitudes of the Science Teachers for the Use of Materials and Technology in Their Lectures. *5th National Positive Sciences and Mathematics Education Conference.* Nigde, Turkey. 27-30 June.

Kay R 2012. Using video podcasts to enhance technology-based learning in pre-service teacher education: A formative analysis. *Journal of Information Technology and Application in Education,* 1(3): 97-104.

Kay RH 2006. Evaluating strategies used to incorporate technology into pre-service education: A review of literature. *Journal of Research on Technology in Education,* 38(4): 385-410.

Keating T, Evans E 2001. Three computers in the back of the classroom: Pre-service teachers' conceptions of technology integration. *Proceedings of Society Information Technology and Teacher Education International Conference.* Chesapeake, VA: AACE, pp. 1671-1676.

Kirschner P, Selinger M 2003. The state of affairs of teacher education with respect to information and communications technology. *Technology, Pedagogy and Education,* 12(1): 5-17.

Lei J 2009. Digital natives as pre-service teachers: What technology preparation is needed? *Journal of Computing in Teacher Education,* 25(3): 87-97.

Lemlech JK 1995. *Becoming a Professional Leader.* New York: Scholastic.

McGrail E 2005. Teachers, technology and change: English teachers' perspectives. *Journal of Technology and Teacher Education,* 13(1): 5-24.

Metin M, Birisçi S, Coskun K 2013. Investigation of prospective teachers' attitudes towards instructional technology in terms of different variables. *Kastamonu Egitim Dergisi,* 21(4): 1345-1364.

Mishra P, Koehler MJ 2006. Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record,* 108(6): 1017-1054.

Morrison WF, Jeffs TL 2005. Outcomes of pre-service teacher's technology use. *Assistive Technology Outcomes and Benefits,* 2(1): 71-78.

Mullen L 2001. Beyond infusion: Pre-service teachers' understanding about educational technologies for teaching and learning. *Journal of Technology and Teacher Education,* 9(3): 447-466.

Murley LD, Jukes P, Stobaugh R 2013. Raising expectations for pre-service teacher for use of technology. *International Journal of Humanities and Social Science,* 3(14): 1-8.

Oksuz C, Ak S 2009. Pre-service teachers' perceptions for technology use in the teaching of mathematics in elementary schools. *Yüzüncü Yil Üniversitesi Egitim Fakültesi Dergisi,* 4(2): 1-19.

Ozer O, Tunca N 2014. The opinion of pre-service teachers towards preparing and using of materials.

Route Educational and Social Science Journal, 1(3): 215-229.

Ozgen K, Obay M 2008. The Attitudes of Secondary Mathematics Pre-service Teachers Towards Educational Technology. *8th International Educational Technology Conference Proceedings Book.* Eskisehir, pp. 583-588.

Pala A 2006. Ilkögretim birinci kademe ögretmenlerin egitim teknolojilerine yönelik tutumlari. *Manas Üniversitesi Sosyal Bilimler Dergisi,* 16: 177-188.

Pope M, Hare D, Howard E 2005. Enhancing technology use in student teaching: A case study. *Journal of Technology and Teacher Education,* 13(4): 573-618.

Rehmat AP, Bailey MJ 2014. Technology integration in a science classroom: Pre-service teachers' perceptions. *J Sci Educ Technol,* 23: 744-755.

Robertson I 2004. Teachers at the Interface: A Model of Implementation. *Australian Association for Research in Education Conference Proceedings.* Melbourne: Australian Association for Research in Education, pp. 1-14.

Ropp MM 2009. Exploring individual characteristics associated with learning to use computers in pre-service teacher preparation. *Journal of Research on Computing in Education,* 31(4): 402-424.

Tokmak Sancar H 2014. Pre-service teachers' perceptions on TPACK development after designing educational games. *Asia-Pacific Journal of Teacher Education*, 42(3): 1-18.

Spotts TH 1999. Discriminating factors in faculty use of instructional technology in higher education. *Educational Technology and Society,* 2(4): 92-99.

Sahin TY 2003. Student teachers' perceptions of instructional technology: Developing materials based on a constructivist approach. *British Journal of Educational Technology,* 34(1): 67-74.

Sahin TY, Yildirim S 1999. *Ögretim Teknolojileri ve Materyal Tasarimi.* Ankara: Ani Yayincilik.

Shin SK 2015. Teaching critical, ethical and safe use of ICT in pre-service teacher education. *Language Learning and Technology,* 19(1): 181-197.

Teo T 2006. Attitudes toward computers: A study of post-secondary students in Singapore. *Interactive Learning Environments,* 14(1): 17-24.

Teo T 2008. Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology,* 24(4): 413-424.

Tezci E 2009. Teachers' effect on ICT use in education: The Turkey sample. *Procedia Social and Behavioral Sciences,* 1(1): 1285-1294.

Usta E, Korkmaz Ö 2010. Pre-service teachers' computer competencies, perception of technology use and attitudes toward teaching career. *Uluslararasi Insan Bilimleri Dergisi,* 7(1): 1335-1349.

Uyangor SM, Ece DK 2010. The attitudes of the prospective mathematics teachers towards instructional technologies and material development course. *Turk Online J Educ T,* 19(1): 213-220.

Wei KK, Teo HH, Chan HC, Tan BC 2011. Conceptualizing and testing social cognitive model of the digital divide. *Information Systems Research,* 22(1): 170-187.

Whetstone L, Carr-Chellman AA 2001. Preparing pre-service teachers to use technology: Survey results. *Tech Trends,* 45(4): 11-17.

Willis JW, Mehlinger HD 1996. Information technology and teacher education. In: TJ Sikula, EG Buttery, AO Educators (Eds.): *Handbook of Research on Teacher Education.* New York: Simon and Schuster, pp. 978-1029.

Wozney L, Venkatesh V, Abrami PC 2006. Implementing computer technologies: Teachers' perceptions and practices. *Jl of Technology and Teacher Education,* 14(1): 173-207.

Yavuz S 2005. Developing a technology attitude scale for pre-service chemistry teachers. *Turk Online J Educ T,* 4(1): 17-25.

Yavuz S, Coskun AE 2008. Attitudes and perceptions of elementary teaching through the use of technology in education. *Hacettepe University Journal of Education,* 34: 276-286.

Yildirim S 2000. Effects of an educational computing course on pre-service and in-service teachers: A discussion and analysis of attitudes and use. *Journal of Computing in Education,* 32(4): 479-495.

Yilmaz I, Ulucan H, Pehlivan S 2010. The attitudes and thoughts of the students attending physical education teaching program about using technology in education. *Ahi Evran University Journal of Kirsehir Education Faculty (KEFAD),* 11(1): 105-118.

Yurdakul IK, Coklart AN 2014. Modeling pre-service teachers' TPACK competencies based on ICT usage. *J Comput Assist Lear,* 30: 363-376.

Zammit SA 1992. Factors facilitating or hindering the use of computers in schools. *Educational Research,* 34(1): 57-66.

Zhao Y 2007. Social studies teachers' perspectives of technology integration. *Journal of Technology and Teacher Education,* 15(3): 311-333.

Zhao Y, Pugh K, Sheldon S, Byers J 2002. Conditions for classroom technology innovations. *Teachers College Record,* 104(3): 482-515.