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Abstract: Purpose of this study was to determine and analyze Turkish pre-service science teachers' perceptions on technology in terms of learning style, computer competency level, possession of a computer, and gender. The study involved 264 Turkish pre-service science teachers. Analyses were conducted through four-way ANOVA, t-tests, Mann Whitney U test and one-way ANOVAs and the results showed there were one main effect for gender and one interaction effect between gender and computer competency level. The interaction effect pointed out that the male pre-service science teachers who were weak in computer competency held more positive perceptions toward instructional technology than their counterparts.

Introduction

Reforming the public schools has long been a way of improving not just education but society in general (Tyack & Cuban, 1995). Turkish students' poor performance in Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) captured Turkish policy makers' and educators' attention (Acar, 2012; Anıl, 2009; Atar & Atar, 2012; Uzun, Bütüner, & Yiğit, 2010). In 2004 Turkish Ministry of National Education (MEB) took serious measures to reform entire educational system. The reform initiatives embraced both structural and curricular changes in public schooling in Turkey. The curricular changes shifted all subject matters including science, mathematics, social science and language to be taught by a constructivist approach requiring teachers to enact student-centered and inquiry-based instructional strategies. As part of the structural changes, technology appeared to be a focal aspect of the schooling reform by providing internet connection and technology laboratories in almost all schools in 2006. This initiative was followed by a big project called F@TİH (Boosting Opportunities and Enhancing Technology). Turkey is one of the nations having a large gap between high and low performing students in the world (Martin, Mullis & Foy, 2008). The project aimed to close this gap by using technology to allow equal learning opportunities for all elementary, middle and high school students. Initiated in 2010 and piloted in 2011 the project with an $8 billion dollar budget required Ministry of Education to equip every classroom with a smart board and students with tablets ensuring rich and equal learning experiences for all students in 2012-2013 school year (Celik, Celen & Seferoglu, 2011).

The reform initiatives for change challenge "the cultural traditions of schools" (Romberg & Price, 1983, p.159) and required fundamental shifts in teacher thinking, and their classroom practice. Cuban (1988) noted that reforms that seek to change the fundamental facets in schools are essentially difficult to implement and sustain. This difficulty prompted science education reformers to view change within the larger educational system, calling on teacher educators to prepare teachers with effective pedagogical and practical tools to implement reform initiatives in their classrooms. In an attempt to overcome such difficult transition, pre-service science teachers' positive perceptions and also their competencies in technology appear to be an important construct to be investigated (Bell, Maeng & Binns, 2013).

As noted by the reform documents and the relevant literature, use of technology provides more effective teaching and learning activities, creates more secure and richer environment essential for designing and conducting experiments, and helps learner to better understand science-technology-society interaction in science education (Cope & Ward, 2002; Hızal, 1992; MEB, 2004). Sang, Valcke, van Braak and Tondeur (2010) surveyed 727 prospective teachers, 100 of whom were prospective science teachers. According to Sang et al. (2010), teacher education programs' effective integration of information and communication technologies played crucial role in shaping prospective teachers' perceptions on the use of computer in teaching and learning. As implementers of instructional technology science teachers are considered to be the most important factors to ensure effective use of technology in science teaching. Unfortunately, the current literature has shown that teachers do not use computers and related technologies as part of their instructional practices at a desired level (Asan, 2003; Onohwakpor & Rhima, 2008). It is also noted that many teachers have limited knowledge and lack of awareness about the advantages of instructional technology available to them (Asan, 2003; Marzilli et al., 2014; Onohwakpor & Rhima, 2008). Recognizing the benefits of instructional technologies, science teacher education reform documents and curriculum developers place an emphasis on helping science teachers to appropriately use available instructional technologies (AAAS, 1993; Rutherford & Ahlgren, 1989; NRC, 1996). Responding to the call for reform in science teacher education, some researchers conducted studies by modifying method courses to improve ability of pre-service science teachers to effectively use technology for teaching (Angeli, 2005; Schaverien, 2003; Syh-Jong, 2008). Teachers mainly used technology for administrative purposes such as document management, record keeping about school and students rather than instructional purposes (Becker, 2001). Recent studies illustrate that the pre-service science teachers are relatively unfamiliar with the advantages of educational technologies that results in lack of technology literacy and its insufficient use in classroom settings (Beşoluk, Kurbanoglu & Onder, 2010; Türkmen, Pedersen & McCarty, 2007). Thus, the relevant literature implies that science teacher education institutions are the primary components in shaping pre-service science teachers' perceptions about effective integration of instructional technology and enhancing their level of competencies regarding the use of technology in science teaching. Several studies attempted to explore the relationship between pre-service science teachers' perceptions about technology and instructional technologies and their learning experiences in teacher education programs (Pedersen & Yerrick, 2000; Türkmen, Pedersen & McCarty, 2007; Koç & Bakır, 2010; Tınmaz, 2004). For Tınmaz (2004), the level of emphasis given to instructional technologies in teacher education programs has a potent impact on pre-service teachers' knowledge and perceptions about technology and instructional technologies. For instance, pre-service teachers' lack of knowledge and deficient perceptions about hypermedia and video editing technologies attributed to limited emphasis given to hypermedia and video editing in teacher education programs (Türkmen, Pedersen and McCarty, 2007; Pedersen and Yerrick, 2000). Koç and Bakır (2010) found that the pre-service teachers were not comfortable with using hypermedia and video editing tools for which no emphasis was given by the teacher education programs.

By focusing on Turkish pre-service teachers enrolled in different teacher education programs, Tınmaz (2004) found that the least positive perception about use of technology in education was held by pre-service science teachers compared to their counterparts. Luft et al. (2003) argue that science teachers differ from other teaching areas because of the complex nature of science teaching associated with the discipline of science (i.e., variety of tasks that science teachers have to do and large amount of preparations). The problem summarized above might be related to perception differences of Turkish pre-service science teachers determined by their learning styles, computer competency levels, possessions of a computer, and gender. Therefore this study aims to explore Turkish pre-service science teachers' perceptions on technology use for instructional purposes in terms of learning style, computer competency level, possession of a computer, and gender.

Theoretical Framework: Teacher Perceptions toward Instructional Technologies

Perception means attaching personal meanings to internal and environmental inputs received through the senses and neural impulses (Schunk, 2000) influencing individuals' motivations and tendencies essential for thoughts and actions as well (Vaughan, 2007). The perceptions of pre-service teachers are significant as they enable pre-service teachers to benefit from the instructional technologies more effectively (Çelik & Kahyaoğlu, 2007; Drenoyianni & Selwood, 1998) and integrate these technologies in their practices. However, the factors shaping teachers' perceptions toward instructional technologies and how these formed perceptions inform these teachers' integration of available technologies in their classroom practices are difficult to ascertain. Relaying on previous research a theoretical framework developed by Trigwell, Prosser and Waterhouse, (1999) to explain the link between teacher perception on teaching environment, teaching and learning, and students' learning outcomes and perceptions on teaching environment and learning, appear to be an effective tool for understanding the complex relationship between teacher perceptions toward instructional technologies and how these perceptions influence these teachers' effective integration of available technologies into their classroom practices. From perception of the pre-service science teachers on technology to quality of teaching and learning outcomes regarding science, conceptual framework (seen in Figure 1) should allow multifaceted, mobile and rich understanding of pre-service science teachers' perceptions about technology.

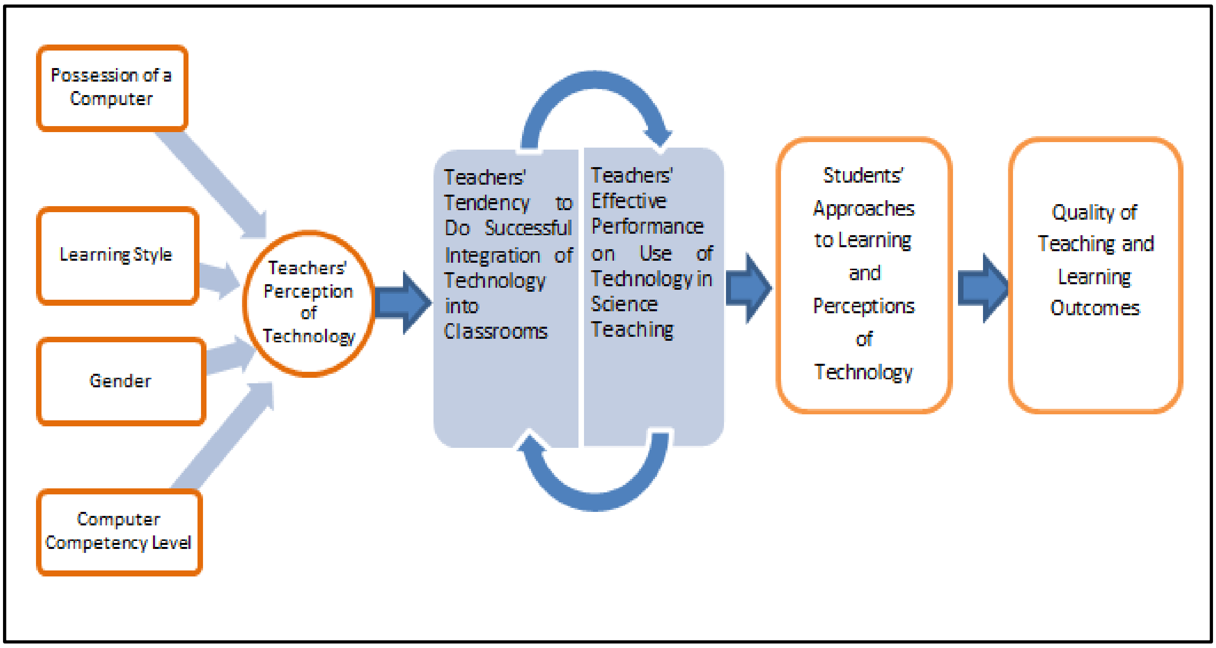

Figure 1.Framework of the relationship between the factors that are effective on perception of the pre-service science teachers on technology and quality of teaching and learning outcomes on science.

One of the components of the conceptual framework, teachers' perception of technology in education was shown to be affected by different factors (Koksal & Yaman, 2009; Koohang, 1987; McHaney, 1998; Shaw & Marlow, 1999; Tınmaz, 2004). Among the factors studied in the literature, *learning style* (Koksal & Yaman, 2009; Shaw & Marlow, 1999), *computer competency level* (Koohang, 1987; Koksal & Yaman, 2009), *possession of a computer* (Tınmaz, 2004*), and gender* (Koohang, 1987; Tınmaz, 2004; Shaw & Marlow, 1999) were appeared to be important on molding teachers' perceptions about instructional technology (Koksal & Yaman, 2009; Koohang, 1987; McHaney,1998; Shaw & Marlow, 1999; Tınmaz, 2004). Based on the importance of the factors on the perceptions, the conceptual framework of this study involved the factors as entering variables to explain differences in technology perceptions of prospective science teachers.

In the conceptual framework six different associated components are involved; entering variables associated with teachers' perception of technology, teachers' perception of technology, teachers' tendency to successfully integrate technology into classroom, teachers' performance on use of technology in science teaching, students' approaches to learning and perceptions of technology and quality of teaching and learning outcomes. The first component includes frequently studied four different variables associated with teachers' perception of technology; possession of a computer, learning style, gender and computer competency (Koksal & Yaman, 2009; Koohang, 1987; Shaw & Marlow, 1999; Tınmaz, 2004). Jara et al. (2015) emphasizes that having a computer at home provides advantage in being aware of current perceptions for technology and its importance in future acts. In line with this emphasis, teachers gain awareness about advantages of technology use by having a computer (Yıldırım, 2000). As another variable, learning styles of teachers might predict their training preference such as technology-supported or traditional training preferences (Buch & Bartley, 2002). At the same time Cheng (2014) stated that students who had active learning style mostly valued uselfulness of on-line virtual learning tool while students who had verbal dominated learning style found communication feature of the tool as a valuable component. Hence learning syles of students have a potential to affect their perceptions on technology. Jackson, Helms and Jackson (2008) also speculated this notion that some of the students with various learning styles might gain most from technology use and they might perceive technology as more positive. Gender variable is another possible factor which has an effect on teachers' perception of technology. Kubiatko, Usak, Yılmaz and Tasar (2010) found that males had significantly more positive perceptions on effectiveness of information and communication technology in science teaching. Teachers' perception of technology is also associated with perceived computer competency level, since perceived computer competency is a pre-requisite to perform successful applications on technology-based tasks and a critical element in determining what individuals are able to do with the knowledge and skills they have (Pajares & Schunk, 2001). The factors of the first component of the frame summarize background characteristics which are effective on teachers' perception of technology. Second component; teachers' perception of technology includes personal meanings given by teachers to usefulness of technology in teaching and to effectiveness of undergraduate technology course to help teaching (Tınmaz, 2004). Third and fourth components explain performance aspects of technology use in teaching. In these components, it is stated that tendency of successful integration of technology in teaching and using technology effectively in teaching are affected by teachers perception of technology. The fifth component summarizes students' approaches to learning (knowledge construction vs knowledge transfer) and perceptions of technology (Prosser, Trigwell & Taylor, 1994). In students' perceptions of technology there is a possible range from usefulness of technology in learning to uselessness of technology in learning. The final component includes consideration of quality in both teaching and learning outcomes after an effective technology supported teaching (Koksal & Yaman, 2012).

Learning Styles

The construct of learning style describes individual differences related to the learner's preference for employing different phases of the learning cycle. With the effects of individuals' personal characteristics, personal experiences, and contextual factors, people develop a preferred way of choosing among the four learning modes (concrete, abstract, active and reflective) helping to determine and resolve conflicts between being concrete or abstract and between being active or reflective in pattern, certain and characteristic ways (Kolb & Kolb, 2005). If a learner is to be successful in any field, he or she needs four different types of abilities including Concrete Experience (CE), Reflective Observations (RO), Abstract Conceptualization (AC) and Active Experimentation (AE). By the means of these abilities then, the learner is able to involve her or himself fully, openly and without bias in new experiences (CE); observe and reflect on the experiences from different perspectives (RO); create concepts, ideas and thoughts that integrate her or his observations into logically certain theories (AC) and use these theories in problem solving process and to make decisions (AE) (Kolb,1981). Based on these pre described abilities, four types of learning styles were described; the diverging composed of CE and RO, the assimilating composed of AC and RO, the converging composed of AC and AE and the accommodating composed of CE and AE (Kolb, Boyatzis & Mainemelis, 2001). For Manochehr (2006) individual differences including learning styles are major factors to be taken into account in designing a course with the use of educational technology. Echoing this, Manochehr (2006) indicated that students who have the assimilating learning style and the converging learning style have more benefitted from technology based teaching application. Cheng (2014) focused students with different learning styles, he found that students who preferred active learning style mostly valued usefulness of an on-line virtual learning tool while students who preferred verbal dominated learning style found communication feature of the tool as a valuable component. Consequently, learning styles seems to have a potential to be effective on perceptions about educational technology as educational technologies offer learning tools that might or not be associated with individuals' learning styles.

Perceived Computer Competency

The second factor being crucial for perception about instructional technologies is the concept of perceived computer competency that is also known to be a kind of perceived self-efficacy. The perceived computer competency or perceived self-efficacy on computer competency is one's beliefs about his or her capabilities to produce designated levels of performance on computer and about her or his perception related to knowledge about computers that he or she holds (Bandura, 1994; Linnenbrick & Pintrich, 2003). These beliefs have an impact on thoughts, feelings, actions and perceptions (Bandura, 1994; Compeau & Higgins, 1995; Tschannen-Moran, Hoy, & Hoy, 1998). Moreover perceived computer competency has a relationship with perceptions of individuals on technology use in education (Yılmaz, Uredi & Akbaşlı, 2015). Therefore, perceived computer competency is a critical element in presenting successful performance on computer-based tasks and helps determine what individuals are able to do with the knowledge and skills they have (Pajares & Schunk, 2001).

Possession of a Computer

The third factor relates to ownership of a computer which includes possession of a computer for personal use. McHaney (1998) pointed that having a computer at home is associated with individuals' current perceptions for technology and its importance in their future acts. Ownership of a computer has an importance as its positive association with awareness of pre-service teachers about advantages of technology use (Yıldırım, 2000); therefore, it might contribute to perceptions of pre-service science teachers on technology in science teaching. In a study Yılmaz, Uredi and Akbaşlı, (2015) determined that ownership of a computer in home was associated with higher level of perceived computer competency. Hence it can be said that ownership of a computer in home is indirectly associated with perceptions of individuals on technology use in education. In this study, it is expected that having a computer for personal use will increase awareness of pre-service teachers about advantages of technology use.

Gender

Moreover, gender, as a socially constructed meaning based partially on biological differences between male and female, is the fourth factor having potential effect on the perceptions of pre-service science teachers on educational technology. McHaney (1998) shown that males had a significantly higher personal affect for technology and computers than females did. Kubiatko (2010) in his survey study has also shown similar findings that male prospective science teachers (n= 316) had more positive attitude toward information and communication technologies. Kubiatko, Usak, Yılmaz and Tasar (2010) investigated gender difference in perceptions of 770 prospective science teachers about information and communication technology use in science teaching. They found that males had significantly more positive perceptions on effectiveness of information and communication technology use in science teaching than females. Cooper (2006) explained the gender difference by citing general beliefs of public that males were more related to and interested in using computer technologies, and hence they were more competent in using computers than their counterparts. However, Pamuk and Peker (2009) called for more research as the differences in cultural backgrounds of the participants and the unique conditions of each setting and country may result in different pattern regarding how male and female perceptions toward using computer technologies differ.

Ensuring successful transition and implementation of recent reform initiatives in Turkish educational system, it is evident that understanding of pre-service science teachers' perceptions about instructional technologies and their use in science classrooms are important. This study is a follow-up study of two previous studies (2009, 2012) in which the perceptions of elementary level prospective teachers on technology were examined. In contrast, this study focused on Turkish pre-service science teachers' learning styles, computer competency levels, possessions of a computer, and gender, this study aims to determine interactions among these factors shaping pre-service teachers' perceptions on educational technology.

Research Questions

The main question of this study is "Is there any statistically significant difference in the perception scores of the pre-service science teachers toward educational technology in terms of gender, learning styles, computer competency level and possession of a computer?" Revolving around the main question, this research also tries to explore how these different factors and variables relate to each other and also to their interactions with prospective-science teachers' perceptions about computers as instructional tools.

Method

Quantitative research perspective was chosen to investigate the dependent variable (perception about educational technology) of this study due to the inferential nature of the study. Survey method was employed by using four instruments. Sample of the study included 264 prospective science teachers enrolled in a middle-scale university in Turkey. Non-randomized selection of the participants is a limitation for generalizing the results of this research, however all prospective teachers have been taking the same program determined by Turkish Higher Education Council (HEC). In Turkey, higher education system is governed by Higher Education Council; all of the universities are responsible to the HEC for their arrangements about educational, financial and administrative acts. Moreover, science teacher education programs are also governed by the HEC and only one curriculum for all science education programs has been developed by the HEC to educate future science teachers. Science teacher education programs are four-year undergraduate programs which are carried out in education faculties. In the program, there are content, and pedagogical courses on teaching and learning as well as special interest courses offered to teacher science teacher candidates. In many Turkish universities some programs have alternative programs offering evening schedule for students. While the normal programs are carried out during the day time from 8:30 am to 5:00 pm, the evening programs using the same curriculum with normal schedule take part in between 5:00 pm and 11:00 pm. The participants of the study consisted of 98 male (37.1%) and 166 female (62.9%) prospective science teachers. Descriptive values of the participants are presented in Table 1.

Variables	Categories	f	%
Type of Program (2 Missing)	Daytime Program	164	62.1
	Evening Program	98	37.1
Years in School (1 Missing)	Freshman	67	25.4
	Sophomore	72	27.3
	Junior	90	34.1
	Senior	34	12.9

Table 1. Descriptive values about the prospective science teachers

As seen in the Table 1, majority of the pre-service science teachers (n=164) were enrolled in normal schedule science teacher education program. It is also evident through Table 1 that the most of the prospective teachers participating in this study (n=90) was at the junior level students.

Instruments

Four instruments were used to collect data namely, personal information sheet, Kolb's learning style inventory (Kolb, 1985), computer competency scale and technology perception scale. Personal information sheet included gender, years at university, schedule type of the program.

For the data collection on learning styles, "Kolb's Learning Style Inventory" established on four fundamental quadrants including accommodative, divergent, assimilative and convergent, was used. Kolb developed the instrument to determine individual learning preferences of individuals in 1985 and he found reliability values ranging from .73-.88. This inventory was adapted to Turkish and its validity and reliability was re-evaluated by Aşkar and Akkoyunlu (1993). There were different versions of the instrument, but Aşkar and Akkoyunlu (1993)'s adaptation was used in this study for its practical benefits and making comparison with a certain group from the same culture if it was required. Aşkar and Koyunlu's sample included 103 prospective teachers; 38% majoring in science and mathematics education, 52% in social sciences. This inventory has 48 items with four subscales (accommodative, divergent, assimilative and convergent). Therefore, each style has 12 items. The time allowed to respond these items is 10 minutes. For the learning styles, scores range from 12 to 48. The total score for the entire inventory is 192. Aşkar and Akkoyunlu found that the reliability values of the factors were from 0.58 to 0.77. Eyyam, Meneviş and Dogruer (2011) also studied reliability of this instrument's Turkish version and they found the reliability values between .59-.72.One example for the items of the inventory is presented below;

When I learn, I learn by
......feeling
......watching
......thinking
......doing

To explore prospective teachers' perception about technology the Technology Perception Scale was employed. This instrument was developed by Tınmaz (2004) and has a five-point scale (Likert type) (5 point=Certainly Agree, 1 point= Certainly Disagree) with two factors; “belief of the positive effect of technology in education” (factor 1), “effects of undergraduate program” (factor 2). Two examples of the items for each factor in the instrument are “Use of technology in education increases achievement of students” and “The computer courses I have taken during my undergraduate education contribute to quality of my teaching”. The values of the Cronbach Alpha of these factors were determined as .89 for factor 1 and .81 for factor 2. The instrument has 28 items (16 items for factor 1 and 12 items for factor 2).

Computer Competency Scale was also developed by Tınmaz (2004) and used to determine the computer competency level of Turkish prospective teachers including science, elementary, early childhood, Turkish physical education, music, and social studies teachers as well. This scale has only one factor (Computer Competency). The Cronbach Alpha coefficient of scale was calculated as .87 denoting an acceptable reliability. This scale has 10 items regarding general computer competencies on Operating System, Word Processor, Internet, E-mail, Spreadsheets and such and it is a three-point competency scale including choices Not Competent (1 point), Intermediate (2 point) and Competent (3 point). Confirmatory factor analysis procedures including “Principle Axis Factoring” and “Promax rotation with Kaiser Normalization” and internal consistency analysis were applied to the scores of the current study on the “Technology Perception Scale” and “Computer Competency Scale” in order to satisfy reliability and validity of these instruments. We decided to use principle axis factoring for confirmatory factor analysis as similar studies with large sample benefitted from this technique (Beghetto, 2009; Fletcher, Walls, Eanes & Troutman, 2010). Confirmatory factor analysis is a data reduction technique and it is used to build a model to explain the empirical data by focusing relatively few parameters or by considering pre-determined theoretical factor structure or known theoretical frame (Jöreskog & Sörbom, 1993). To provide reliability and validity evidence on the data of the current study, internal consistency and factor analysis results of Tınmaz’s study and the current study have been compared.

It was seen that internal consistency values and validity evidence are in acceptable ranges (Tınmaz, 2004). The comparisons with Tınmaz’s findings were evidenced an increase in validity of the study by using a norm reference point using the same instrument in the same cultural context.

Data Analysis

In this study, one dependent variable (perception about technology in education) and four independent variables (Learning style, computer competency level, possession of a computer and gender) were included. To analyze perception scores of the participants in terms of the four independent variables, four-way ANOVA (Analysis of Variance) was applied to the data by setting 0.05 as alpha level. Since 0.05 value in standard normal distribution approximately corresponds to twice the standard deviation so exceeding this value makes difference in probability of finding such a distribution and decision is “significant difference” (Fisher, 1926, p.506).

Findings

The descriptive findings of the study on the independent variables illustrated that majority of the participants have a computer and they mostly feel moderately efficient to use computers. As the other finding, majority of the participants have convergent learning style while small percent of them have accommodative learning style. Detailed descriptive values on the independent variables are presented in Table 2.

Variables	Categories	f	%	Mean of Perception Scores	Standard Error of Perception Scores
Gender	Female	166	62.9	4.18	.06
	Male	98	37.1	4.42	.07
Possession of a computer (2 Missing)	Yes	148	56.1	4.21	.06
	No	114	43.2	4.33	.06
Computer competency level	Weak	11	4.2	4.17	.14
	Intermediate	185	70.1	4.31	.06
	Good	68	25.8	4.32	.08
Learning style (10 Missing)	Assimilative	81	30.7	4.23	.07
	Divergent	51	19.3	4.28	.09
	Convergent	110	41.7	4.24	.08
	Accommodative	12	4.5	4.26	.14

Table 2. Descriptive values on the independent variables of the study

Descriptive findings on the dependent variable (perception about technology) shown that pre-service science teachers' perceptions about use of technology in education (N=264, M=4.23, SD=.44) were generally positive. To investigate whether the perception of the participants differs in terms of the independent variables, four-way ANOVA was run after the normality, independence of the observations, continuity of the dependent variable were checked.

Before the ANOVA, Levene Test result was checked and it was found that the assumption on homogeneity of error variances was violated ($F=1.49$, $df_1=42$, $df_2=221$, $p=.036$). Hence, use of appropriate post-hoc comparison way (Dunnet C) was anticipated. The findings of the ANOVA shown that there was a statistically significant difference between the female and male participants in favor of males ($M_{male}=4.42$, $M_{female}=4.18$, Partial Eta Squared= 0.06, $p < .05$). Practical importance of the result was at the level of medium effect (Green & Salkind, 2008) and observed power of the analysis showed that probability of rejecting a false hypothesis was 96%. In addition to the main effect for gender, there was also a statistically significant interaction effect between gender and computer competency level (Partial Eta Squred= 0.06, $p<.05$). Practical importance of this result was at the level of medium effect (Green & Salkind, 2008) and observed power of the analysis showed that probability of rejecting a false hypothesis was 92%. But, there were no statistically significant differences in terms of other independent variables and their interactions. Four-way ANOVA results are illustrated in table 3.

Source of Variance (N=264)	Sum of Squares	df	Mean Square	F	p	Partial Eta Squared	Observed Power
Gender (G)	2.80	1	2.80	14.45	.00*	.06*	.96*
Possession of a computer (POC)	.50	2	.25	1.30	.28	.01	.28
Learning Style (LS)	1.76	4	.44	2.28	.06	.04	.66
Computer Competency Level (CCL)	.30	2	.15	.77	.46	.01	.18
G*CCL	2.66	2	1.33	6.86	.00*	.06*	.92*
G*POC	.00	1	.00	.00	.99	.00	.05
G*LS	.56	4	.14	.73	.58	.01	.23
POC*LS	.02	4	.00	.03	.99	.00	.05
POC*CCL	.17	2	.08	.44	.65	.00	.12
LS*CCL	.71	6	.12	.61	.72	.02	.24
G*POC*LS	.48	4	.12	.61	.65	.01	.20
G*POC*CCL	.09	2	.04	.24	.80	.00	.08
POC*LS*CCL	.48	3	.15	.82	.49	.01	.23
G*LS*CCL	.29	3	.10	.50	.68	.01	.15
G*LS*CCL*POC	.14	1	.14	.72	.39	.00	.14
Error	42.88	221	.19				
Total	4776.47	264					

Table 3. Four-way ANOVA results (Note: "*" means difference is significant at the level of 0.05.)

For investigating the interaction effect, follow-up independent t-tests for gender in each level of computer competency and one-way ANOVAs for computer competency levels for each gender were run by adjusting alpha level with Bonferroni adjustment (alpha=.01). Table 3 illustrated that gender had a significant effect on perception about technology (F=14.45; p < .01). Based on Table 3 male participants had more positive perceptions toward technology compare to their counterparts. Additionally, analysis showed that participants' possession of a computer, learning styles and computer skills had no effect on dependent variable (p > .05). Based on the interactions among the independent variables, gender and computer competency level significantly affected the perceptions toward technology (F=6.86; p < .01), however the interactions between gender and possession of a computer, gender and learning style, possession of a computer and learning style, possession of a computer and computer competency level, learning style and computer competency level, illustrated no significant relations (p > .05). The results on the follow-up t-tests are presented in Table 4.

Level of Computer Competency	Groups	N	Mean	SD	df	t	p
Weak	Female	7	3.75	.39	9	5.157	.001**
	Male	4	4.83	.19			
Intermediate	Female	121	4.22	.47	183	1.10	.28
	Male	64	4.30	.40			
Good	Female	38	4.18	.40	66	.58	.57
	Male	30	4.23	.36			

Table 4. The results on the follow-up t-tests for the interaction effect between gender and computer competency level (N=264) (Note: "**" means difference is significant at the level of 0.01.)

As seen in Table 4, the female participants who felt themselves as weak competent users of computer had significantly lower perception about use of technology in education than the male participants who felt themselves as weak competent computer users. Subsequently, there is a statistically significant difference in technology perceptions of males and females with weak computer competency perception in favor of males. At the level of weak competence, pre-service science teachers showed a significant difference based on gender. However, the number of the participants in the weak competency group was not sufficient to see difference by using only parametric t-test; hence non-parametric Mann Whitney U test was also conducted. The results of the Mann Whitney U test supported that there was a statistically significant difference between females and males at the group of weak computer competency level (Mann Whitney U=.000, Z=2.67, *p*=0.006). As another side of the interaction, competency level differences across gender was investigated by one-way ANOVAs, the results on the follow-up ANOVAs are presented in Table 5.

Gender	Source of Variance (N=264)	Sum of Squares	Df	Mean Square	F	p	Partial Eta Squared
Male	Level of Computer Competency	1.31	2	.66	4.50	.014	.09
	Error	13.88	95	.15			
	Total	1825.83	98				
Female	Level of Computer Competency	1.45	2	.73	3.47	.033	.04
	Error	33.97	163	.21			
	Total	2950.64	166				

Table 5. The results on the follow-up ANOVAs for the interaction effect between gender and computer competency level (Note: All comparisons were made at the level of 0.01 after Bonferroni adjustment.)

As seen in Table 5, there was no statistically significant difference between the male participants who were at different level of computer competency. Also, there was no statistically significant difference between the female participants who were at different levels of computer competency.

In summary, the analyses showed that there was one main effect for gender and one interaction effect for gender and computer competency. The main effect pointed out that the male pre-service science teachers had more positive perceptions about instructional technology than the female pre-service science teachers did. Furthermore, the interaction effect pointed out that the male pre-service science teachers who were weak in computer competency had more positive perceptions about instructional technology than the female pre-service science teachers who were weak in computer competency.

Discussion and Suggestions

Based on the results of this study, it is evident that the perception of Turkish pre-service science teachers participated in this study about educational technology is positive in general. This result is in congruence with Tınmaz (2004)'s study, which also found that Turkish pre-service science teachers in his sample held positive perception about benefits of using technology in education. These results might be related to structure of elementary science teacher education in Turkey as elementary level science teacher education involves two content components including science and technology. Therefore, pre-service science teachers take both technology and science courses in their undergraduate years and know that their teaching should be based both on science and technology. Abitt and Klett (2007) also pointed out the same argument. They studied the effects of technology courses on pre-service teachers' perception about usefulness of computer technology and concluded that such technology classes offered by the teacher education programs significantly enhanced pre-service teachers' perceptions of computer technology.

Another finding of this study; possession of a computer, might be a factor to explain the positive perception of the pre-service teachers participated in this research. Having a computer might also contribute to awareness of the participants regarding possible benefits of technology as the results of this study illustrated that majority of the pre-service science teachers participating in the study had a computer. Similar to the result of this study, Deniz (2007, p.121) found that 62% of Turkish pre-service teachers in her sample owned a personal computer. As an explanation of the positive perception, possession of a computer might increase positive perception about technology in education. Considering the latest F@TIH reform initiative, Turkish teachers are needed to use smart boards and tablets to teach their subject matters. The awareness towards the overall benefits of computer technology can be promoted if a person owns and uses a personal computer. It is evident that owning a computer will not be enough for teachers to implement F@TIH reform incentives (Çelik, Çelen ve Seferoğlu, 2011). In parallel, Kurt (2014) stated that teachers often fail to integrate technology into the instruction in spite of existent appropriate and technology in schools. In improving conditions for F@TIH reform project, teachers' willingness and level of technology competency should be taken into account in preparing training programs and new technology teams for overcoming technical and planning problems of teachers should be given task in schools (Banoglu, Madenoglu, Uysal & Dede, 2014). In addition teachers themselves need to be familiar with wired tablet and smart board combination in order to provide most effective learning experiences for their students.

Additionally, this study illustrated that Turkish prospective teachers' perception about technology in education was different across gender. Males appeared to have more positive perception about instructional technology than females were. The literature also presented the similar results. According to the results of Tınmaz (2004)'s study on similar sample of prospective Turkish teachers, there was a significant effect of gender on technology perception scores of prospective teachers and 1% of the variance in technology perception score was accounted by gender. The difference was in favor of males. Again in Turkey, Pamuk and Peker (2009) studied gender difference toward computer efficacy and they found that male prospective science and mathematics teachers had more positive perception about computer use than female counterparts. This finding contributes to the result of this study that liking computers does also differ between males and females in favour of males, so indirect effect of liking computers might also have contributed to the gender difference found in this study. Parallel results were also seen in international context. For instance; Chang et al. (2014) found that males had a significantly higher personal affect for internet and computers than females did. This result might be related to difference in previous experiences regarding to time for daily use of technology and motivational situations of females and males in being active in technology related tasks. Since males spent more time on using computers and they are using technology frequently (Imhof, Vollmeyer & Beierlein, 2007; Kubiatko, 2010). Also their interest in using technology is higher than female’s interest (Cooper, 2006). In a study, Imhof, Vollmeyer and Beierlein (2007) compared female and male undergraduate students in terms of amount of time given to technology applications and quality of products produced by using computers. They found that males spent more time on technology use while they conducted their learning task and made more qualified products by computers than their counterparts did. As another study on gender factor, Kubiatko (2010)’s study showed similar findings that male prospective science teachers (n= 316) held more positive affect toward information and communication technologies. Kubiatko, Usak, Yılmaz and Tasar (2010) investigated gender difference in perceptions of prospective science teachers about information and communication technology use in science teaching. They found that males had significantly more positive affect on effectiveness of information and communication technology use in science teaching than females did. Sølvberg (2002) focused on time for daily use of technology and the author stated that males used computers more frequently than their counterparts in schools. Another research trying to explain the gender difference conducted by Cooper (2006) illustrated that males were more related to computers and interested in using computer technologies and hence they were more competent in using computers than females. By focusing technology based application in a science classroom, Kennedy-Clark (2011) studied on perception of pre-service teachers’ perspectives on scenario–based virtual worlds in science education and the author found that female pre-service teachers had less positive perception on using virtual worlds in their classrooms. The author stated that perception difference in its study might be related to the difference in purposeful use of virtual games by males and use of virtual games by females to pass time. The difference in purpose of technology use might also be factor explaining perception difference of males and females in this study. In parallel to the finding of this study, Plumm (2008) also explained technology as an agent to increase gender-bias in classrooms and she wrote that the biases were simply converted into a new form in her review study on gender-bias in education.

When we looked at the interaction result, it was evident that gender difference in perception toward instructional technology in Turkey was still in favor of males even if this study only focused on the participants who felt about themselves as weak competent computer user. The result might be explained by females’ lower interest in and knowledge on technology, lower self-efficacy to use computer technology and lower perception about teaching technology (Bauer, 2000; Incantalupo, Treagust & Koul, 2014). In his study, Bauer (2000) asked 45 female pre-service teachers about how they compared themselves to males in relation to computer technology. The author stated that the female participants thought males knew more about computers and felt more enthusiasm. At the same time, similar to the female participants of this study, the participants of Bauer (2000) felt medium competence to use technology in education.

Another finding of this study was the non-significant results on learning styles, this finding was also in line with the results of previous studies (Koksal & Yaman, 2009). These findings might be explained by wide variety in purposes of technology use in education, the technology provides wide variety of learning tools to study for pre-service teachers having different learning styles. There are different fields of technology use in education with examples including as on-line lectures, simulations, and calculators. These ways support each learning style by providing appropriate learning content, context and tools. Therefore, technology in education provides opportunities for every learning style; this might contribute to non-significance in difference among perception towards technology in education.

Although the current study has provided evidence on gender difference in perception towards technology in education, it has some limitations. The first is that the study is limited to 264 pre-service science teachers who have provided data through to self-report instruments. The larger sample and performance based measurements on perception towards technology should be applied to the different group of pre-service science teachers by using similar methodology. The second limitation is that the independent variables of the study are limited to *learning style, computer competency level, possession of a computer and gender.* There is a need to extend the findings of this study by applying other theoretically associated independent variables such as “perceived usefulness of technology” and “perceived ease of use” in different theoretical frameworks (Venkatesh & Davis, 2000). The third is that there is also a need to collect examples of previous experiences of the pre-service science teachers, the examples that are effective on shaping perceptions of female students might give clearer picture to analyze perceptional differences between male and female pre-service teachers. The fourth is that non-random nature of sampling is another limitation for this study. If random sampling is applied to the participants at the same level, following findings will probably provide more sound support for the research problem of this study.

Implications

The findings of this study have indicated that in the current science teacher preparation programs perceptions of the female pre-service science teachers are not as high as perceptions of the male pre-service science teachers. The findings of this study have shown that female pre-service science teachers need to be supported for increasing their perception toward technology in education. Based on the model illustrated in figure 1, it can be said that balance in technology perception between male and female pre-service science teachers is important since the difference in the perception might cause to the difference in teaching quality or using technology appropriately. This result might cause inequality among elementary students who are thought by the teachers in different gender and might increase the gap among the students. The findings of this study call perceptional support implications in technology use for the female pre-service teachers in science teacher education programs in Turkey.

Finally, fundamental educational change is difficult, and repeated attempts at reform have resulted in little difference (Woodbury, 2003; Woodbury & Gess-Newsome, 2002). Among the potential explanations for this paradox, this study was able to focus closely on Turkish pre-service science teachers’ perceptions about technology and its use as mediators of reform. A review of the recent reform documents of Turkish Ministry of National Education, one thing is evident that teachers are expected to be equipped well with essential pedagogical, content and technological knowledge and skills for an effective implication of reform initiatives. This expectation is clearly prompted science education reformers to view change within the larger educational system, calling on faculty from science teacher education programs to act as partners in reform by offering technology courses and infirming future Turkish science teachers about effective blend or integration of technology in science teaching for effective student science learning. Especially requirements and competencies of F@TIH project should be involved in objectives of technology courses in Turkish science education programs. By this way perceptions of pre-service science teachers might be changed for improving F@TIH project.

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