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Determining student teachers' perceptions on using technology via Likert scale, visual association test and metaphors: A mixed study

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Abstract

The aim of this study is to determine senior student teachers' perceptions on using technology by approaching various points of view. In this study, researchers collected data through Technology Perceptions Scale, Visual Association Activity and Technology Metaphors. The participants of the study were 104 senior student teachers who were enrolled in Balıkesir University Necatibey Faculty of Education. In this descriptive study, researchers interpreted qualitative data in conjunction with quantitative data. Based on the data obtained, even though student teachers' perceptions on using technology were found positive in the light of Likert scale, there was no significant relation in terms of gender and enrolled undergraduate program. According to the results of visual association test, student teachers ranked smartboard, Internet and computer in the first three, and portable media player, mobile phone and video/camera in the last three. Besides, researchers analyzed and classified student teachers' metaphors about technology under 9 categories: 1)developing-changing technology, 2)rapidly progressing technology, 3) limitless-endless technology, 4)beneficial technology, 5)harmful technology, 6)both beneficial and harmful technology, 7)indispensible technology, 8)technology as a necessity, 9) all-inclusive technology. At the end of the study, those nine categories which were acquired using the content analysis technique are presented in a table which shows the interaction between categories in a holistic view.

Keywords: Technological perceptions, technology integration, visual association, metaphors, student teachers.

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1. Introduction

People's desire to live in a modern world increases day by day, and technology develops rapidly in parallel with that desire (Yenilmez & Karakuş, 2007). Developments and advancements in these technologies started to create new opportunities for teaching and learning (Summak, Samancıoğlu, & Bağlıbel, 2010) and using various technologies becomes inevitable to solve problems in education (Çankaya & Karamete, 2008). As a result of this situation, integrating technology into teaching and learning situations becomes the focus of many educators (Drent & Meelissen, 2008; Guzman & Nussbaum, 2009; Almekhlafi & Almeqdadi, 2010).

Recently, there have been a great number of studies investigating technology integration (e.g. Hennessy, Ruthven, & Brindley, 2005; Hew & Brush, 2007; Jang, 2008; Paraskeva, Bouta, & Papagianna, 2008; Guzman & Nussbaumt, 2009; Öksüz, Uça, & Genç, 2009; Almekhlafi & Almeqdadi, 2010; Summak, Samancioğlu, & Bağlıbel, 2010; Al-Ruz & Khasawneh, 2011; Mazman & Koçakel-Usluel, 2011; Tondeur, Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich, 2012). When national and international studies examined technology integration, they pointed out that it cannot be described in only one way. For example; while Hew and Brush (2007) considered technology integration as teacher's using of any technology to increase learner achievement, some researchers explained this as a forming of learning activities by teachers in the classroom (Hennessy et.al, 2005) or revealing learner's creative learning abilities (Lim, Teo, Wong, Khine, Chai, & Divaharan, 2003). According to Perkmen and Tezci (2011), the core of technology integration is "using technology in class in a way that there cannot be any method to teach in that way but with the technology". On the other hand, integrating technology into the classroom is a complex process which includes learning the technology, using technology in the teaching and learning process, and integrating technology to enhance student learning (Dockstader, 1999). Considering any process related to technology integration, it is a complicated, dynamic and slow process, and being one of the most critical variable of this process, teachers face a lot of challenges, and it is very crucial for them to be more open to improvement (Demir, Ozmantar, Bingölbali, & Bozkurt, 2011) and to develop a vision for technology (Ertmer, Lewandowski, Conklin, Osika, Selo, & Wignall, 2003).

The value of technology depends upon how effectively school teachers use it to support teaching in the classroom because only the effective use of technology can provide powerful tools for students' learning (Fulton, Glenn, & Valdez, 2004). However, effective integration of technology into education, learner's perception on technology has a considerable role in addition to using it efficaciously (Çelik & Kahyaoğlu, 2007; Paraskeva, et.al, 2008; Mazman & Koçakel-Usluel, 2011). For this reason, determining the student teachers' perception on technology comes to an important point to develop strategies providing successful technology integration and to strengthen teacher education curriculum since student teachers are viewed as the transmitters of up-to-date knowledge and can effectively link theory into practice as well as to guarantee their future success and the success of their students (Al-Ruz & Khasawneh, 2011). In Teo and Lee's (2010) study, it is found out that student teachers' existing behavioral approaches and perceptions on technologies which they will be using in their classroom have a strong influence on their future perceptions and willingness of using them in their teaching situations. When student teachers have adequate instruction during their education, they have positive ideas for instruction with technology and they believe in the effectiveness of it (Morrison & Jeffs, 2005). Education institutions have a great importance since they are primarily responsible for teacher training. But, as Roblyer (2002) stated, many student teachers are still entering universities with little knowledge of computers and appropriate skills as well as lacking positive attitudes toward technology use in the classroom. Gunter (2001) stated that many higher education institutions are still failing to prepare student teachers for positive technological experiences. Figure 1 can give some clues to have a better understanding of the relationship between students' learning outcomes and students' impact on teacher's perception on technology on students' perceptions on or approaches to learning.

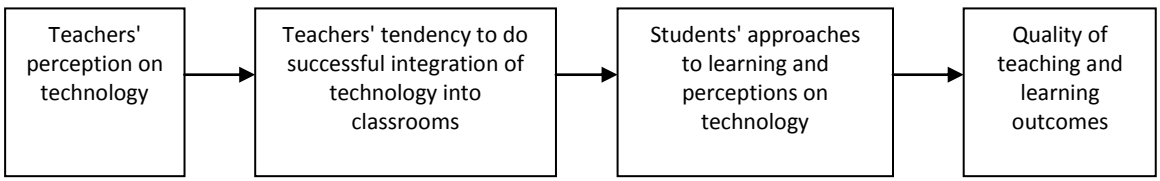

Figure 1- Relationship between teachers' perception on technology and students learning outcomes (Koksal & Yaman, 2009)

Given the critical role of educators and the contributions that teachers make in supporting or inhibiting the integration of technology in the classrooms, the need to understand student teachers' perceptions on using technology calls for an examination into the factors that influence teachers' effective use of technology becomes crucial. In addition, as Pajares (1992) noted, "Few would argue that the teachers' beliefs hold influence on their perceptions and judgments, which in turn affect their behavior in the classroom". The successful and effective use of technology in teaching and learning depends on the factors that significantly influence teacher' perceptions on technology, which provides an insight into issues relating to teachers' acceptance and usage of technology.

Within this context, this study aims to determine student teachers' perceptions in terms of using technology supported with visual and metaphorical images. This study is designed to address the following research questions.

1. What are the student teachers' perceptions in terms of using technology?

a) Is there any significant difference in student teachers' perceptions on using technology in terms of gender?

b) Is there any significant difference in student teachers' perceptions on using technology in terms of undergraduate program?

2. Which technology represents the concept of using technology in education according to student teachers?

3. Which metaphors represent student teachers' technology concept?

2. Methodology

2.1. Design of the study

In this study, a well-known mixed method design is used to obtain different but complementary data on the same topic as well as to bring together the differing strengths of qualitative and quantitative methods (Creswell, 2007). Quantitative data were collected through Technology Perception Scale and Visual Association Test. The analyses of these data are employed to investigate student teachers' (studying at secondary science and mathematics education) perceptions on using technology.

2.2. Participants

The participants of the study were 104 (62 female, 42 male) senior student teachers who were enrolled in secondary science and mathematics education department (physics ed., chemistry ed., biology ed. and mathematics ed.) of Balıkesir University Necatibey Faculty of Education in Turkey in 2011-2012 fall semester. Distribution of student teachers in terms of gender and undergraduate program are shown below in Table 1.

Table 1**.** Distribution of student teachers in terms of gender and undergraduate program

		Undergraduate Program								**Total**	
		Mathematics Ed.		**Biology Ed.**		**Chemistry Ed.**		**Physics Ed.**			
		f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**
Gender	**Female**	20	19.2	23	22.1	12	11.5	7	6.7	62	59.6
	Male	17	16.3	9	8.7	9	8.7	7	6.7	42	40.4
Total		37	35.6	32	30.8	21	20.2	14	13.5	104	100.0

2.2.2. Data collection tools

2.3.1. Technology Perception Scale: “Technology Perception Scale”, which was developed by Tınmaz (2004), is used to measure student teachers’ perceptions on using technology. The scale is a 5 point Likert scale which consists of 28 items. In reference to validity and reliability assessment scores, the scale has two factors which are “belief in positive effect of technology in education” and “effects of undergraduate program” and Cronbach Alpha coefficient of factors are .89 and .81 respectively. Internal consistency coefficient for the whole test is .86

2.3.2. Visual Association Activity: This activity is developed by the researchers through literature and receiving field experts’ opinion. It consists of 11 images which can be used as educational tools. The reason of having 11 images is not to get people confused since it is a ranking activity which should not normally be presented with more than 10 or 12 items (Anderson & Arsenault, 1998). In the activity, there are 11 images to be listed in order of importance. It is a useful variation of these types of questions according to Anderson and Arsenault (1998). Student teachers are asked to list the

images as the first three and the last three. The main purpose of the activity is to elicit student teachers' perceptions on using technology by associating the images which represent their concept of using technology in education in order of importance.

2.3.3. Metaphors: In order to determine student teachers' perceptions on using technology metaphors, qualitative data collection techniques were utilized. Metaphors used in education contribute to revealing some concepts, perceptions and attitudes in some subjects which are not fully understood or hard to understand (Döş, 2010). Data were collected by researchers, and before data collection, students were informed about metaphors, and it was special attention was paid not to canalize students. For this purpose, student teachers are given a form written "Technology is like……., because……." on and are asked to give free answers. The answers are analyzed with metaphorical analysis methods to determine their perceptions on using technology.

3. Data analysis

The statistical analyses of the quantitative data collected were done via SPSS 17 package program in the .05 significance level.

For the analysis of the data collected through visual association activity, frequency and percentage statistics were used to determine ranks of student teachers and chi-square analysis was used to determine the effect of undergraduate program enrolled. For the Likert type scale, arithmetical means and standard deviations were used. To evaluate the answers for the Technology Perception Scale, ranges of the score in groups were calculated through the formulae of "range/group number" (Tekin, 2000). This calculation was found as (5-1/5=) 0.80 from the answers given by student teachers. Therefore, in the scales, answers are ranked on a 5-point Likert scale: strongly disagree (1.00- 1.80), disagree (1.81- 2.60), neither agree nor disagree (2.61- 3.40), agree (3.41- 4.20), and strongly agree (4.21- 5.00).

Since the obtained data do not seem in normal distribution, Mann Whitney U Test for the gender differences and Kruskal Wallis H Test for the enrolled undergraduate program were used.

The metaphors which serve as the qualitative data in this study were analyzed through content analysis method. In this method, categories were organized by clearing up the reasons for that metaphor. While transferring student teachers' expressions about metaphors, their names were numbered and coded according to department of study to protect their privacy. For example, physics student teacher number one is coded as P1. (Chemistry Ed.; C1, Mathematics Ed.; M1, Biology Ed.; B1)

4. Findings

4.1.The first sub-problem:

Table 2 shows values concerning student teachers' perceptions on using technology.

Table 2. Values concerning student teachers' perceptions on using technology

n	M	S
104	3.83	.46

Table 2 shows that student teachers' mean score on technology perception scale is $\bar{X}$ =3.83. Considering the evaluation ranges in the scale, it is seen that student teachers' answers are in the level of "agree". This finding shows that student teachers' perceptions on using technology are positive.

To control whether student teachers' scores on technology perception scale are normal, Kolmogorov- Smirnov Test was used, and results are shown below in Table 3 (Buyukozturk, 2010).

Table 3. Kolmogorov- Simirnov test of normality results

	Kolmogorov-Simirnov Test of Normality		
	Statistic	**Df**	**Sig.**
Perception Scale	.131	104	.000

As can be seen from Table 3, a result of test of normality scores, the significance of perception scale is found as p=.000<.05. It can be said that distribution is not normal, since the significance value of perception scale scores is less than .05.

Mann Whitney U test is used to determine whether student teachers' perceptions on using technology have significant difference in terms of gender or not. Table 4 shows Mann W.U Test results according to gender.

Table 4. Mann W.U. test score results for perceptions on using technology scale in terms of gender

Gender	N	**Mean Rank**	**Sum of Ranks**	**U**	**p**
Female	62	52.13	3232	1279	.879
Male	42	53.05	2228		

The result of Mann Whitney U Test is used as the distribution used is abnormal for student teachers' perceptions on using technology in terms of gender. The test results show that although male student teachers' mean rank is higher than female students', there is no significant difference between males and females (u=1279, p>.05). In other words, male and female student teachers have similar perceptions on using technology.

To determine whether there is significant difference in student teachers' perceptions on using technology in terms of undergraduate program, Kruskal Wallis H test was used, since data gathered were non-parametric.

Table 5. Kruskal Wallis H test results for perceptions on using technology in terms of undergraduate program

Perception	**N**	**Mean Rank**	**sd**	x^2	**p**
Physics Ed.	14	53.39	3	5.844	.119
Chemistry Ed.	21	54.81			
Biology Ed.	32	42.34			
Mathematics Ed.	37	59.64			

When Table 5 is examined, it can be seen that there is no significant difference in student teachers' perceptions on technology in terms of undergraduate program ($x^2(3) = 5.844$, $p > .05$). This finding indicates that student teachers who are attending different undergraduate programs have similar perceptions.

4.2.Findings of second sub-problem:

Table 6 indicates the results of visual association activity which aims to reveal student teachers' representations regarding the concept of using technology in education the most.

Table 6. Results of visual association activity

		Smart Board	Overhead Projector	Simulator	Mobile Phone	Camera/ Video	Mp3 player	Projection	Television	Internet	Educational Software	Computer
First three												
1.rank	**f**	37	4	16	3	0	0	4	0	16	8	16
	%	35.6	3.8	15.4	2.9	0	0	3.8	0	15.4	7.7	15.4
2.rank	**f**	15	7	7	3	1	0	18	1	17	11	24
	%	14.4	6.7	6.7	2.9	1	0	17.3	1	16.3	10.6	23.1
3.rank	**f**	10	15	5	2	3	1	15	0	27	13	13
	%	9.6	1.4	4.8	1.9	2.9	1	14.4	0	26.0	12.5	12.5
1st Total	**f**	62	26	28	8	4	1	37	1	60	32	53
Rank	**%**	59.9	24.9	26.9	7.7	3.9	1	35.5	1	57.7	30.8	51.0
Last three												
1.rank	**f**	2	16	11	18	15	15	5	11	1	8	2
	%	1.9	15.4	10.6	17.3	14.4	14.4	4.8	10.6	1.0	7.7	1.9
2.rank	**f**	1	6	10	29	14	29	3	9	0	3	0
	%	1.0	5.8	9.6	27.9	13.5	27.9	2.9	8.7	0	2.9	0
3.rank	**f**	3	9	18	10	14	45	0	1	0	4	0
	%	2.9	8.7	17.3	9.6	13.5	43.3	0	1.0	0	3.8	0
2nd Total	**f**	6	31	39	57	43	89	8	21	1	15	2
Rank	**%**	5.8	29.9	37.5	54.8	41.4	85.6	7.7	20.3	1	15.5	1.9

According to the results shown in Table 6, student teachers mostly chose smart board, internet and computer in the first three ranks, as can be seen from the first total rank row in Table 6. It means they think these technologies most accurately represent the concept of technology integration in education. Since using smart board, which is described as computer-projection-board connection (Tataroglu, 2009), has recently been increasing in educational institutions, it can be said by looking at the ranks that computer and projection technologies fall behind. Besides, student teachers in our study are already familiar with this technology because it has been already used by the faculty. Therefore, smart board is ranked as the first by a majority.

Student teachers also put camera/video, mobile phone and portable media players (mp3/mp4) in the last three ranks (see the second total rank row in Table 6). We thus interpret this situation as their reluctance to associate camera/video, mobile phone and portable media players with the concept of using technology. Although learning via video has some benefits, such as increasing motivation and visualizing knowledge (Pekdag, 2010), it is mostly represented at the last three ranks. Mobile technologies in our pockets (mobile phone, portable media players (mp3/mp4) (Bulun, Gülnar, & Güran, 2004; Küçükarslan, Koçak, & Kara, 2009) and podcasts (Gülseçen, Gürsul, Bayrakdar, Cilengir, & Canım, 2010; Işık, Özkaraca, & Güler, 2011) are offering a chance to be used as time and place independent and are increasingly used in education. However, it is seen that student teachers mostly put these technological tools in the last three ranks, which means they don't consider these technologies as the most useful in education.

Tables 7 and 8 show the results of chi-square test to determine if undergraduate program variable has a significant effect on the answers for the visual association activity.

Table 7. Chi-square test results for visual association activity in terms of undergraduate program (first three ranks)

		Mathematics Ed.			Biology Ed.			Chemistry Ed.			Physics Ed.		
First Three Rank		**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**
Smart Board	**f**	7	8	3	15	6	3	8	1	4	7	0	0
	%	18.9	21.6	8.1	46.9	18.8	9.4	38.1	4.8	19.0	50.0	.0	.0
Overhead Projector	**f**	1	2	6	0	3	6	2	1	2	1	1	1
	%	2.7	5.4	16.2	.0	9.4	18.8	9.5	4.8	9.5	7.1	7.1	7.1
Simulator	**f**	13	2	1	2	2	2	0	1	0	1	2	2
	%	35.1	5.4	2.7	6.3	6.3	6.3	.0	4.8	.0	7.1	14.3	14.3
Mobile Phone	**f**	3	1	1	0	1	0	0	0	1	0	1	0
	%	8.1	2.7	2.7	.0	3.1	0	.0	0	4.8	.0	7.1	0
Camera/ Video	**f**		1	2		0	1		0	0		0	0
	%		2.7	5.4		.0	3.1		.0	.0		0	.0
Mp3 player	**f**			0			0			1			0
	%			.0			.0			4.8			.0
Projection	**f**	1	5	4	2	10	4	1	3	3	0	0	4
	%	2.7	13.5	10.8	6.3	31.3	12.5	4.8	14.3	14.3	.0	0	28.6
Television	**f**		0			0			1			0	
	%		0			0			4.8			0	
Internet	**f**	5	1	5	6	4	4	3	10	4	2	2	0
	%	13.5	2.7	13.5	18.8	12.5	12.5	14.3	47.6	19.0	14.3	14.3	.0

Educational Software	**f**	4	6	3	3	1	6	1	0	2	0	4	2
	%	10.8	16.2	8.1	8.1	3.1	18.8	18.8	.0	9.5	.0	28.6	14.3
Computer	**f**	3	11	12	4	5	6	6	4	4	3	4	5
	%	8.1	29.7	32.4	12.5	15.6	18.8	28.6	19.0	19.0	21.4	28.6	35.7
TOTAL	**f**	37			32			21			14		
	%	100			100			100			100		

1st rank→ x^2 = 36,39 df= 21 p= ,020 *2nd rank*→x^2 = 49.0 df=27 p= ,006 *3rd rank*→x^2 = 25,26 df=27 p= ,560

When Table 7 is examined, it is seen that while student teachers enrolled in mathematics ed. point simulator out in the first rank (%35,1), student teachers enrolled in biology ed.(%46,9), chemistry ed. (%38,1) and physics ed. (%50) show smart board in the first rank. For the second, rank student teachers in mathematics ed. show computer (%29,7), while student teachers in biology ed. show projection (%31,3), chemistry ed. show internet (%47,6), and physics ed. show educational software and computer (28.6%). In the third rank, while student teachers enrolled in mathematics ed. point computer out, biology ed. student teachers point computer, internet and overhead projector (%18,8), chemistry ed. student teachers list smart board, internet and overhead projector (%19), and student teachers in physics ed. name computer (%35,7).

It can be said that the difference in the perceptions of student teachers enrolled in different departments is significant in the first and second ranks (p<,05), and undergraduate program has an effect on students teachers' decision of using technology.

Table 8. Chi-square test results for visual association activity in terms of undergraduate program (last three ranks)

		Mathematics Ed.			**Biology Ed.**			**Chemistry Ed.**			**Physics Ed.**		
Last Three Rank		**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**	**1st**	**2nd**	**3rd**
Smart Board	**f**	1	0	1	0	0	0	1	1	1	1	0	0
	%	2.7	0	2.7	0	0	0	4.8	4.8	4.8	7.1	0	0
Overhead Projector	**f**	3	1	8	4	1	6	1	2	2	1	2	0
	%	8.1	2.7	21.6	12.5	3.1	18.8	4.8	9.5	9.5	7.1	14.3	0
Simulator	**f**	4	3	2	6	3	2	5	3	6	3	1	1
	%	10.8	8.1	5.4	18.8	9.4	6.3	23.8	14.3	28.6	21.4	7.1	7.1
Mobile Phone	**f**	3	13	8	2	6	5	3	7	0	2	3	5
	%	8.1	35.1	21.6	6.3	18.8	15.6	14.3	33.3	0	14.3	21.4	35.7
Camera/ Video	**f**	4	7	5	7	3	6	2	3	3	1	1	1
	%	10.8	18.9	13.5	21.9	9.4	18.8	9.5	14.3	14.3	7.1	7.1	7.1
Mp3 player	**f**	21	9	5	12	12	2	8	3	5	4	5	3
	%	56.8	24.3	13.5	37.5	37.5	6.3	38.1	14.3	23.8	28.6	35.7	21.4
Projection	**f**		1	3		2	2		0	0		0	0
	%		2.7			6.3	6.3		0	0		0	0
Television	**f**	0	2	4	1	5	4	0	1	1	0	1	2
	%	0	5.4	10.8	3.1	15.6	12.5	0	4.8	4.8	0	7.1	14.3
Internet	**f**			0			1			0			0
	%			0			3.1			0			0
Educational	**f**	1	1	0	0	0	3	1	1	3	2	1	2

Softwares	**%**	2.7	2.7	0	0	0	9.4	4.8	4.8	14.3	14.3	7.1	14.3
Computer	**f**			1			1			0			0
	%			2.7			3.1			0			0
TOTAL	**f**	37			32			21			14		
	%	100			100			100			100		

1st rank→ x^2 = 18,66 df= 21 p=0,607 *2nd rank→* x^2 = 21,51 df=24 p=0,608 *3rd rank→* x^2 = 36,65 df=30 p=0,188

When Table 8 is examined, it can be said that student teachers in mathematics ed. name mp3 player, simulator, mobile phone and overhead Projector; biology ed. Point out Mp3 player, camera/video and Overhead Projector; chemistry ed. name mp3 player, mobile Phone and simulator; physics ed. mp3 player and mobile phone as the last three devices to use in education. From the answers given by the student teachers, the emphasis is seen mostly on Mp3 player, simulator, mobile phone, Overhead Projector and Camera/video. Different undergraduate programs do not show significant difference according to the results of Chi-square test. (p>,05).

4.3. Findings of third sub-problem:

Student teachers in our study developed 104 metaphors about technology concept. These metaphors were analyzed and divided into nine categories which are: developing and changing technology, rapidly progressing technology, limitless, endless technology, beneficial technology, harmful technology, both beneficial and harmful technology, indispensable technology, technology as a necessity, and all-inclusive technology. Table 7 shows the metaphors regarding nine categories, their frequencies and percentages.

Table 9. Student teachers' metaphors about technology concept

Categories	**Metaphor Name**	**Metaphor Frequency(f)**	**Metaphor Percentage (%)**
developing and changing technology	Energy (f=2), Newborn baby (f=1), Life (f=3), Fashion (f=3), Tree (f=3), Zygote (f=1), Cell(f=1), Person(f=2), Race Horse (f=2), Flu Bug(f=2), Rain (f=1)	*21*	*20*
rapidly progressing technology	Clock (f=1), High Speed Train (f=1), Mathematics (f=4) , Time (f=2), Rain (f=3) ,Series (f=1)	*12*	*12*
limitless, endless technology	Ocean (f=3),Universe (f=4), Humankind (f=4), Bottomless pit (f=1),Indefinite integral (f=1), Sky (f=3), Numerical axis (f=1)	*17*	*16*
beneficial technology	Sun (f=3), Book (f=3), Simulation (f=1), Green House (f=1), Door (f=1), Formula (f=3), Light (f=2) ,Newsmonger (f=1)	*15*	*14*
harmful technology	Tropical fruit (f=2), Paparazzi (f=1)	*3*	*3*
both beneficial and harmful technology	Atomic bomb (f=3),Uranium (f=2), Food (f=2) ,Magic wand (f=1) , Medicine (f=3) ,Bank (f=1)	*12*	*12*
indispensable technology	Toy (f=3), Illness (f=1),Video camera (f=1), Cigarette(f=3)	*8*	*8*
technology as a	Breathing (f=1), Touch (f=1) ,Air and Water	6	6

necessity	(f=3),Staple Food(f=1)		
all inclusive technology	Bag (f=1), Computer (f=1), Earth (f=2), Life (f=2), Library (f=1) ,Gene Pool (f=1) , Subconscious (f=1), Garbage (f=1)	*10*	*10*

When Table 9 is examined, it is seen that student teachers frequently develop 21 metaphors in "developing and changing technology" category. Their metaphors in "harmful technology" category are less in number compared to other categories. Table 10 shows examples of some metaphors developed by student teachers.

Table 10. Examples of metaphors by category

Categories	**Expressions**
developing and changing technology	"Technology is like a zygote, because when something is explored, it grows and develops by adding new properties" (B23) "Technology is like life, because it grows like a human who grows mature in his life by passing through different life periods"(C3) "Technology is like a flu bug, because it changes constantly in the same way with the virus and we can not accommodate it (M18)
rapidly progressing technology	"Technology is like mathematics, because even we think that we learnt everything about mathematics it is not true, while we try to catch up on, every day new things are added and it is hard to reach its speed." (M23)
limitless, endless technology	"Technology is like universe, because we don't know exactly the limits and incorporations of it." (P4) "Technology is like indefinite integral because it is not definite where it starts and goes. Technology changes by years according to the quality of the outcomes."(M29)
beneficial technology	"Technology is like the sun, because it opens the way for people and enlightens their way."(C10) "Technology is like a greenhouse because in a greenhouse you can get the best of the crops you product. It is the same when we use technology and try to reach the best student." (M14)
harmful technology	"Technology is like a tropical fruit, because it seems delicious and nutritious but it is expensive and it is not good for budget." (B7)
both beneficial and harmful technology	"Technology is like an atomic bomb, because it is actually a great power but if we do not use it consciously or use it for bad, it causes a widespread devastation but if we use it for good it supports the development of brains and help us reach the things we would never have without it." (P3)
indispensible technology	"Technology is like a toy because it is hard not to play with it since it is fun." (C1) "Technology is like a cigarette, because it causes addiction" (M22)

technology as a necessity	*"Technology is like air and water, because it is indispensable and societies without technology cannot reach highest levels of life quality"(M1)*
all inclusive technology	*"Technology is like garbage because, with the disorganized developing technology digital data bank became very chaotic and reaching the true knowledge became very hard."(P12)* *"Technology is like a bag because it includes everything we need or not need."(C8)*

The answers given by student teachers about the technology metaphors also show an interesting tendency to use domain-specific metaphors to describe using technology in education. This tendency is very notable for the student teachers enrolled in mathematics education. For example, student coded M29 says *"Technology is like an indefinite integral because it is not definite where it starts and goes. It changes year by year"*. Another student teacher from biology education says: *"Technology is like a gene pool because new innovations increase day by day and from these limitless technologies, a teacher can choose the most useful one for teaching and learning situations".* Student teacher coded C16 says: *"Technology is like uranium, because when used for a good purpose you can even constitute a nuclear power station but if you use it for a bad purpose you can produce an atomic bomb either".* Lastly, student teacher coded P3 says: *"Technology is like an atomic bomb, because even though it has an enormous power, when people are not conscious how to use it effectively, it harms and destroys the society but on the other side it supports the development of brain and helps us to reach the things we always dream of."*

5. Conclusions and recommendations

The outcomes of this study which aimed to determine student teachers' perceptions on technology supported with visual and metaphorical images are described below.

It was found that student teachers' mean score on technology perception scale is =3.83. Considering this score, it can be said that student teachers have positive perceptions on technology. This result is in parallel with several studies (Tınmaz, 2004; Abboud-Blanchard, 2005; Eyyam, Meneviş, & Doğruer, 2010; Usta & Korkmaz, 2010). Also, the study revealed no significant difference between student teachers in terms of gender. This finding supports Korkmaz and Yeşil's (2011) study. On the other hand; Demirci and Yadigaroğlu (2011) found out that female student teachers' perceptions on technology were more positive than male student teachers'. Contrary to this study, in his dissertation, Tınmaz (2004) reported that female student teachers have more positive perceptions on technology than male student teachers. This contradiction in different studies can reveal that educational institute which student teachers studied may have different approaches against technology or student teachers who participated in different studies may not have enough exposure to technology.

Also, it no significant difference was found between student teachers in terms of undergraduate program. This finding indicates that student teachers who are studying in different undergraduate programs have similar perceptions on using technology. In Demircioğlu and Yadigaroğlu's (2011) study, student teachers' which were studying at Physics Ed., Chemistry Ed., Biology Ed. and Mathematics Ed. perceptions of using technology in learning situations showed no significant difference in terms of undergraduate program.

The results of visual association activity which aims to reveal student teachers' representations of the concept of using technology in education show that student teachers ranked smart board, computer and internet in the first place, and camera/ video, mobile phone which they commonly associate with the technology using concept in education and portable media players (mp3/mp4) in the last place, which shows that they don't commonly associate them with the

technology using concept in education. The results of visual association activity in terms of undergraduate program show that for the first and second rank, the technologies they pointed out have a significant difference ($p<.05$), while there is no significant difference for the other ranks.

Student teachers in this study developed 104 metaphors which were divided into nine categories: developing and changing technology, rapidly progressing technology, limitless, endless technology, beneficial technology, harmful technology, both beneficial and harmful technology, indispensable technology, technology as a necessity and all inclusive technology about technology concept. The categories which have the maximum number of metaphors are "developing and changing technology" with 21 metaphors and minimum number of metaphors is "harmful technology" with 3 metaphors named tropical fruit and paparazzi. In other words, student teachers perceive technology mostly as a concept which "changes and develops" and less as a concept which "harms". These results are consistent with Gök and Erdoğan's (2008) study which also used metaphor analysis to find out student teachers' perceptions on technology. In their study, student teachers' metaphors are mostly emphasized on 'developing technology'. Also, these findings indicate that student teachers' perceptions on technology are positive. Similarly, Carroll and Eifler (2002) used metaphors to reveal teachers' perception on technology and categorized 41 participants' metaphors under 6 categories which were: (1) an entity with capacities, needs, and appetites; (2) a tease; (3) a specific kind of butler; (4) a tool; (5) a power without form; and (6) a double-edged sword. The results indicate that teachers mostly define technology as computer. Çoklar and Bağcı (2010) investigated the roles of student teachers in the educational technology use. Data was obtained from 131 student teachers and categorized under 6 categories: (1) being important; (2)useful, assistant; (3)guide, user, producer; (4)designer; (5)learner; and (6) attitude.

In the light of these conclusions, some suggestions may be put forward: When teachers are constantly educated about the changing information technologies with pre- and in- service education for improving their abilities of using technology effectively, it helps increase their perceptions and facilitate the integration of technology in education. For this reason, in pre- and in-service education, it is vital to give enough consideration in terms of using technology and raise teachers' awareness.

Having adequate instruction during their education, student teachers can develop positive ideas in terms of instruction with technology, and they can believe in its effectiveness. Therefore, instructors and facilitators have to use technology effectively in education faculties.

In future studies, open-ended questions related to technologies in the visual association technology can be addressed to student teachers to investigate and deepen their reasons for their preferences to use these technologies in teaching and learning situations.

This study is practiced upon student teachers. Similar studies can be made on teachers to determine their perceptions in terms of using technology. Furthermore, student teachers' representations of technology concept can be taken into account, and new studies can be made by reconsidering their reasons.

References

Abboud-Blanchard, M. (2005). Uses of ICT by pre-service teachers. In F. Olivero & R. Sutherland (Eds.), Proceedings of the 7th International Conference of Technology in Mathematics Teaching, Vol. 2 (pp.74 - 78).

Almekhlafi, A. G., & Almeqdadi, F. A. (2010). Teachers' perceptions of technology integration in the united Arab emirates school classrooms. Educational Technology & Society, 13(1), 165–175.

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

Anderson, G., & Arsenault N. (1998). Fundamentals of educational research (2nd ed). Pennsylvania: Falmer Press.

Bulun, M., Gülnar, B., & Güran, S.(2004). Eğitimde mobil teknolojiler. *The Turkish Online Journal of Educational Technology – TOJET, 3(2), 165-169.*

Kobak, M. &, Taşkın,N.,R. (2013). Determining student teachers' perceptions on using technology via Likert scale, visual association test and metaphors: A mixed study, World Journal on Educational Technology. 5, 223-237.

Büyüköztürk, Ş. (2010). Veri Analizi El Kitabı (12. Baskı). Ankara: Pegem Akademi Yayıncılık.

Carroll, J. B., & Eifler, K. E. (2002). Servant, master, double-edged sword: Exploring the metaphors teachers use to describe technology. *Journal of Technology and Teacher Education, 10, 235–246.*

Creswell, J. W., & Plano Clark, V. L. (2007). Designing and conducting mixed methods research. Thousand Oaks, CA: Sage.

Çankaya S., & Karamete A. (2008). Eğitsel bilgisayar oyunlarının öğrencilerin matematik dersine ve eğitsel bilgisayar oyunlarına yönelik tutumlarına etkisi. Mersin Üniversitesi Eğitim Fakültesi Dergisi, 4(2), 115-127.

Çelik, H. C., & Kahyaoğlu, M. (2007). İlköğretim öğretmen adaylarının teknolojiye yönelik tutumlarının kümeleme analizi. Türk Eğitim Bilimleri Dergisi, 5(4), 571–586.

Çoklar, A.N., & Bağcı, H. (2010). What are the roles of prospective teachers on the educational technology use: A metaphor study. *World Journal on Educational Technology, 2(3), 186-195.*

Demir, S., Ozmantar, M.F., Bingölbali, E., & Bozkurt, A. (2011). Sınıf öğretmenlerinin teknoloji kullanımlarının irdelenmesi. 5th International Computer & Instructional Technologies Symposium, Elazığ.

Demircioğlu, G., & Yadigaroğlu, M. (2011, April). Öğretmen adaylarının öğrenme öğretme ortamlarında bilgi ve iletişim teknolojilerinin kullanımına ilişkin görüşleri. 2nd International Conference on New Trends in Education and Their Implications, Antalya.

Dockstader, J. (1999). Teachers of the 21st century know the what, why, and how of technology integration. TH.E. Journal, 26(6), 73-74.

Döş İ. (2010). Aday öğretmenlerin müfettişlik kavramına ilişkin metafor algıları. Gaziantep Üniversitesi Sosyal Bilimler Dergisi, 9(3), 607 -629.

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? Computers & Education, 51, 187–199.

Ertmer, P. A., Conklin, D., Lewandowski, J., Osika, E., Selo, M., & Wignall, E. (2003). Increasing preservice teachers' capacity for technology integration through use of electronic models. Teacher Education Quarterly, 30(1), 95–112.

Eyyam, R., Meneviş İ., & Doğruer N. (2010). Perceptions of student teachers towards technology use in class. Procedia Social and Behavioral Sciences, 3, 88–93.

Fulton, K., Glenn, A. D., & Valdez, G. (2004). Teacher education and technology planning guide. North Central Regional Educational Laboratory, Learning Point Associates. Retrieved October 23, 2011from http://www.learningpt.org/pdfs/tech/guide.pdf

Gök B., & Erdoğan T. (2008, May). Sınıf öğretmeni adaylarının teknoloji kavramına ilişkin algılarının metafor analizi yoluyla incelenmesi. International Educational Technology Conference, Eskişehir.

Gulseçen, S., Gürsul, F., Bayrakdar, B., Cilengir, S., & Canım, S. (2010, February). Yeni nesil mobil öğrenme aracı: podcast. 12. Akademik Bilişim Konferansı, Muğla.

Gunter, G. A. (2001). Making a difference: Using emerging technologies and teaching strategies to restructure an undergraduate technology course for pre-service teachers. Education Media International, 38(1), 13–20.

Guzman, A., & Nussbaumt, M. (2009). Teaching competencies for technology integration in the classroom. Journal of computer Assisted learning, 25, 453-469.

Hennessy, S., Ruthven, K., & Brindley, S. (2005). Teacher perspectives on integrating ICT into subject teaching: Commitment, constraints, caution, and change. *Journal of Curriculum Studies, 37(2), 155–192.*

Hew, K. F., & Brush, T. (2007). Integrating technology into k-12 teaching and learning: Current knowledge gaps and recommendations for future research. Education Technology Research & Development, 55, 223–252.

Işık, H.A., Özkaraca, O., & Güler, İ. (2011, February). Mobil öğrenme ve podcast. 13.Akademik Bilişim Konferansı, Malatya.

Jang, S. (2008). The effects of integrating technology, observation and writing into a teacher education method course. Computer & Education, 50, 853-865.

Korkmaz, Ö., & Yeşil, R. (2011). Cinsiyet temelli gruplarla çalışan öğrencilerin başarılarının, teknoloji kullanımına yönelik tutumlarının ve grupla çalışmaya ilişkin düşüncelerinin değerlendirilmesi. Gazi Eğitim Fakültesi Dergisi, 31(1), 201-229.

Koksal, M.S., & Yaman, S. (2009). An analysis of Turkish prospective teachers' perceptions about technology in education. Relieve, 15(2), 1- 10.

Kobak, M. &, Taşkın,N.,R. (2013). Determining student teachers' perceptions on using technology via Likert scale, visual association test and metaphors: A mixed study, World Journal on Educational Technology. 5, 223-237.

Küçükarslan, S., Koçak, Ş., & Kara, M. (2009, February). Cepte taşınabilir aygıtların eğitimde kullanılması üzerine bir öneri: mp4 oynatıcı örneği. 11. Akademik Bilişim Konferansı, Şanlıurfa.

Lim, C. P., Teo, Y. H., Wong, P., Khine, M. S., Chai, C. S., & Divaharan, S. (2003). Creating a conducive learning environment for the effective integration of ICT: Classroom management issues. Journal of Interactive Learning Research, 14(4), 405–423.

Mazman, S. G., & Koçak Usluel, Y. (2011). Bilgi ve iletişim teknolojilerinin öğrenme-öğretme süreçlerine entegrasyonu: modeller ve göstergeler. Eğitim Teknolojisi: Kuram ve Uygulama, 1, 62-79.

Morrison, W. F., & Jeffs, T. L. (2005). Outcomes of preservice teacher's technology use. Assistive Technology Outcomes and Benefits, 2(1), 71-78.

Öksüz, C., Uça, S., & Genç, G. (2009, February). Designing multimedia videocases to improve mathematics teaching with techologhy: "Technology integration into mathematics education" Project. World Conference on Educational Sciences, Nicosia.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. Review of Educational Research, 62(3), 307–332.

Paraskeva, F., Bouta, H., & Papagianna, A. (2008). Individual characteristics and computer self-efficacy in secondary education teachers to integrate technology in educational practice. Computer and Education, 50(3), 1084–1091.

Pekdağ B. (2010). Kimya öğreniminde alternatif yollar: animasyon, simülasyon, video ve multimedya ile öğrenme. Türk Fen Eğitimi Dergisi, 7(2), 79-110.

Perkmen S., & Tezci E. (2011). Eğitimde Teknoloji Entegrasyonu: Materyal Geliştirme ve Çoklu Ortam Tasarımı. Ankara: Pegem Akademi Yayınları.

Roblyer, M. D. (2002). Integrating educational technology into teaching (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Summak, M.S., Samancioğlu, M., & Bağlıbel, M. (2010, February). Technology integration and assesment in educational settings. World Conference on Educational Sciences, İstanbul.

Tataroğlu, B.(2009). Matematik öğretiminde akıllı tahta kullanımının 10. sınıf öğrencilerinin akademik başarıları, matematik dersine karşı tutumları ve öz-yeterlik düzeylerine etkileri, Dokuz Eylül Üniversitesi, Eğitim Bilimleri Enstitüsü, İzmir, Unpublished master's thesis.

Tekin, H. (2000). Eğitimde ölçme ve değerlendirme (14. baskı) [Educational measurement and evaluation]. Ankara: Yargı Yayınları

Teo, T., & Lee, C. B. (2010). Explaining the intention to use technology among student teachers: An application of the theory of planned behavior. Campus-Wide Information Systems, 27(2), 60-67.

Tınmaz, H. (2004). An assessment of preservice teachers' technology perception in relation to their subject area (Unpublished master thesis). Middle East Technical University, Ankara.

Tondeur, J., Braak, J. V., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. Computer & Education, 59, 134-144.

Usta, E., & Korkmaz, Ö. (2010). Öğretmen adaylarının bilgisayar yeterlikleri ve teknoloji kullanımına ilişkin algıları ile öğretmenlik mesleğine yönelik tutumları. Uluslararası İnsan Bilimleri Dergisi, 7(1), 1335-1349.

Yenilmez, K., & Karakuş, Ö. (2007). İlköğretim sınıf ve matematik öğretmenlerinin bilgisayar destekli matematik öğretimine ilişkin görüşleri. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 14, 87-98.