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PRE-SERVICE MATHEMATICS AND PRIMARY TEACHERS' EXPERIENCE ABOUT THE COMPUTER SOFTWARE PROGRAMS

ABSTRACT

The purpose of this study is to examine the computer software experience of pre-service teachers. There were a total of 541 pre-service teachers involved in this study. The researcher used one questionnaire, developed by Yushau (2006) in the collection of the data. Data were analyzed using descriptive statistics techniques and, independent samples t-test and One Way ANOVA to determine the differences of pre-service teachers' computer experience in terms of gender and their education programs. The result of study shows that pre-service teachers' computer software experience is insufficient. In addition, it was seen that gender is not associated with teachers' experience with computer software programs. Finally, according to attended programs, results of current research indicate that significant differences were found in pre-service teachers' experience with computer software programs

Keywords: Computer Experience, Mathematics, Gender, Pre-Service Teachers, Education Program

MATEMATİK VE SINIF ÖĞRETMENİ ADAYLARININ BİLGİSAYAR PROGRAMLARI HAKKINDAKİ DENEYİMLERİ

ÖZET

Bu çalışmanın amacı öğretmen adaylarının bilgisayar programları hakkındaki deneyimlerini araştırmaktır. Araştırmaya toplam 541 öğretmen adayı katılmıştır. Yushau (2006) da kullanılan ölçek Türkçe'ye uyarlanmış ve verilerin toplanmasında bu ölçek kullanılmıştır. Verilerin betimsel analiz tekniği ve cinsiyet ile öğrenim görülen programa göre fark olup olmadığı bağımsız örneklemler için t-testi ve tek yönlü ANOVA testi kullanılarak analiz edilmiştir. Araştırmanın sonuçları öğretmen adaylarının bilgisayar deneyimlerinin yeterli olmadığını göstermiştir. Ayrıca bilgisayar deneyiminin cinsiyete göre anlamlı farklılık göstermediği görülmüştür. Bunların yanı sıra öğretmen adaylarının okudukları bölüme göre bilgisayar programlarındaki deneyimlerinde istatistiksel olarak anlamlı bir farklılık gözlemlenmiştir.

Anahtar Kelimeler: Bilgisayar Deneyimi, Matematik, Cinsiyet, Öğretmen Adayı, Eğitim Programı

1. INTRODUCTION (GİRİŞ)

Computer technology is integral to modern society, including to education. Kirkpatrick and Cuban (1998) stated that, in the 21st century, "computers are certain to dominate work lives and home lives" (p. 58). One of these fields is mathematics education. In Turkey, computers have been used in education for one decade, while computers have been used in teaching and learning mathematics for more than three decades in the developed many countries in the west. Turkey is one of the fastest developing nations in the Balkan States and Middle-East. Computer use could not be more widespread in work and home lives – and particularly in education, since computer technology was generally too expensive until the last decade. For that reason, in Turkey, computer use has become widespread only in recent years. As a result of widespread integration of computer, the new mathematics curriculum (1-8th and 9-12th grades), which was prepared by the Ministry of National Education, [MNE] (2005a, 2005b, 2005c) in Turkey, emphasizes the importance of computer and technology, and teachers are expected to be more efficient in using computers in teaching and learning mathematics.

For the last three decades, mathematics educators have focused on the effects of computers in students' mathematics performance (Aktümen and Kacar 2008; Baki & Ozpınar, 2007; Isiksal & Askar, 2005; Kodippili & Senaratne, 2008; Gürbüz, 2007;2009; Lazakidou & Retalis, 2010; Olkun, Altun, & Smith, 2005; Vale & Leder, 2004). For example, Baki & Ozpınar (2007) examined the effects of computer-based instruction on the success of students. They found that the students who received a computer based instruction were more successful than those who were in traditional instruction. Similarly, Isiksal & Askar (2005) claimed that computer use in the mathematics classroom had a positive effect on students' learning. Olkun, Altun & Smith (2005) explored the effects of computers on Turkish fourth-grade students' geometry scores and further geometric learning and they found that students who did not have computers at home at the beginning had lower geometry scores.

Considering related literature, it can be seen that the use of computers in mathematics classroom increases students' mathematics performance. But the uses of computers in the classroom are affected by some factors. One of these factors is computer experience (Sadık, 2006). According to Smith, Caputi, Crittenden, Jayasuriya, & Rawstorne, (1999) there is little consensus on a definition of computer experience and researchers have generally equate amount of computer with computer experience and these phrase are generally used synonymously. As evidence of computer experience, researches generally used terms such as "computer usage level," "amount of computer use," and "opportunities" (Jones & Clark, 1995). Teachers' computer experiences can affect their attitudes (Birgin, Kutluca, Çatlıoğlu, 2007; Dambrot, Watkins-Malek, Silling, Marshall, & Garver, 1985) which in turn will influence teachers' use of computers, since computer attitudes have been shown to correlate positively with computer experience (Smith, et al., 1999). Several studies related to teachers' computer experience were conducted by

educators and mathematics researchers (Birgin, Çatlıoğlu, Gürbüz, Aydın, 2010; Deniz, 2007; Lee, 1986; Levine & Donitsa-Schmidt, 1998; Liu, Reed & Phillips, 1992; Schumacher & Morahan-Martin, 2001). Deniz (2007) investigated prospective primary teachers' computer experiences and their attitude toward computers. The result of his study shows that 62% of prospective class teachers have a computer at home and 50% of them the computer owners have computers less than three years. Birgin et al. (2010) found that out of the 180 Turkish pre-service mathematics teachers 53.3% have a computer, and 88.9% of pre-service teachers have 3 years of computer use experience and more than half uses a computer at Internet Cafes (68.9%) or at home (56.7%). They also determined that 72.8% of pre-service mathematics teachers used computer more than 3 hours in a week. Liu, Reed & Phillips (1992) found that almost half of the elementary education students and mathematics education students (22.7%) had no prior computer experience. Also, they found that 47.3% of the males had no prior experience with computers whereas 43.6% of the females had no prior computer experience. However, Lee (1986) claimed that past computer experience significantly affected performance on computerized test.

Another factor affecting computer use is gender. Many research (Birgin, Çoker, Çatlıoğlu, 2010; Morahan-Martin, Olinsky & Schumacher, 1992; Chen, 1985; Comber, Colley, Hargreaves, & Dorn, 1997), showed that boys had more experience with computers than did girls. For example Morahan-Martin, Olinsky & Schumacher, (1992) found significant gender differences with males reporting greater experience and skills with computers than females. Birgin et al. (2010) investigated the gender differences of first year Turkish pre-service teachers about computer and Internet use. As a result of the study, it was concluded that females are more likely to own a computer, whereas males were more experienced in using computers and that they used computers more frequently. It was also found that computer attitudes did not change according to gender, though a significant difference was found in terms of computer competency favoring males. Similarly, Comber et al. (1997) investigated the effects of age, gender, and computer experience upon computer attitudes. They found males had more computer experience than females, but the gender differences were less for younger children, and they said that males reported more home computer use than females. Similarly, the finding of Shashaani (1997) showed that males had more experience with computers than females. Kadijevich (2000) explored gender differences in computer attitude among ninth-grade students. The result indicated that males had a more positive attitude than females, when experience was controlled. Also it can be seen that there was no gender difference in experience, when attitude was controlled.

2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

Several research studies have reported that the use of technology plays prominent roles in teaching and learning mathematics and has positive impacts on students' motivation and achievements in mathematics (NCTM, 2000; Hazzan, 2003; Lin, 2008),

and technology and computer are more influential than traditional teaching methods in education (Isiksal & Askar, 2005; Mistretta, 2005; Olkun, Altun, & Smith, 2005). Therefore, computers and technology are very important in education in general, and in learning and teaching mathematics in particular. But, the use of the computer in classroom varies with several factors such as gender, years of teaching experience, computer knowledge, and computer experience (Marcinkiewicz, 1994; Sadık, 2006). Moreover, according to Shulman (1986) teachers must know and understand the subjects that they teach, and the material that they use. If the teacher has insufficient knowledge of the subject that they teach and the material that they use, they cannot succeed. Today, 26% of Turkey' population (about 19 million) is in the 0-14 age group (Turkish Statistical Institute [TSI], 2010). Pre-service teachers, including participants of the present study, will become these children's teachers and they will teach mathematics to these children in the future. Therefore, it is important to understand pre-service teachers' computer knowledge and computer experiences. For this reason, the aim of this study is to examine and explore elementary pre-service teachers' computer knowledge and computer experiences.

The current study was conducted to determine the level of pre-service teachers' computer experience based on gender and attend programs. Specifically, in this research the following research questions are investigated:

- What are the pre-service teachers' levels of computer experience?
- Do the pre-service teachers' computer experience levels differ by gender?
- Do the pre-service teachers' computer experience levels differ with program the attended?

3. METHOD (YÖNTEM)

The current study explored primary pre-service teachers (PPT) who will teach mathematics in the elementary (1-5 grades), pre-service elementary mathematics teachers (PEMT) and pre-service high school mathematics teacher (PHMT)' experience in computer software. Because survey instruments were administered and numerical data was collected, in this study, a quantitative method was used in analyzing the data.

3.1. Participants (Katılımcılar)

The researcher followed the convenience sampling procedure in which the participants are not randomly selected. According to McMillan and Schumacher (2001), a convenience sample is a group of subjects selected on the basis of being accessible or expedient and it is appropriate to use the group as subjects. Sample of this study consists of 541 pre-service teachers. There were a total of 195 (36%) PPT, 184 (34%) PMT, 164 (30%) HPMT enrolled in teacher education programs in four different universities in Turkey. 51.6% of participants were female (279) and 48.4% were male (262) in the study. The participants in this study were voluntary and they were assured that their answers would be kept confidential.

3.2. Instruments (Veri Toplama Araçları)

The researcher used one questionnaire, developed by Yushau (2006) in the collection of the data. Two mathematics educators, one-education researcher, and an instructor at the department of Foreign Languages oversaw and edited the original forms and the Turkish forms. These procedures were done to provide issues of construct and content validity (Mcmillan & Schumacher, 2001). The questionnaire included demographics, computer experience and familiarity with computer software. The computer experience part asked participants to rate their computer experience. *First computer experience:* The participants were asked about their first experience with learning about or working with computers in the education process within three ranges: elementary school, high school and university. *First computer experience in teaching:* The participants were asked about their first experience with learning or working with computers in teaching in education process three ranges: elementary school, high school and university. *The opportunity to use computers:* The participants were asked where they access computers. The choices are internet cafe, with my computer, common areas for computer use in university. *The frequency of computer use:* Here the choices are: everyday, a few times a week, a few times a month, a few times a year. *Frequency of computer use for teaching purpose:* The participants were asked how often they use computers for teaching purpose. The ranges are: every week, a few times in each semester, sometimes in some semesters. *Familiarity with frequently used software such as:* word processors (e.g. MS word, LaTEX, etc), spreadsheet and statistical packages (e.g. MS Excel), Presentation programs (e.g. PowerPoint), computer algebra systems (e.g. Mathematica, Matlab, Maple etc), programming languages (Fortran, C, C++, Java etc.), and Internet design software (e.g. FrontPage). The items were arranged for scoring using a 5-point Likert-type response scale, and the items were scored by the following key: 5 = excellent, 4 = good, 3 = average, 2 = poor and 1 = very poor. The Cronbach's alpha coefficients calculated for these items and it was calculated to be .73.

3.3. Procedure and Data Analysis (İşlem ve Veri Analizi)

There was no time limitation for the testing session, however most pre-service teachers finished the questionnaire within 10 minutes. Descriptive statistics was employed to determine pre-service teachers' experience. The researchers also employed the independent sample t-test and One Way ANOVA with $\alpha = 0.05$ in the analysis of the differences of pre-service teachers' computer experience based on gender and their education programs.

4. FINDINGS (BULGULAR)

Pre-service teachers were asked to indicate when they used a computer for the first time in the education process. Table 1 showed that while 45.3% of the pre-service teachers used the computers in elementary school, 38.6% of the pre-service teachers used them in secondary school. Also, the results indicated that 16.1% of them used the computer in their university education.

Table 1. Frequency of the first usage of computers in education process
(Tablo 1. Bilgisayarı eğitim sürecinde ilk kullanma dönemi)

	f	%
Elementary School	245	45.3
Secondary School	209	38.6
University	87	16.1
Total	541	100,0

Pre-service teachers were asked to indicate the computer activities they used for the first time in education process for teaching purposes. The frequency of computer use for teaching purposes, Table 2, showed that 23.1% of the pre-service teachers used the computers in elementary school, and 32.0% of the pre-service teachers used in their secondary school education. Also, the results indicated that about half of them used the computer in their university education (46.1%) for teaching purposes, thought 16.1% of them firstly used the computer in their university education process.

Table 2. Frequency of the first usage of computers in education process for teaching purposes
(Tablo 2. Bilgisayarı eğitim amaçlı olarak ilk kullanma dönemi)

	f	%
Elementary School	124	23.1
Secondary School	172	32.0
University	242	45.0
Total	538	100,0

Pre-service teachers were asked to indicate the opportunity of computer use. It can be seen in table 3 that while 46.2% of the pre-service teachers are use computers in internet cafes, 46.0% of them have a computer. Some of them use the computer in the common areas in their campus (7.7%). This shows many of the Turkish pre-service teachers do not have computers. So, they have been finding access to computers another way.

Table 3. Opportunity of computer use
(Tablo 3. Bilgisayar kullanma imkanı)

	f	%
In internet cafe	250	46.2
With my computer	249	46.0
Common areas for computer use in university	42	7.7
Total	541	100

The frequency of computer use, Table 4, shows that 35% of the pre-service teachers use computers every day and 52% of them use computers every week. It can be said that in total, 87% of

them use computers every week. This result shows how widespread the use of computer has become in our daily life.

Table 4. Frequency of computer use
(Tablo 4. Bilgisayar kullanma sıklığı)

	f	%
Every day	186	34.5
A few times in a week	281	52.1
A few times in a month	65	12.1
A few times in a year	7	1.3
Total	539	100

The frequency of computer use for teaching purpose, Table 5, shows that 39.2% of the pre-service teachers use computers every week and 45.1% of them use computers a few times each semester. Also result of current study shows 15.7% of them use sometimes in some semesters.

Table 5. Frequency of computer use for teaching purpose
(Tablo 5. Eğitim amaçlı bilgisayar kullanma sıklığı)

	f	%
Every week	212	39.2
A few times each semester	244	45.1
Sometimes in some semesters	85	15.7
Total	541	100

Table 6. Gender differences in computer software experiences by item
(Tablo 6. Bilgisayar yazılım programlarındaki cinsiyet farklılığı)

Items	Total			Males			Females			
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t
1. Word processors	539	3.60	0.97	261	3.64	0.91	278	3.56	1.02	.989
2. Spreadsheet & statistical packages	534	2.97	0.97	261	3.07	1.00	273	2.87	0.94	2.303
3. Presentation programs	540	3.92	0.94	262	3.87	0.98	278	3.96	0.91	1.200
4. Internet design programs	529	2.21	1.01	259	2.19	1.02	270	2.22	1.01	.289
5. Computer Algebra System	528	2.40	1.10	257	2.44	1.12	271	2.37	1.09	.696
6. Programming Language	536	2.15	1.11	259	2.15	1.11	277	2.14	1.11	.024

The current study investigated whether there were gender related differences between the pre-service teachers' computer software experiences. The results for the responses given by female and male pre-service teachers were compared. There were no significant differences between genders on the pre-service teachers' computer software experiences for all items. For example, the mean for Item 1 (familiarity with word processors) were 3.64 for males and 3.56 for females. For item 1, the t-calculated value of .989 was less than the t-critical value. Similarity, the mean for Item 6 (familiarity with programming language) was 2.15 for males and 2.14 for females. For this item, the t-calculated value of .024 was less than the t-critical value. The pre-service teachers' familiarity is high on word processors and presentation programs ($3.41 < \bar{x} < 4.20$). While the pre-service teachers' familiarity is average on Spreadsheet & Statistical packages ($2.61 < \bar{x} < 3.40$), their familiarity is poor on internet design programs, computer algebra system, and programming language.

Table 7. Descriptive statistics for pre-service teachers' familiarity with computer software
(Tablo 7. Öğretmen adaylarının bilgisayar yazılım programlarına aşinalıklarına ilişkin betimsel analiz)

Items	Programs	N	$\bar{x}$	sd
1	PPT	193	3.57	1.01
	PEMT	184	3.68	0.96
	PHMT	162	3.54	0.91
2	PPT	190	2.97	0.99
	PEMT	183	3.15	0.93
	PHMT	161	2.76	0.97
3	PPT	194	4.05	0.93
	PEMT	184	4.02	0.91
	PHMT	162	3.64	0.95
4	PPT	190	2.22	0.99
	PEMT	180	2.18	1.04
	PHMT	159	2.22	1.01
5	PPT	189	2.11	1.00
	PEMT	179	2.58	1.15
	PHMT	160	2.55	1.09
6	PPT	192	1.88	1.01
	PEMT	183	1.90	1.00
	PHMT	161	2.74	1.13

Overall, computer software familiarity scores were categorized into three groups: PPT, PEMT, and PHMT. The ANOVA tests were used to analyze the differences between attained groups and their computer software familiarity. As seen table 8, One-way ANOVA indicated that computer software familiarity affected teachers' attained graduated programs including the spreadsheet & statistical packages [F (2-531) = 7.02, p < .01], presentation programs [F (2-537) = 10.18, p<.01], computer algebra system [F (2-525) = 11.06, p<.01], and programming language [F (2-533) =37.31, p<.01]. According to table 7, among all pre-service teachers, the PHMT had the lowest mean score of computer software

familiarity ($\bar{x}=2.76$) in spreadsheet & statistical packages. In contrast, PEMT had the highest mean score of computer software familiarity ($\bar{x}=3.15$) in this item. According to the results of the Scheffe multi-comparison test, there was a statistically significant difference in familiarity of computer software between the PEMT and PHMT. The PHMT had the lowest mean score of computer software familiarity ($\bar{x}=3.64$) in presentation programs. In contrast, PPT had the highest mean score of computer software familiarity ($\bar{x}=4.05$) in this item. According to the results of the Scheffe multi-comparison test, there was a statistically significant difference in familiarity of computer software between the PHMT and the other two groups, PEMT and PPT. On the other hand, the PPT had the lowest mean score of computer software familiarity ($\bar{x}=2.11$) in computer algebra system. In contrast, PEMT had the highest mean score of computer software familiarity ($\bar{x}=2.58$) in this item. According to the results of the Scheffe multi-comparison test, there was a statistically significant difference in familiarity with computer software between the PPT and the other two groups, PEMT and PHMT.

Table 8. ANOVA results of familiarities by computer software
(Tablo 8. Bilgisayar yazılım programlarına aşinalıklarına ilişkin ANOVA sonuçları)

Items		Sum of Squares	df	Mean Square	F	Significance with
1	Between Groups	1.971	2	.986	1.057	
	Within Groups	499.665	536	.932		
	Total	501.636	538			
2	Between Groups	13.014	2	6.507	7.02**	PEMT-PHMT
	Within Groups	492.380	531	.927		
	Total	505.393	533			
3	Between Groups	17.580	2	8.790	10.18**	PEMT-PHMT PPT-PHMT
	Within Groups	463.670	537	.863		
	Total	481.250	539			
4	Between Groups	.142	2	.071	.069	
	Within Groups	540.398	526	1.027		
	Total	540.541	528			
5	Between Groups	25.820	2	12.910	11.06**	PPT-PEMT PPT-PHMT
	Within Groups	613.059	525	1.168		
	Total	638.879	527			
6	Between Groups	81.131	2	40.566	37.31**	PHMT-PEMT PHMT-PPT
	Within Groups	579.518	533	1.087		
	Total	660.649	535			

**$p < .001$

Finally, the PPT had the lowest mean score of computer software familiarity ($\bar{x}=1.88$) with programming languages. In contrast, PHMT had the highest mean score of computer software familiarity ($\bar{x}=2.74$) in this item. According to the results of the Scheffe multi-comparison test, there was a statistically significant difference in familiarity with computer software between the PHMT and the other two groups, PEMT and PPT.

5. DISCUSSION AND CONCLUSION (TARTIŞMA VE SONUÇ)

It was seen that experience with computers by the pre-service teacher was not excellent, and pre-service teacher do not frequently use the computer either in daily life or for teaching purposes. Families' socio-economic level could be a factor affecting this research finding, since more than half of the pre-service teachers do not have a computer. As mentioned in the introduction section, Turkey is a developing country. Since computer technology was too expensive until the last ten years, low-income-families could not buy a computer for themselves. Therefore, in Turkey, computer use has become widespread in last decade, particularly only in the last five years. This result shows that computer technology is not yet integral to society, including to education. This finding was supported by result of Deniz (2007). He found that 50% of pre-service primary teachers do not have a computer.

The second important result in this research is that gender is not linked with pre-service teachers' experience with computer software programs. Both male and female pre-service teachers take similar computer-related courses. So, all pre-service teachers have equal opportunities for computer experience. This result is supported by finding of some studies (Kadijevich, 2000; Sacks, Bellissimo, & Mergendoller, 1994). For example, Kadijevich (2000) found that there was no gender difference in experience, when attitude was controlled. Similarly, Sacks, et al. (1994) reported that there were no sex differences in computer use. However, this finding of current study difference from some early studies in the literature (Birgin et al., 2010; Liu, et al., 1992, Morahan-Martin, Olinsky & Schumacher, 1992; Chen, 1985; Muira, 1986; Comber et al., 1997). For instance, Shashaani (1997) reported that males had more experience with computers than females. However, Liu, et al., (1992) found that male teacher education students had slightly less prior computer experience than females.

Finally, another important result in this research is that attended programs are affecting pre-service teachers' experience about computer software programs. That is, experiences with computer software programs show statistically significant difference according to pre-service teachers' attended programs. For this difference, courses related to computer which pre-service teacher take in undergraduate programs is a factor to be considered. All the pre-service teachers who attend primary teacher, elementary mathematics teacher, and education programs in Turkey take the Computer-I and the Computer-II course. Furthermore, PMT in this study take the computer-assisted mathematics teaching course. These courses generally related to technological pedagogical content knowledge (TPCK). According to Mishra and Koehler (2008), "TPCK is an emergent form of knowledge that goes beyond all three components (content, pedagogy, and technology) (pp.1028)." Therefore, the PPT and PMT encounter more opportunities to use computers in instruction. On the other hand, PHMT including participants of the current study take courses related to content knowledge (CK) which is knowledge about the actual subject matter that is to be learned or taught and technological knowledge (TK) includes knowledge of how to install

and remove peripheral devices, install and remove software programs, and create and archive documents in the Faculty of Arts and Science. Later, they take a course related to pedagogical knowledge which provides deeper knowledge about the processes and practices or methods of teaching and learning to be teacher in a year in Faculty of Education (Mishra and Koehler, 2006 pp. 1026). Hence, they cannot find the opportunity of using computers in instruction. For this the reason, it may be said that the PPT and PMT' computer software familiarity on presentation programs and word processors higher than that of PHMT', while PHMT's computer software familiarity on programming language and computer algebra system higher than that of PPT and PMT'.

After these result of current study, it can be said that pre-service teachers' computer experience is not sufficient. Therefore, the current study has some significant implications for the questions often asked by researchers related to pre-service teachers' computer experience that affect use of computer in classroom. Firstly, teachers' education programs should provide extra opportunity so that pre-service teachers can gain computer experience. For example computer based instruction might be made compulsory for pre-service teacher. Families should give the opportunity for computer experience to both boys and girls since gender is not affecting pre-service teachers' computer experience.

Further research may be conducted on the relationships between in-service teachers' computer experience and the use of computers in mathematics education; pre-service teachers' and in-service teachers' computer experience may be compared. Also, research should be carried out on the factors influencing pre-service and in-service teachers' computer experience. Finally, in this study, quantitative methods were used. In the future, qualitative methods, such as open-ended question prompts, focus groups and/or one-on-one interviews could be used to support and enrich present studies' findings.

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