Computer Literacy of
Preservice Elementary Teachers

Esin ACAR, Adnan Menderes University, esinnacar@gmail.com

Isil KOC, İstanbul University, isilkoc@istanbul.edu.tr

Abstract

The purpose of this study was to investigate pre-service elementary teachers' computer literacy levels in terms of age, grade level, computer ownership, and computer experience. The participants of the study consisted of 179 pre-service elementary teachers (135 female and 44 male) from the department of elementary education in the faculty of education in Adnan Menderes University in Turkey during the spring semester of the 2011-2012 academic year. The Computer Literacy Scale (CLS), developed by Kay (1990) and adapted into Turkish by Kilinc, & Salman (2006) was utilized to explore pre-service elementary teachers' computer literacy levels. Based on results, the total means for basic skills ($\overline{X}$= 35.50), application software skills ($\overline{X}$= 33.20), and computer awareness ($\overline{X}$= 26.40) subscales were greater than the mean for the programming ($\overline{X}$=18.00) subscale. Results are discussed in terms of pre-service elementary teachers' computer literacy levels and their background variables.

Keywords: Computer literacy; computer skills; pre-service elementary teachers; teacher education

Introduction

Computer is the most preferred tool for information sharing. Adults generally like the structured and organized world in some logical way (Lombardi, 1983, p.5). That is, computer technologies provide us to learn about how to produce, understand, share and use information effectively.

Computer literacy is defined as "an understanding of computer characteristics, capabilities, and applications, as well as an ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society" (Simonson, Mauere, Montag-Toradi, & Whitajer, 1987, p. 233). Also, computer literacy equips you to approach the computer in the way same (Lombardi, 1983, p.5). As Kay (1990b) stated essential criteria for becoming computer literate have included basic-information knowledge, competency in computer software applications, computer awareness, and programming ability. However, some researchers are against to this kind of knowledge pack referring to computer literacy (Levin, 1983; Baxter, 1984; Ganske & Hamamoto, 1984; Longstreet & Sorant, 1985; Rhodes, 1986). For instance, Rhodes (1986) defends the idea that an individual who is able to use the computer to satisfy personal needs is computer literate. Besides, the people attaining some competences such as learning host information in order to enhance the quality of their lives, reaching the information or using it for entertainment; being able to pursue, discuss and interpret computer innovations; being able to compare information technologies at a certain level and being able to estimate can be accepted as computer literate (Yazıcı, 2006).

Teacher's role has changed after beginning the computer usage in classrooms. Teacher has adopted a guidance role any more than a magic person knowing everything. Also, the meaning of being teacher has changed with the usage of computers in classrooms (Norton and Wiburg, 1998; Kocasaraç, 2003; Kılınç, & Salman, 2006). According to the expected teacher competencies determined by Ministry of National Education, modern-day and future teachers should use computer which is a big part of human life and influences education much (MEB, 2002). Today's and future's teachers should be able to use effective and abundantly computers being an important part of human life and was understood better to effect on education (Rosenberg, 1989).

As asserted in Kay's (1990b) study, computer literacy consists of computer awareness, programming ability and competency in computer software applications. But some researchers are against to this kind of knowledge pack referring to computer literacy (Baxter, 1984; Ganske and Hamamoto, 1984; Levin, 1983; Longstreet and Sorant, 1985; Rhodes, 1986); for example, Rhodes (1986) defends the idea that an individual who is able to use the computer to satisfy personal needs is computer literate (Kay, 1990b). Newfields (1997) gathered the characteristics of a person having computer literacy under three titles as being able to understand the basic computer using principles, being able to know about how to use at least one software and being able to use one or more software (Akt. Benzer ve Aksaya, 2012).

There are some studies aiming to bring students in computer literacy or some abilities related to computer using. In one of these studies, Akkoyunlu (1996) intended to bring fourth and fifth grade students some skills about computer using by word-process instruction in her experimental study. Additionally, she tried to see the effects of computer using in Science and Social Sciences course on the students' academic achievements and their attitudes. The study was resulted that the students' attitudes to computer using are high for both experimental group and control group. Also at the end of the study, the students' attitudes to computer using increased from *high* to *very high*. In her study about the effect of computer courses and technology use on the prospective teachers' views of internet and computer literacy, Altinay (2011) manifested that the prospective teachers' abilities of being able to use computer and internet made a positive contribution to their computer literacy. In the study aiming to determine the computer literacy level of incipient university students, Korkmaz and Mahiroğlu (2009) concluded that the very few students perceived themselves as computer literate and many of these students see themselves as that they don't have any computer literacy or have just a little. In the study, it was investigated that if computer literacy level differentiate to gender. According to the results, male students' computer literacy level is higher than the female ones.

Research problem

Understanding of teacher candidates' computer literacy level has becoming important in parallel with developing technology and communication dizzily. Therefore, using of computers in education via schools makes essential knowing about teachers' level of computer literacy, which is identified as the comfort level someone has with using computer programs and other applications associated with computers (Wikipedia). Based on this requirement, the present study was planned for finding out the level of computer literacy levels of pre-service elementary teachers based on specific demographic variables such as age, grade level, computer ownership, and computer experience. In accordance with this objective, the study specifically focuses on the following research questions:
- What are pre-service teachers' computer literacy levels?
- Are there any relationships between pre-service elementary teachers' computer literacy levels regarding Computer Literacy Scale (CLS) subscales and their demographic variables such as age, grade level, computer ownership, and computer experience?

Purpose

In recent, the Ministry of National Education in Turkey has put great efforts and financial investments to implement technology into schools. Most of elementary schools have provided with computer labs that were equipped with computers. Consequently, appraisal of teacher computer literacy levels has gained importance following the widespread availability of computers in today's schools. Elementary school teachers encounter some basic computer courses in their education period in faculty of education. During this education, prospective teachers take a course explaining what computer is. Then, its' operating system is taught. Also, it is known that *Microsoft Word*, *Excel*, *Powerpoint* and information about Internet connection are taken place in practicing part of the course. Except this, some programming language and data concepts are instructed in case these concepts can be helpful for solving a problem about computer (Şafak 1999; Kocasaraç, 2003; in Kılınç & Salman, 2006). According to the expected teacher competencies determined by Ministry of National Education, modern-day and future teachers should use computer which is a big part of human life and influences education much (MEB, 2002).

In this study, it was aimed to see the computer literacy level of pre-service elementary teachers in terms of their knowledge and skills of computer usage in elementary education department in the faculty of education. Understanding of computer literacy level and computer practicing skills of the students' can be helpful for considering if the computer courses taught in the department could reach its goal. Corbel and Gruba (2004) indicate four perspectives in the literature on computers and learning as the skills perspective, the textual practices perspective, the socio-political perspective and the information perspective.

This study target to measure pre-service teachers' computer literacy levels from their perspectives because we applied a scale instead of observing and evaluating their development on this topic.

Methods

Participants

The participants consisted of 179 pre-service elementary teachers (135 female and 44 male), ranging in age from 19 to 26, with an average age of about 22 years old, enrolled in College of Education at Adnan Menderes University in Turkey. All participants (100%) voluntarily participated in the study and were assured that their responses would be anonymous and confidential. The study was conducted during the spring semester of the 2011-2012 academic years. Taking two basic computer courses at undergraduate level was the main criteria for selecting the participants.

In elementary education undergraduate program, pre-service teachers are totally taken in a six-credit 'Computer' course in their first year. The courses divided into two semesters are compulsory and organized as the complementary courses. The courses' credit hours and their weighted percentages are presented in Table 1.

Table1. Elementary Education Program's Weighted Percentage of Computer Course

Department	Course	Total course credits (CC)	Total credits for graduation (TC)	Weighted percentage (CC/TC)*
Elementary Education	Computer-I and Computer-II	6 (3+3)	156	3.84

In particular, 'Computer I' course contains concepts of software and hardware, general computer-managed system, word processing programs, tabulation, data presentation, Internet usage, concepts of the information and communication technology (ICT), effects of the ICT on the social lives, their safety and ethical concepts, while Computer II course comprises concepts and elements of computer-based education, its theoretical frameworks, limits and application methods, determining of presentations software and their evaluations, distance education, electronic databases, positive and negative gains of computers and Internet usage. Although, the contents of the courses have some basic knowledge of computer and computer usage, 'Computer II' course is more convenient for developing computer literacy as it gives some opportunities for determining and discussing about some software and related

presentations. Also, because it is more possible that the pre-service teachers would consolidate all the information they learned before in 'Computer II' course.

Instrument

Data for the study were derived from the administration of Computer Literacy Scale. Additionally, a participant information form was utilized to gather detailed information about pre-service elementary teachers so that their responses to the instrument could be better comprehended. The participant information form consists of questions including gender, age, grade level, computer ownership, and computer experience.

Computer Literacy Scale (CLS)

The Computer Literacy Scale (CLS), developed by Kay (1990b) and adapted into Turkish by Kilinc & Salman (2006) was utilized to explore pre-service elementary teachers' computer literacy levels. The original instrument was developed with 60 students and practiced on 383 students by Kay in Toronto University. The CLS consisted of the following four subscales: (a) basic skills, (b) application software skills, (c) computer awareness skills, and (d) programming skills. Each subscale was composed of six items based on a seven-point Likert scale. Responses for each item statement range from "Very Unsure" to "Very Confident". Possible scores on the each subscale item may range from 1 to 7. It was expected that a high score on the scale indicated a possession of computer literacy with respect to computer using skills.

The CLS was reported as a valid and reliable instrument for measuring computer literacy levels of individual. Reliability analysis produced the Cronbach's alpha coefficient for the basic skills (r=.93), application software ability (r=.91), computer awareness (r=.90), and programming (r=.95). Details of the reliability and validity can be found in Kay (1990b). Turkish version of the CLS had also similar internal consistencies. Reliability analysis produced the Cronbach's alpha coefficient for the basic skills (r=.91), application software skills (r=.93), computer awareness skills (r=.94), and programming skills (r=.91). These findings indicate that the adapted version of the CLS provides a reliable assessment of computer literacy levels of Turkish pre-service elementary teachers.

Data Collection

Data were collected during the spring semester of the 2011-2012 academic years. Some instructors from the Elementary Education Department were requested to contribute 15-20 minutes of their class time to distribute the survey. All instructors agreed to have the students fill out the survey during class time. In total, four classes participated in the survey. Before distributing the survey, participants were briefly instructed on how to complete the survey and were informed of their participation rights. Overall, 179 of 180 of the surveys handed out were returned for analysis.

Data Analysis

Pre-service elementary teachers' responses to the instrument were statistically analysed with SPSS version 16.0. At first, the means and standard deviations were computed for assessing participants' computer literacy levels. Accordingly, t-test and one-way analysis of variance (ANOVA) were computed between subscales and age, grade level, computer ownership, and computer experience for testing the significance of the differences. In order to determine sources of the differences on means found in ANOVA, Scheffe test was computed.

Results and Discussion

Even it is expected to see pre-service teachers' computer literacy levels and the relationships between their levels and their demographic variables, the pre service teachers' sample reflected their perceived computer literacy levels. Their perceived computer literacy levels were measured after taking the course of Computer II, because it was expected to understand what pre-service teachers think about their learning about computer literacy.

As seen in Table 2, of the 179 pre-service elementary teachers about 83% have their own computers. Furthermore, nearly 45% of the participants declared that they have at least six-year computer experience. However, about 20% of the pre-service elementary teachers have computer experience less than four-year (Table 3). These findings indicate that more than half of the participants have enough computer experience (at least four-year).

Table2. Computer Ownership of the Pre-service Elementary Teachers

	Frequency f	Percentage %	Cumulative Percentage
No Computer	30	16.76	16.76
Has Computer	149	83.24	100.00
Total	**179**	**100.00**	

Table3. Computer Experience/Years of the Pre-service Elementary Teachers

Years	Frequency f	Percentage %	Cumulative Percentage
0-1	4	2.23	2.23
2-3	32	17.88	20.11
4-6	63	35.20	55.31
6+	80	44.69	100.0
Total	**179**	**100.0**	

Table 4 presents pre-service elementary teachers' mean scores with the standard deviations of the four subscales. The total means for all computer literacy subscales ranged from 18.0 to 35.50. Also, the standard deviations for all subscales ranged from 0.81 to 1.17. As presented in Table 4, the total means for basic skills ($\bar{X}$=35.50), application software ability ($\bar{X}$=33.20) and computer awareness ($\bar{X}$=26.4) subscales were greater than the mean for programming ($\bar{X}$=18.0) subscale. Based on the findings, the total test means for programming ($\bar{X}$= 18.0) is the lowest one as compared to other subscales. This result means that the participants in the study feel inadequate themselves on programming.

Table4. The Descriptive Statistics of the CLS

Subscale(s)	No. of Items	Mean	SD
Basic Skills	6	35.50	.81
Application software	6	33.20	1.17
Computer awareness	6	26.4	.85
Programming	6	18.0	.86

N= 179

Table 5 presents the pre-service elementary teachers' mean scores with the standard deviations of for "Basic-Skills" subscale. The arithmetic means for basic-skills subscale vary from 5.20 to 6.25. The standard deviations for individual items ranged from 1.24 to 1.81. This means that the participant students have basic computer skills at good level.

Table5. Means and Standard Deviations for the Basic-Skills Subscale

Items	$\bar{X}$	SD
1. Be able to turn on a computer and load a diskette	6.25	1.77
2. Be able to load a disk or CD	6.17	1.63
3. Be able to format a new CD	5.20	1.81
4. Be able to store files in a diskette or CD and recall them again	5.96	1.64
5. Be able to use a computer manual effectively	5.98	1.24
6. Be able to use disk operating system effectively	5.94	1.41
Total	**5.92**	**.81**

Table6. Means and Standard Deviations for the Application Software Skills Subscale

Items	$\overline{X}$	SD
7. Be able to use Word processor to create a variety of documents	6.14	1.42
8. Be able to operate computer-aided instruction or teaching software	5. 35	1.48
9. Be able to run through a computer game or simulation	5.58	1.54
10. Be able to create a data base (reports, tables etc.) using the computer	5.47	1.43
11. Be able to teach someone to use a computer software package	5.38	1.59
12. Be able to create charts or graphs with a computer	5.29	1.51
Total	**5.53**	**1.17**

Also the participant students' software skills are not at bad level. Especially, "using word processor for creating a variety of documents" is the most dominated skill. Although they think that they are not good enough at "creating charts or graphs with a computer", "operating computer-aided instruction or teaching software" and "teaching someone using a computer software package", their skills of "using software" are better than "programming skills".

Table7. Means and Standard Deviations for the Programming Skills Subscale

Items	X	SD
13. Be able to see a program error	4.08	1.47
14. Be able to program original software that you could sell	2.76	1.53
15. Be able to write a complex computer program (over 200 lines)	2.60	1.45
16. Be able to write a computer program in BASIC or Logo	2.56	1.54
17. Be able to write a computer program in a high level language (e.g., Pascal, Fortran, C, Cobal)	2.43	1.50
18. Be able to read and understand a computer program	3.58	1.74
Total	**3.00**	**.86**

If it is looked at the means and correlations of *Computer Literacy Scale's subscales*, it can be seen that the most insufficient subscale that the students think is "Programming". However, their ideas about their skills of programming scales vary to different items. The item that they feel very weak themselves is "writing a computer program in a high level language". Following this skill, the second difficulties programming skill is "writing a computer program in BASIC or Logo". The most achievable skill in programming is "seeing a program error". This skill means that the students can understand and entitle program errors when they meet them.

Table8. Means and Standard Deviations for the Computer Awareness Skills Subscale

Items	$\overline{X}$	SD
19. Be able to discuss strengths and weaknesses of various software packages	3.40	1.64
20. Be able to identify the basic parts of computers and their functions	4.08	1.67
21. Be able to identify ethical issues regarding computers	5.06	1.46
22. Be able to elaborate on the social and economic impact of computers in society	5.56	1.40
23. Be able to discuss the history of computers	4.22	1.52
24. Be able to elaborate on various computer applications in society	4.06	1.57
Total	**4.40**	**.85**

Table9. The Correlations between Subscales and Age, Grade Levels, Computer Ownership, and Computer Experience

	Age	Grade level	Computer ownership	Computer experience
Basic Skills	0.50**	0.01	0.22**	0.34**
Application Software	0.54**	-0.15	0.23**	0.27**
Programming	0.35**	0.03	0.11	-0.04
Computer Awareness	0.52**	0.05	0.30**	0.27**

** $p < 0.05$

Table 9 contains a complete breakdown of independent variable comparisons made using CLS's subscales scores. As seen in Table 9, statistically significant differences were found for all subscales for age, and for some subscales for computer ownership, and computer experience. To investigate the relationship between pre-service elementary teachers' computer literacy and years of computer experience, scores for years of computer experience were categorized into four levels: from 0 to 1, 2 to 3, 4 to 6, and 6+ years of computer experience. The ANOVA tests were used to analyze the differences among the four groups and their computer literacy levels. The findings showed that pre-service elementary teachers' computer literacy levels regarding basic skills, computer software skills, programming skills, and computer awareness skills were not affected by their grade level.

Conclusion and Recommendations

The purpose of the study was to investigate pre-service elementary teachers' computer literacy levels as based on their ideas. The low mean of "programming" skill means that pre-service elementary teachers need some requirements of high-level competences and they do not have enough learning experiences on programming. Since most of the pre-service teachers are not prepared to teach about computing or use a computer in teaching, they may need computer literacy as part of their work. As mentioned in the in-service education of teachers conducted by Martin and Heller (1982), teachers should be able to read and write a simple program, have experience using education software and documentation, have a working knowledge of computer terminology, be able to discuss the history of computers and be able to discuss moral and human impact issues to the Association for Computing Machinery.

Successful computer education must meet the basic needs of the pre-service elementary teachers. If the students recognize that the computer courses have some new information or skills, which are useful, that can be interesting to them. Also, the classroom size is one of the determinants of the practicing of the information. Additionally, the computer equipment in the classrooms and their qualities are some other determinants for a well design computer course. Martin and Heller (1982) assert that video presentations or lectures would be better for large group instruction, besides small groups should be preferred for workshops. But the best teaching can be practiced by one-on-one training or a tutor.

In the study, the time of computer course taken by pre-service classroom teachers is six hours in total as two full three-credit college courses. The point is whether the amount of time is enough for generating computer literacy for them. Another important point is that people are exposed to technology substantially in their daily lives and it is inevitable that people can have some basic information and usage of computer. But, this is not enough for these people for being a computer literate, so education and the computer courses are required.

People who can be accepted as computer literates should have some skills of data preparation and its presentation. Also, they should be adapted to new technological innovations as regarding to computer usage. If they can construct the new knowledge on the old one and make connection between them, they can be computer literates also.

In this study we did not looked at the instructor's effect on the level of students' perceived basic computer and software skills. Therefore, we cannot assert that it is indeed just related with the content of course or just the instructor's teaching skills. But, the participant students' programming language knowledge is still largely affected from these two variables (course content and instruction-ins

It should be focused on that faculty of education which train teachers about the education at different programs will be more important in coming years if computer literacy can be included in the education programs smoothly. Today's and future's teachers should be able to use effective and abundantly

computers being an important part of human life and was understood better to effect on education. The competence centered that teachers need to become skillful at understanding that which program and topics are sufficient and what these competences provide for students, rather at teacher's competences about how computer work, its capacity and how it can be programmed. Teacher's role in classroom has changed recently with use of computer in classroom. Teacher is not a magical person who has to know everything, but she is a guide. Also, the context of profession of a teacher has changed when computers go into education process in classroom (Norton, & Wiburg, 1998; Kocasarac, 2003) (in Kılınç, & Salman, 2006). Correspondingly, this study shows that students know the computers' and teachers' roles in classroom.

In the study, we understood that the mean of computer literacy has changed to technology literacy (especially using mobile phone and tablets). Therefore, more experimental studies, which try to improve the computer literacy of pre-service elementary teachers to document the progressive development of computer literacy, may be conducted.

References

Akkoyunlu, B. (1996). The effect of integration of computer literacy skills into curriculum on 4th and 5th grades primary pupils' achievements and attitudes. *Hacettepe University Journal of Education, 12,* 127-134.

Altınay, Z. (2011). Bilgi toplumunda bilgi, internet ve bilgisayar okuryazarlığı: Öğretmen adaylarının görüşleri. *Eğitim Teknolojileri Araştırmaları Dergisi, 2*, 3, 20-33.

Benzer, A. & Aksaya, H. (2012). Bilgisayar okurayazarlığı. In Ed. A. Benzer and H. Aksaya, Bilgisayar Okuryazarlığı, I-II. Pegem Akademi, Ankara.

Corbel, C. & Gruba, P. (2004). *Teaching computer literacy*. Sydney: National Centre for English Language Teaching and Research.

Hoffman, M., & Blake, J. (2003). Computer literacy: Today and tomorrow. *Journal of Computing Sciences in Colleges*, *18*, 5, 221-223.

Kay, R. H. (1990b). The relation between locus of control and computer literacy. *Journal of Research on Computing in Education, 22*, 4, 464-474.

Kılınç, A. & Salman, S. (2006). Fen ve matematik alanları öğretmen adaylarında bilgisayar okuryazarlığı. *Mersin University Eğitim Fakültesi Dergisi*, 2, 2, 150-166.

Korkmaz, O. & Mahiroğlu, A. (2009). Üniversiteyi yeni kazanmış öğrencilerin bilgisayar okuryazarlık düzeyleri. *Kastamonu Eğitim Dergisi, 17*, 3, 983-1000.

Lombardi, J.V. (1983). Computer literacy- Basic concepts and language. pp. 1-9. Indiana University Press, Bloomington. ISBN: 0-253-31401-1.

Martin, C. D., & Heller, R. S. (1982). Computer literacy training for teachers. *Educational Leadership, 40*, 1, 46-47. http://www.ascd.org/ASCD/pdf/journals/ed_lead/el_198210_martin.pdf

Newfields, T. (1997). *Computer literacy: Issues and approaches.* The Proceedings of the 2nd Annual JALT CALL SIG Conference, pp. 63-68. Chubu University, Japan.

Rosenberg, R. L. (1989). *Computer literacy education.* Technical Report MIT, Cambridge, MA.