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Computer Use of Science Teachers and Their Attitudes toward Computer Supported Teaching: A Sample from Turkey

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ABSTRACT

The aim of this study was to examine (i) science teachers' level of computer use, (ii) their attitudes toward Computer Supported Teaching (CST), and (iii) to investigate the correlation between science teachers' level of computer use and their attitudes toward CST. 75 female and 97 male totally 172 science teachers (91 science and technology, 26 physics, 26 chemistry, and 29 biology teachers) from 96 primary and secondary schools participated in the research during the 2008-2009 semester in Gaziantep, Turkey. Computer Supported Teaching Questionnaire was used to collect data. The questionnaire has three parts, which consists of demographic items, level of computer use items, and Attitude toward Computer Supported Teaching items. The data gathered were analyzed by SPSS 14 software. Cronbach's Alpha value was 0.93. Mean, standard deviation, and Pearson correlation analyses were used. Results indicated that science teachers' level of computer use was high and their attitudes toward CST were positive. There was a moderate positive correlation between teachers' computer use level and their attitudes toward CST. Findings were discussed in the framework of the related literature, and some suggestions were made.

Keywords: Computer Supported Teaching; Science Education; Teacher Attitude; Computer Use.

INTRODUCTION

The rapid developments in technology have made tremendous changes in all aspects of life. For instance, people can pay tax easily, gather information from different countries instantly, even gain money or make payment without going to work/bank. Understanding the effects of new technologies on the workplace and everyday life, today's educational organizations try to redesign their programs and classroom activities in order to reduce the teaching and learning technology gap between today and the future. According to Tomei

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(2005), this process needs effective integration of technologies, especially computers into existing context to provide students with knowledge of subject areas, to develop active learning and to increase professional productivity.

Today computers are used in most courses to improve student learning. Computer technologies are becoming increasingly effective components of education (Papadouris & Constantinou, 2008). Researchers have shown the positive effects of the use of information and communications technology (ICT) on pupils' learning (Mumtaz, 2000).

Teachers perceived that immediate feedback to students and provision of alternative teaching techniques are the major advantages of computer-aided instruction (Wang & Chan, 1995). According to Azarmsa (1991), CST is the use of computer by the teachers in teaching as an interactive process which makes learning easier. Educators have begun to use computer supported teaching methods more often to increase the participation of students to the learning activities and to promote access to learning materials (Yaman, 2007).

Perhaps more than any other fields, science teaching has benefited from the developments of computer technology (Ogunkola, 2008). Clearly, the role of ICT in science education is significant. Where investigative science plays a central part, there are applications of ICT, which can both support 'live' bench work and some, which can replace it, providing a virtual system to investigate using the same principles as in the laboratory (McFarlane & Sakellariou, 2002).

CST increases student achievement in science education more than traditional teaching methods do (Aiello & Wolfe, 1980; Akçay, Tüysüz, & Feyzioğlu, 2003; Bayraktar, 2002; Demircioğlu & Geban, 1996; Park, Khan, & Petrina, 2009). In addition, some studies revealed that computer supported science education positively affects students' attitudes toward science education (Akçay et al., 2003; Park et al., 2009; Schank, 1994; Yenice, 2003). CST in science education also increases the interest of the students and decreases teachers and students' time allocated for teaching and learning (Yumuşak & Aycan, 2002). Computer-assisted instruction has the potential to help lower achieving students in science classes and may increase enrolment rate in science lesson (Park et al., 2009). CST also increases conceptual understanding of students (Flick & Bell, 2000; Schank, 1994).

According to Redish and Steinberg (1999) "it is encouraging that we have found that interactive physics education and instructional strategies lead to better classroom results when compared to traditional instruction". And also it was found that CST was more effective than traditional method on remediating students' misconceptions related to photosynthesis (Köse, Ayas, & Taş, 2003).

A research organization in USA indicates that computer-based technology should be integrated into the context of science content and science education should take advantage of the unique features of computer technologies (National Research Council, 1996). So, research explicitly reports that science education and computer technology created a good cooperation over the 21 century (Flick & Bell, 2000).

ICT in Turkish Science Education

Turkey has made the considerable investment in implementing ICT in schools to help students and educators improve their ICT-related knowledge and skills (Yalın, Karadeniz, & Şahin, 2007). In Turkey, ICT-related initiatives began as early as 1984 (Göktaş, Yıldırım, & Yıldırım, 2008), then in 1991, national educational policy included computer-aided instruction (Akbaba-Altun, 2006). General objectives of the Turkish education system put emphasis on improving ICT infrastructure in schools and developing methods for supporting to use ICT in classrooms (Resmi Gazete, 2006).

Turkish Ministry of National Education (MoNE) has developed policies and initiated a number of projects to improve technological infrastructure and to integrate technology into schools. Some of these projects are Computer-Aided Education (CAE) Project, which was started in 1984, "Catching the Epoch 2000", "Improving the National Education", "Basic Education Project, Phase-I and Phase-2" which are supported by World Bank and "MoNE Internet Access Project" (Summak, Bağlıbel, & Samancıoğlu, 2010). Within the scope of these projects, 2837 technology classrooms have been established in 2451 schools. And about 50.000 computers were offered at a special rate for administrators, students, and teachers at schools. And also at the end of 2008, approximately 38.000 school computers were connected to the internet via broad-band connection (MEB, 2009a; MEB, 2009b). Additionally, 25,000 elementary school teachers were trained on computer literacy, and 15,928 elementary school teachers received advanced computer training (Akbaba-Altun, 2006).

In another project named "ICT Supported Science Laboratories Project", MoNE aims supporting physical infrastructure of the laboratories, creating a web site, including science education materials such as interactive experiments, animations, simulations, developing CST materials, determining educational methods and strategies for the ICT supported laboratories, and instructing teachers about the ICT supported laboratories (EĞİTEK, 2010). MoNE also planned to establish 2000 ICT Supported Science Education Laboratories into schools (MEB, 2008). More than half of these laboratories, 1333 have been established until now. In addition, MoNE will have provided in-service-training about the laboratories to science teachers by the end of 2010 (MEB, 2010).

In Turkish literature some empirical researches about science educators' attitudes toward computer supported teaching and technology use in education have been conducted by many researchers (Akkoyunlu, 1996; Cavas, Cavas, Karaoğlan, & Kışla, 2009; Cavas & Kesercioglu, 2003; Kutluca & Ekici, 2010; Pektaş, Köse, Çelik, Katrancı, & Pektaş, 2008; Türkmen, 2006; Türkmen, Pedersen, & Mccarty, 2007). In one of these studies, Kutluca and Ekici (2010) investigated the attitude of teacher candidates (including science teacher candidates) toward computer-assisted education (CAE). This research showed that candidate teachers' attitudes toward CAE were positive. Moreover, no significant difference between the attitudes of teacher candidates toward CAE and the program they enrolled (e.g. chemistry, biology, physics) was found (Kutluca & Ekici, 2010). A similar study revealed that the majority of science teachers had positive attitudes toward CAL (Cavas & Kesercioglu, 2003).

Cavas et al. (2009) investigated Turkish primary science teachers' attitudes toward ICT use in education. The study demonstrated that almost all Turkish science teachers have positive attitudes toward ICT in education. The results of study also revealed that almost half of the Turkish science teachers use computers in their classes. In another study, Türkmen (2006) investigated Turkish science education faculty members' educational technology use and understandings. The study showed that most of the science education teaching staff reported themselves in intermediate and/or advanced level technology user. The faculty members' knowledge level of educational technology use in science education was low. Yet, the results showed that the staff did not use educational technology in their classrooms. The study also expressed that most of Turkish science education staff had not taken enough technology or computer courses. Science education faculties tend to focus more on the older and simpler instructional applications of computer technology (e.g., computer assisted instruction, word processing) and older educational technologies (e.g., overhead projectors, calculators, slides) and less on exposure to and practice with newer, more sophisticated tools (e.g., electronic networks, hypermedia, digital cameras, integrated media, problem-solving applications). The study also revealed that these faculties believe that technology support should become an integral part of teacher education and classroom curricula. In another study,

Türkmen et al.(2007) found that Turkish pre-service science education teachers were relatively unfamiliar with the advantages of educational technology. However, they had a desire to know more about the advantages of educational technology and its use in the instruction.

Akkoyunlu (1996) found a meaningful relationship between pre-service teachers' knowledge about technology and their attitude toward technology. She found that pre-service teachers with more information about technologies have more positive attitude toward the use of technologies in teaching and learning environments. Pektaş, Köse, Çelik, Katrancı, & Pektaş (2008) conducted a research to determine Turkish pre-service science teachers' attitude toward CST. Study showed that prospective teachers' attitude toward CST was positive.

Teachers are change agents in schools. They play very important roles in integrating technology into schools (Teo, 2008). Furthermore, the success of any initiatives to implement technology in an educational program depends strongly upon the support and attitudes of teachers involved (Christensen, 2002; Griffin, 1998; Hew & Brush, 2007; Huang & Liaw, 2005; Jacobsen, Clifford, & Frieson, 2002; Yildirim, 2007; Zhao & Frank, 2003).

Teachers are at the center of the successful implementation of these technologies in the classroom (Ng & Gunstone, 2003), because teachers' attitude toward computers is an important factor related to the teacher's role toward the effective use of computers in education (Griffin, 1998). Therefore, the question of teacher attitude toward computers is critical to the effective use of computers in education (Yuen & Ma, 2001; Yushau, 2006).

According to literature, it is important to describe science teachers' level of computer use, their attitudes toward CST and the relationship between their level of computer use and their attitudes toward CST (Mumtaz, 2000). Because teachers' use of Computer Based Teaching (CBT) in their classrooms will depend on their attitude toward computers (Moroz & Nash, 1997). Accordingly, literature suggests that teachers' attitude toward computers is a key factor regarding to their CBT uses for instruction (Hung & Hsu, 2007; Lawton & Gerschner, 1982; Lloyd & Gressard, 1984; Yildirim, 2000; Zhao & Frank, 2003). A major reason for studying teachers' attitude toward CST is that it is a key predictor for future computer use in the classroom (Hung, Hsu, & Tsou, 2004; Myers & Halpin, 2002; Ravitz, Wong, & Becker, 1999; Teo, 2008). In the area of science, there has been the limited evaluation into teachers' attitudes toward the use of computer-based technologies for instruction (Ng & Gunstone, 2003).

In Turkish literature, although there are some researches regarding science teachers' attitude toward CAL/CAE/CST (Cavas & Kesercioglu, 2003) (Kutluca & Ekici, 2010) (Pektaş, et al., 2008) and use of computers and other ICTs in education (Cavas, et al., 2009) (Türkmen, et al., 2007), little is known about the relationship between science teachers' attitudes toward CST and their level of computer use in the classroom.

The aim of this study was to examine science teachers' level of computer use, their attitudes toward Computer Supported Teaching (CST) and also to investigate the correlation between science teachers' level of computer use and their attitudes toward CST. Based on the aim of the study, following research questions were formulated and addressed:

1. What is the level of computer use of science teachers?
2. What is the attitude of science teachers toward CST?
3. Is there a relationship between science teachers' attitudes toward CST and their level of computer use?

METHODOLOGY

In this study, the descriptive research method was employed. This method is defined as gathering information about the existing condition (Creswell, 1994). All data were gathered by using a questionnaire.

a- Participant

The survey was sent to 228 science teachers at 96 primary and secondary schools in Gaziantep, and 191 were returned. Due to incorrect marking, 19 of the returned surveys were deemed invalid. At the end of the application procedure, 172 valid surveys were analyzed to answer the research questions. Data were gathered from total 172 science teachers consisting of the 91 science and technology, 26 physics, 26 chemistry, and 29 biology were in 2008-2009 academic year.

Table 1. *Demographic Profile of Participants (N=172)*

Demographic Variables	N	%
School Type		
Primary School	95	55.2
Secondary School	87	44.8
Gender		
Female	75	43.6
Male	97	56.4

As seen from Table 1 above, 52.2% (N=95) of all participants were primary school science and technology teachers. The rest of them (44.8%, N=87) were physics, chemistry, and biology teachers in secondary schools. Also, the Table demonstrated that 43.6% of participants were female (N=75) and 56.4% were male (N=97).

b- Measurement Tools

The data were collected by Attitude toward Computer Supported Teaching Questionnaire. The questionnaire was developed by Arslan (2006). He performed factor analysis assessing validity and calculated Cronbach-alpha measuring reliability of the questionnaire. Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity (BTS) were conducted to determine relevance of factor analysis for the data (Büyüköztürk, 2002; Büyüköztürk, 2007). KMO value of the questionnaire was 0.88 and BTS significance value was 0.00. He found one-factor construct. For reliability analysis, the Cronbach-alpha value was calculated 0.93. These values reveal that the questionnaire is valid and reliable.

The survey had three sections. The first section of the survey was used to collect descriptive information. The second part of the survey was used to obtain science teachers' level of computer use. Response categories ranging from "1-None", 2- Basic, 3-Good, 4-Excellent 5-Superior" and numerical borders are in Table 2 below.

Table 2. *The Numerical Borders of Level of Use Questionnaire*

Points	Choices	Numerical Borders
1	None	1.00-1.79
2	Basic	1.80-2.59
3	Good	2.60-3.39
4	Excellent	3.40-4.19
5	Superior	4.20-5.00

The last section of the survey was used to collect information on science teachers' attitudes toward CST with response categories ranging from "Strongly Disagree" to "Strongly Agree". Numbers from 1 to 5 were assigned to the scale responses. These are given in Table 3 below.

Table 3. *The Numerical Borders of Attitudes toward CST Questionnaire*

Points	Choices	Numerical Borders
1	Strongly Disagree	1.00-1.79
2	Disagree	1.80-2.59
3	Slightly Agree	2.60-3.39
4	Agree	3.40-4.19
5	Strongly Agree	4.20-5.00

c- Data analyze

In our research, Cronbach's alpha value was calculated as 0.93. All valid surveys' data were analyzed in the SPSS 14 statistical packet program. Negatively worded items were reverse coded so that a higher score consistently reflects a more positive evaluation. Descriptive analysis such as mean ($\overline{X}$) and standard deviation (SD) were used in first and second research questions. Pearson Correlation Analysis was conducted to investigate the last research question.

FINDINGS

Mean and standard deviation were calculated to determine science teachers' level of computer use, which was our first problem. These statistics and descriptor of each item were shown in table 4.

Table 4. *Questionnaire of Science Teachers' Level of Computer Use*

Items	$\overline{X}$	SD	Descriptor
Using Web (Internet Explorer, search engine-Google).	3.92	1,05	Excellent
Communication via computer (e-mail, MSN etc.).	3.80	1,17	Excellent
Basic computer use (working with CD, moving to directory).	3.78	1,11	Excellent
Using Word Processing (MS Word)	3.40	1,28	Excellent
Using the Scanner	3.04	1,40	Good
Using Spread sheet (MS Excel)	2.99	1,33	Good
Using Presentation Software (MS PowerPoint)	2.78	1,35	Good
Using Database Software (MS Access)	2.24	1,18	Basic
Preparing Web page (MS FrontPage)	1.96	1,16	Basic
MEAN OF ALL ITEMS	**3.10**	**1.00**	**Good**

As indicated in table 4, regarding the level of science teachers' use of computer, mean value of all items was 3.10. This value indicates that participant science teachers were at "good" level in computer use. Also, it was shown in the table that the respondent teachers' Web use ($\overline{X}$=3.92), communication via computer ($\overline{X}$=3.80), basic computer ($\overline{X}$=3.78), and Word Processing use (3.40)" level were excellent. Besides, the respondents informed their some computer skills such as "using the scanner ($\overline{X}$=3.04), using Spreadsheet ($\overline{X}$=2.99), and using presentation software ($\overline{X}$=2.78)" were at good level. The teachers were relatively the lowest level in "using database software ($\overline{X}$=2.24), and preparing the web page ($\overline{X}$=1.96)".

In order to find out the attitudes of science teachers toward CST, we calculated mean and standard deviation for each item related. These values were shown in Table 5 below.

Table 5. *Questionnaire of Science Teachers' Attitude toward CST*

Statements	$\overline{X}$	SD	Descriptor
1. Computer is not use in education effectively*	4.24	1.00	Strongly Agree
2. I like and prefer to use the computer in my class.	3.97	.98	Agree
3. I don't use the computer for supporting my lesson except obligation.*	3.99	.96	Agree
4. Computer supported learning is important for me.	4.13	.85	Agree
5. Students can't improve their creativity in computer supported learning.*	4.03	.95	Agree
6. I search the ways for using the computer effectively in my classes.	3.95	.85	Agree
7. I can't associate the computer and education.*	4.39	.86	Strongly Agree
8. Students learn better in the computer used classes.	3.94	.88	Agree
9. I prefer lecture instead of computer supported learning.*	3.63	1.04	Agree
10. Teachers should be encouraged for using the computer.	4.42	.73	Strongly Agree
11. Computer supported teaching is a waste of time.*	4.18	.93	Agree
12. Computer is an effective tool attracting students.	4.19	.77	Agree
13. Students learn less with computer supported learning than the other methods and techniques.*	3.99	.94	Agree
14. Computer supported learning is enjoyable.	4.03	.84	Agree
15. Contribution of education with computer supporting can not afford studying.*	4.05	.96	Agree
16. Computer has to be use in all classes actively.	4.20	.83	Strongly Agree
17. I'd like not to use the computer during my class.*	4.22	.86	Strongly Agree
18. I think the computer is an effective teaching tool.	4.12	.87	Agree
19. I want the computer off immediately.*	3.81	1.07	Agree
20. I try to use the computer in my class.	3.84	.93	Agree
MEAN OF ALL ITEMS	**4.07**	**.60**	**Agree**

Significant of the probability level is 0.05 *: Reverse-scored items.

It can be seen from Table 5, generally the teachers' attitudes toward CST were positive. Overall mean of CST scale was 4.07. This value indicates that science teachers are "agree" to support classroom activities by using computers. The teachers, especially "strongly agree" about "encouraging to use the computer ($\overline{X}$=4.42)", "associating computer and education" ($\overline{X}$=4.39), "would like to use the computer during my class"($\overline{X}$=4.22) "using the computer in all classes actively"($\overline{X}$=4.20).

To investigate the relationship between attitudes toward CST and level of computer use of science teachers, Pearson Correlation Analysis was conducted. The result of the analysis was given below in Table 6.

Table 6. *Pearson Correlation Analysis Result regarding Third Problem*

		Level of Computer Use	**CST**
Level of Computer Use	Pearson Correlation	1	.434
	Sig. (2-tailed)		**.000**
	N	172	172

Table 6 shows correlation analysis results between the teachers' level of computer use and their attitudes toward CST. The analysis of the data revealed that the teachers level of computer use was positively moderate correlated with their attitudes toward CST (r=.434 and p=.000).

DISCUSSION and CONCLUSION

Through this study, firstly it was found that means of "web use", "communication via the internet", "basic computer use", and "word processing use" items were high regarding teachers' level of computer use. In a research, Hung & Hsu (2007) found secondary school science teachers most commonly used computers to access the internet in order to search for information. The other most common use of the computers consists of document editing, teaching related jobs and email. Similarly, teachers had the high frequency of using word processing, the internet, and e-mail (Kutluca, 2010; Šorgo, Verčkovnik, & Kocijančič, 2010). Some similar studies showed that the internet, e-mail, and educational application had high percentage in teachers' use of computer applications in their classroom activities (Ocak & Akdemir, 2008; Phelps & Maddison, 2008). Secondly, this study revealed that the participant teachers' mean value regarding their database software use and web page designing were relatively low. Some researchers reported that teacher rarely used database and web designing program in educational activities (Kutluca, 2010; Ocak & Akdemir, 2008). Therefore, the participants had relatively low mean value in web design and database use.

Another finding of this study was that participant teachers' attitudes toward CST were positive. The teachers especially reported that they "encourage using computer", "associate computer with education", "would like to use the computer during their class" and "use computer in all classes actively". This finding is congruent with some other researches (Gray & Souter, 2000; Ng & Gunstone, 2003; Ogunkola, 2008; Cavas et.al ,2009). Ogunkola (2008) found that the science teachers in Nigeria had the positive attitude toward computers. Also another study demonstrated that most of the secondary science teachers had embraced the introduction of ICT to school well and were generally positive about their potential in the classroom (Ng & Gunstone, 2003). Gray & Souter (2000) reported in their research that, relative to other subject teachers, science teachers came out positive with regard to use of and confident in ICT. Cavas et.al (2009) similarly emphasized that, almost all participants Turkish science teachers of their study had positive attitude toward ICT in education.

According to Ogunkola (2008), the positive attitude of the science teachers could be attributed to the science teachers' past experiences. Kumar and Kumar (2003) reported that most teachers believed that the amount of computer experience had a positive effect on attitude toward computers.

The last finding of this research revealed that the level of science teachers' computer use was positively correlated with their attitudes toward CST. In other words, increasing the science teachers' attitude toward CST seemed to improve the level of computer application use of the teachers. In another empirical study, Hung & Hsu (2007) found that there was a direct correlation between the degree of positive attitude toward computers and degree of application of CBT in science classrooms. Some researches revealed that teachers' attitude toward computers often was a key factor associated with their CST uses (Becker, 2000; Hung et al., 2004; Khine, 2001; Kluever, Lam, & Hoffman, 1994; Ravitz et al., 1999; Yuen & Ma, 2001; Zhao & Frank, 2003). Ravitz et al. (1999) suggested that teachers' attitudes and beliefs regarding technology were of great importance in their decisions to adopt and frequently use technology in the classroom.

In conclusion, this study showed that there was a positive moderate correlation between the level of science teachers' computer use and their attitudes toward CST. This means that the teachers' attitudes toward CST could be the predictors of their level of computer use. The former studies (Kumar & Kumar, 2003; Ogunkola, 2008) showed that teachers' positive attitude towards computer was related with their past computer experience. We suggested that science teachers need to be involved in computerized environments and applications, and such an environment should be provided for them. For to do this, the school computers should be accessible for the teachers' individual and instructional use. Future researches may focus on comparing the results of this study with a larger sample using a longitudinal design to examine computer attitudes over time.

REFERENCES

Aiello, N. C. & Wolfe, L. M. (1980). *A meta-analysis of individualized instruction in science* Boston: American Educational Research Association.

Akbaba-Altun, S. (2006). Complexity of integrating computer technologies into education in Turkey. *Educational Technology & Society*, 9(1), 176-187.

Akçay, H., Tüysüz, C., & Feyzioğlu, B. (2003). Bilgisayar destekli fen bilgisi öğretiminin öğrenci başarısına ve tutumuna etkisine bir örnek: Mol kavramı ve Avogadro sayısı [A sample to effect on student attitude and success of computer assisted science teaching: Mol Cconcept and Avogadro number]. *The Turkish Online Journal of Educational Technology*, 2(2), 57-66.

Akkoyunlu, B. (1996). Öğrencilerin bilgisayara karşı tutumları. *Eğitim ve Bilim*, 20(1), 15-29.

Arslan, A. (2006). The attitude scale toward making computer supported education. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi*, 3(2), 24-33.

Azarmsa, R. (1991). *Educational Computing-Principles and Applications.* New Jersey: Educational Technology Publications.

Bayraktar, S. (2002). A meta-analysis of the effectiveness of computer-assisted instruction in science education. *Journal of Research on Technology in Education,* 34(2), 173-188.

Becker, H. J. (2000). Findings from the Teaching, Learning, and Computing survey: Is Larry Cuban right? *Education Policy Analysis Archives*, 8(51). Retrieved October 3, 2010, from http://epaa.asu.edu/epaa/v8n51/.

Büyüköztürk, Ş. (2002). Faktör analizi: Temel kavramlar ve ölçek geliştirmede kullanımı [Factor analysis: Basic concepts and using to development scale]. *Eğitim Yönetimi Dergisi*, 32, 470-483.

Büyüköztürk, Ş. (2007). *Sosyal bilimler için veri analizi el kitabı (7.Baskı) [Data analysis handbook for social science- 7 Edition]*. Ankara: PegemA Yayıncılık.

Cavas, B. & Kesercioglu, T. (2003). Primary science teachers' attitudes toward computer assisted learning. *Ege Journal of Education*, 3(2), 35-43.

Cavas, B., Cavas, P., Karaoğlan, B., & Kışla, T. (2009). A study on science teachers' attitudes toward information and communication technologies in education. *The Turkish Online Journal of Educational Technology*, 8(2), 20-33.

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

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches*. Thousand Oaks, CA: SAGE Publications.

Demircioğlu, H. & Geban, Ö. (1996). Comparing traditional problem solving activities and computer aided instruction regarding academic success in science education. *Hacettepe University The Journal of Education,* 12, 183-185.

EĞİTEK. (2010). Yürütülen projeler. Retrieved April 14, 2010, from http://egitek.meb.gov.tr/KapakLink/ Projeler/YurutulenProjeler.html.

Flick, L. & Bell, R. (2000). Preparing tomorrow's science teachers to use technology: guidelines for science educators. *Contemporary Issues in Technology and Teacher Education*, 1(1), 39-60.

Göktaş, Y., Yıldırım, S., & Yıldırım, Z. (2008). The keys for ICT integration in K-12 education: Teachers' perceptions and usage. *Hacettepe University The Journal of Education, 34*, 127-139.

Gray, D. S. & Souter, N. (2000). Secondary science teachers use of, and attitudes towards, ICT in Scotland. *Paper presented at the International Symposium "BioEd 2000": The Challenge of the next Century*. UK: Scotland.

Griffin, J. (1998). CAL innovation as viewed by purchasers of computer software in secondary schools. *Journal of Computer Assisted Learning,* 4(1), 34-43.

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(3), 223–252.

Huang, H. M. & Liaw, S. S. (2005). Exploring user's attitudes and intentions toward the web as a survey tool. *Computers in Human Behavior*, 21(5), 729-743.

Hung, Y. W. & Hsu, Y. S. (2007). Examining teachers' CBT use in the classroom: A study in secondary schools in Taiwan. *Educational Technology & Society*, 10(3), 233-246.

Hung, Y. W., Hsu, Y. S., & Tsou, C. H. (2004). Integrating computer-based technology into instruction - A preliminary study in Taiwan. *Paper presented at the Annual Meeting of the National Association for Research in Science Teaching*. Canada: Vancouver.

Jacobsen, M., Clifford, P., & Frieson, S. (2002). Preparing teachers for technology integration: Creating a culture of inquiry in context of use. *Contemporary Issues in Technology and Teacher Education*, 2(3), 363-388.

Khine, M. S. (2001). Attitudes toward computers among teacher education students in Brunei Darussalam. *International Journal of Instructional Media*, 28(2), 147-153.

Kluever, R. C., Lam, T.C. M. & Hoffman, E. R. (1994). The computer attitude scale: Assessing changes in teachers' attitudes toward computers. *Journal of Educational Computing Research*, 11(3), 251–256.

Köse, S., Ayas, A. & Taş, E. (2003). Bilgisayar destekli öğretimin kavram yanılgıları üzerine etkisi: Fotosentez [The effects of computer-based instruction on misconceptions: Photosynthesis]. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi,* 2(14), 106-112.

Kumar, P. & Kumar, A. (2003). Effect of a web-based project on pre-service and in-service teachers' attitude toward computers and their technology skills. *Journal of Computing in Teacher Education*, 19(3), 87-91.

Kutluca, T. (2010). Investigation of teachers' computer usage profiles and attitudes toward computers. *International Online Journal of Educational Sciences*, 2(1), 81-97.

Kutluca, T. & Ekici, G. (2010). Examining teacher candidates' attitudes and self-efficacy perceptions towards the computer assisted education. *Journal of Hacettepe University Education Faculty*, 38, 177-188.

Lawton, J. & Gerschner, V. T. (1982). A review of the literature on attitudes towards computers and computerized instruction. *Journal of Research and Development in Education*, 16(1), 50-55.

Lloyd, B.H. & Gressard, C. (1984). Reliability and factorial validity of computer attitude scales. *Educational and Psychological Measurement*, 44(2), 501-505.

McFarlane, A. & Sakellariou, S. (2002). The role of ICT in science education. *Cambridge Journal of Education*, 32(2), 219-232.

MEB. (2008). *Ulaştırma Bakanlığı ile Protokol İmzalandı*. Retrieved April 20, 2010, from http://www.meb.gov.tr/haberler/haberayrinti.asp?ID=6317.

MEB. (2010). *BT Destekli Fen Laboratuarı Kullanım Kurs [Training of using ICT supported science laboratory]*. (B.08.HED.0.25.06.00/6733 sayı ve 24/11/2009 tarihli yazı). Retrieved September 22, 2010 from http://btfenlab.meb.gov.tr/belge/BT_Destekli_Fen_Lab.pdf.

MEB. (2009a). *Eğitim Teknolojileri Genel Müdürlüğü*. Retrieved September 5, 2009 from http://egitek.meb.gov.tr/.

MEB. (2009b). *MEB Internet Erişim Projesi*. Retrieved September 5, 2009 from http://www.meb.gov.tr/ADSL/adsl_index.html/.

Moroz, P. A. & Nash, J. B. (1997). Bath county computer attitude scale: A reliability and validity scale. *Paper presented at the Annual Meeting of the American Educational Research Association*, Chicago, USA. Retrieved September 10, 2009 from the ERIC database. (ED408319)

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, 9(3), 319-341.

Myers, J. M. & Halpin, R. (2002). Teachers' attitudes and use of multimedia technology in the classroom: Constructivist-based professional development training for school districts. *Journal of Computing in Teacher Education*, 18(4), 133-140.

National Research Council (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

Ng, W. & Gunstone, R. (2003). Science and computer-based technologies: Attitudes of secondary science teachers. *Research in Science & Technological Education*, 21(2), 243 -264.

Ocak, M. A. & Akdemir, O. (2008). An investigation of primary school science teachers' use of computer applications. *The Turkish Online Journal of Educational Technology*, 7(4), 54-60.

Ogunkola, B. J. (2008). Computer attitude, ownership and use as predictors of computer literacy of science teachers in Nigeria. *International Journal of Environmental & Science Education*, 3(2), 53-57.

Papadouris, N. & Constantinou, C. P. (2008). A methodology for integrating computer-based learning tools in science curricula. *Journal of Curriculum Studies*, 41(4), 521-538.

Park, H., Khan, S., & Petrina, S. (2009). ICT in science education: A quasi-experimental study of achievement, attitudes toward science, and career aspirations of Korean middle school students. *International Journal of Science Education*, 31(8), 993-1012.

Pektaş, H. M., Köse, S., Çelik, H., Katrancı, M., & Pektaş, E. (2008). Fen bilgisi öğretmen adaylarının bilgisayar destekli eğitime yönelik tutumları[Attitudes of science teacher candidates towards computer assisted education]. *Paper presented at the II. Uluslararası Bilgisayar ve Öğretim Teknolojlleri Sempozyumu*. İzmir: Ege Üniversitesi Eğitim Fakültesi.

Phelps, R. & Maddison, C. (2008). ICT in the secondary visual arts classroom: A study of teachers' values, attitudes and beliefs. *Australasian Journal of Educational Technology*, 24(1), 1-14.

Ravitz, J. L., Wong, Y., & Becker, H. J. (1999). *A national survey of schools and teachers describing their best practices, teaching philosophies, and uses of technology*. Irvine, CA: Center for Research on Information Technology and Organizations.

Redish, E. F. & Steinberg, R. N. (1999). Teaching physics: Figuring out what works. *Physics Today*, 52(1), 24-30.

Resmi Gazete. (2006). *Dokuzuncu kalkınma planı [Ninth development plan]*. Resmi Gazete. Sayı:26215, Tarih: 01.07.2006.

Schank, R. C. (1994). Active learning through multimedia. *IEEE Multimedia*, 1(1), 69-78.

Šorgo, A., Verčkovnik, T., & Kocijančič, S. (2010). Information and communication technologies (ICT) in biology teaching in Slovenian secondary schools. *Eurasia Journal of Mathematics, Science & Technology Education*, 6(1), 37-46.

Summak, M. S., Bağlıbel, M., & Samancıoğlu, M. (2010). Technology readiness of primary school teachers: A case study in Turkey. *Paper presented at the World Conference on Educational Sciences- WCES 2010*. Turkey: İstanbul.

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

Tomei, L. A. (2005). *Taxonomy for the technology domain*. USA: Information Science Publishing.

Türkmen, H. (2006). Exploring Turkish science education faculties' understanding of educational technology and use. *International Journal of Education and Development using Information and Communication Technology (IJEDICT*), 2(2), 69-81.

Türkmen, H., Pedersen, J. E., & Mccarty, R. (2007). Exploring Turkish pre-service science education teachers' understanding of educational technology and use. *Research in Comparative and International Education*, 2(2), 162-171.

Wang, P. & Chan, P. S. (1995). Advantages, disadvantages, facilitators, and inhibitors of computer-aided instruction in Singapore's secondary schools. *Computers & Education*, 25(3), 151-162.

Yalın, H. İ., Karadeniz, Ş., & Şahin, S. (2007). Barriers to ICT integration into elementary schools in Turkey. *Journal of Applied Sciences*, 7(24), 4036-4039.

Yaman, M. (2007). The competence of physical education teachers in computer use. *The Turkish Online Journal of Educational Technology*, 6(4), 46-55.

Yenice, N. (2003). Effects of computer supported science education on students' attitudes toward science and computer. *The Turkish Online Journal of Educational Technology*, 2(4), 79-85.

Yildirim, S. (2000). Effects of an educational computing course on pre-service and in-service teachers: A discussion and analysis of attitude and use. *Journal of Research on Computing in Education*, 32(4), 479-496.

Yildirim, S. (2007). Current utilization of ICT in Turkish basic education schools: A review of teacher's ICT use and barriers to integration. *International Journal of Instructional Media*, 34(2), 171-186.

Yuen, A. H. K., & Ma, W. K. (2001). Teachers' computer attitudes: Factors influencing the instructional use of computers. *Paper presented at the International Conference on Computers in Education*. Korea.

Yumuşak, A. & Aycan, Ş. (2002). Fen bilgisi eğitiminde bilgisayar destekli çalışmanın faydaları; Demirci (Manisa)'de bir örnek [Benefits of computer aided study in science education; An example of Demirci (Manisa)]. *Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi,*16, 197-204.

Yushau, B. (2006). Computer attitude, use, experience, software familiarity and perceived pedagogical usefulness: The case of mathematics professors. *Eurasia Journal of Mathematics, Science and Technology Education*, 2(3), 1-7.

Zhao, Y. & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, 40(4), 807-840.