Turkish Mathematics and Science Teachers' Technology Use in Their Classroom Instruction: Findings from TIMSS 2011

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Abstract

The goal of this study was to describe Turkish mathematics and science teachers' use of computer in their classroom instruction by utilizing TIMSS 2011 data. Analyses results revealed that teachers most frequently used computers for preparation purpose and least frequently used computers for administration. There was no difference in teachers' technology usage ways in regard to gender. Although teachers had ready access to computer staff in their schools for technical problems and received adequate support for integrating computers in their teaching activities, teachers used computer software rarely as basis for instruction. Textbook was the most commonly used resource as the basis for instruction. In 69.6% of the mathematics classes and in 41.5% of the science classes, students had computer(s) available to use during lessons and in computer available classes, computers were generally connected to internet. Students rarely engaged in computer activities, such as exploring principles and concepts, practicing skills and procedures, looking up ideas and information, doing experiments, processing and analyzing data. Suggestions were made in order to improve technology usage in mathematics and science instruction.

Key words: Technology use, Teacher education, Mathematics teacher, Science teacher, TIMSS 2011

Introduction

For the last twenty-five years, technological tools have become commonplace in many aspects of professional and personal lives of individuals. Despite widespread usage of technology across many disciplines in 21st century, it is rarely used in education. Rapid changes and remarkable advances in technology forced to drive educational institutions to adapt technology into their activities (Campbell et al. 1987; Gülbahar 2008). In the present study, we aim to investigate Turkish mathematics and science teachers' educational technology use at school.

Before 1983, there was almost no literature about using educational technologies in the educational environment (Kaput and Thompson 1994). Up to the year 2000, existing technologies were not very specific to the teaching area and there was lack of research evidence justifying that technology helps teachers to teach concepts effectively. Research studies and large-scale meta-analyses of educational technology studies (e.g. Bernard et al. 2004; Dillon and Gabbard 1998; Fabos and Young 1999) clearly confirmed that educational technology had not reached its full potential back in the early 2000's. In recent years, a number of studies were conducted to investigate effectiveness of educational technology in teaching. Recent studies demonstrated that teachers' teaching practices could be developed if there is adequate technology, administrative support, and a substantial curriculum (Johnson and Maddux 2008).

Today's teachers should employ educational technology to develop a deep understanding of mathematics and sciences both for themselves and for their students (Drier 2001; Leigh 2003). In addition to having subject matter knowledge, pedagogical content knowledge, and the skills to apply the curriculum, teachers also need to be proficient in educational technology in order to perform pedagogical content knowledge (Pierson 2001). Teacher training programs should provide pre-service teachers with a rich technological environment to facilitate techno-pedagogical knowledge and skill development. This perspective suggests that teacher preparation program must provide numerous experiences to engage pre-service teachers in investigating, thinking, planning, practicing, and reflecting (Niess 2005).

According to the National Council for Accreditation of Teacher Education standards (NCATE 2002), the new professional teacher who graduates from a department of education should be able to integrate technology into

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instruction to effectively enhance student learning. In order to be an effective teacher, pre-service teachers need to know fundamental concepts, knowledge, skills, and attitudes for applying technology in educational settings (NETS•T 2008 p.1). To achieve the technological goals stated by NCATE, teachers should be prepared for their new roles in a technological environment (Thompson and Kersaint 2002).

In their study, Johnson and Maddux (2008) determined four conditions for technology integration into education:

1. Capacity–the hardware, software, and connectivity must be of a sufficient quality.
2. Accessibility–both students and teachers must have sufficient access to technology.
3. Implementation–effective teaching and learning strategies for capitalizing on the technology must be implemented in the classroom.
4. Support-policy makers must encourage and support the wise use of technology.

As difficult as it is to satisfy the capacity, accessibility, and implementation aspects of full integration, we have seen examples where even with all other conditions being present, policymakers can stifle integration efforts (Johnson and Maddux 2008 p.2). In consistent with these four conditions, the current elementary mathematics and science curricula developed by Ministry of National Education (MONE) in Turkey also emphasize using technology in teaching and learning process to provide students with the opportunity for expressive mathematics and science teaching. In 2008, Turkish General Directorate of Teacher Training and Education (ÖYEGM) declared educational technology as a required competency to be qualified mathematics and science teachers. According to their standards, professional mathematics teacher should become aware of the importance of using educational technology in teaching for effective learning. Teachers should have the technical skills to use subject specific educational technologies and use this knowledge in teaching actively. In addition, teachers should share their technical knowledge and experiences with their colleagues (ÖYEGM 2008a).

In order to provide educational technology facilities to teachers and learners, MONE established Directorate General for Innovation and Educational Technology (YEĞİTEK) in 1998 (YEĞİTEK 2010). YEĞİTEK prepares learning environments for efficient technological applications and develop projects such as FATIH [Movement for Increasing Opportunities and Improving Technology] Project, Intel Teacher, Intel Students to encourage the use of technology for teaching and learning activities. The FATIH Project, which includes strong support for technology- assisted learning, is expected to show some positive results that are demonstrated with research evidence. FATIH Project compensates the need for technologically literate teacher who can use new technologies effectively to enhance students' learning by in-service training. Teachers were expected to use educational technology consistent with the curriculum. For doing this, MONE created technology modules to be taught in the seminars. To make in-service training available for all teachers, MONE trained formatter teachers. The availability of appropriate technologies were provided by MONE to public schools. These technologies included a variety of modern hardware and software, student tablet pc, classroom smart board, etc. There were networked computers in each classroom, enough to provide one-to-one computer access for the students. The technical support for the use of technology at the district level was also provided by MONE. In a number of schools, district policies encouraged teachers to use the educational technology in their schools. This project also aims to provide each and every student with a tablet PC (Karal et al. 2013).

In recent years, technological tools such as graphing calculators, electronic white boards, spreadsheets, applets, interactive online learning systems, simulations, web pages, and dynamic geometry software have been emerging in educational studies to improve the mathematics teaching and learning environment (Kim and Baylor 2008). National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards (1989), recommended that teachers need to promote use of calculators to enhance mathematics instruction from kindergarten through high school. Calculator enables children to concentrate on understanding the mathematical concepts and develop number sense (Kieran and Guzman 2005). Before doing the calculation via calculator, students learn how to estimate the result to develop number sense, which should be considered by the teachers. Furthermore, students should criticize the results if it is reasonable for that question (Kieran and Guzman 2005). It is believed that when students do not have a concern about computation mistakes, they can focus on reasoning more (Reys and Arbaugh 2001). Dynamic technology-supported instruction presents an opportunity to enhance mathematical reasoning and explore various conjectures of science and mathematics teachers. Graphing calculators and dynamic software packages - such as GeoGebra, Geometer's Sketchpad, and Tinker plots are vital in raising student awareness, challenging their conceptual understanding and motivating the synthesis of mathematical notions (Hollebrands 2007; Kaput and Thompson 1994; Peressini and Knuth 2005). Construction of mathematical objects, creating models, and conducting interactive explorations are available via GeoGebra by dragging objects tracing points, changing parameters, and measuring objects. Technology also can be used to

improve teaching and learning of science concepts and its processes to make scientific concepts more available for students through conducting a simulation experiment in virtual labs, doing hands-on science activities, exploring interactive web resources (Flick and Bell 2000).

In the present study, we aim to investigate Turkish mathematics and science teachers' usage of educational technology at school by utilizing teachers' responses to Trends in International Mathematics and Science Study (TIMSS) 2011 questionnaire. We focused on technology use relevant items in the questionnaire such as teachers' usage of computers for preparation, for their classroom instruction, and for administration; teachers' usage of computers comfortably and technical support they have in their school. Additionally, since many studies have revealed that there may be gender differences in teachers' technology use (e.g. van Braak et al. 2004), we will examine whether there are differences between male and female teachers in regard to technology use. Following research questions were asked:

1.   For which ways (for preparation, for classroom instruction, and for administration) mathematics and science teachers use computer in their teaching?
2.   Is there any difference between male and female teachers in terms of the ways they use technology?
3.   Do mathematics and science teachers feel comfortable when using computers in their classroom instruction?
4.   Do mathematics and science teachers have ready access to technical support staff when they have technical problems and receive support for integrating computers in their teaching activities?
5.   Do mathematics and science teachers use resources, such as textbooks, workbooks, concrete objects, and computer software, as basis and as supplement for mathematics instruction?
6.   Do mathematics teachers allow their students to use calculators during mathematics lessons?
a.   For which activities do students use calculators?
7.   Do students in mathematics and science class have computer(s) and internet available to use?
8.   How often do mathematics teachers have students use computers to explore mathematics concepts, practice skills, look up ideas, and process data?
9.   How often do science teachers have students use computers to practice skills and procedures, look up ideas and information, do scientific procedures or experiments, study natural phenomena through simulations, and process and analyze data?

The significance of this study arises from providing detailed information about the Turkish mathematics and science teachers' technology use in their teaching. By utilizing TIMSS 2011 data for Turkey, we attempt to describe mathematics and science teachers' technology use in their schools. As mentioned earlier, technology usage in teaching is highly recommended by MONE in Turkey (ÖYEGM 2008a; ÖYEGM 2008b) and previous studies suggest positive effects of technology use in the school (e.g. Lee et al. 2013). Thus, it seems important to explore mathematics and science teachers' technology use in their teaching.

Method

The data was taken from TIMSS database (http://timss.bc.edu/timss2011/index.html). TIMSS is a system of international assessment, which provides background information on teachers' demographics to benchmark performance. It is conducted every four years. From the questionnaire, in addition to teachers' demographic information, we were interested in teachers' responses to following items: Whether teachers feel comfortable using computers in their teaching; if there is any technical problems, whether they have ready access to computer support staff in their school; whether they received adequate support for integrating computers in their teaching activities; what kind of teaching resources they use to teach mathematics and sciences; and which activities students do using computers in the class, such as practicing skills and procedures. There was a special question for mathematics teachers about for what reason they permit students use calculators; to check answers, do routine computations, solve complex problems, or explore number concepts. Frequency analyses were conducted to describe mathematics and science teachers' technology use. Additionally, chi-square tests were run in order to examine whether teachers' computer usage ways change in terms of their gender.

Participants

239 mathematics teachers from 239 schools around Turkey participated in TIMSS 2011. There were 106 (44.4%) females and 133 (55.6%) males. 18 (7.6%) of the participants were under 25 years old; 95 (39.9%) of the teachers were between 25 and 29 years; 90 (37.8%) of the teachers were between 30 and 39; 12 (5%) of the

teachers were between 40 and 49; 22 (9.2%) of the teachers were between 50 and 59, and there was one teacher with an age of 60 or more. Participants' experience in teaching profession ranged from 1 to 35 years, with a mean of 9.28 (7.79) years.

238 science teachers from 237 schools around Turkey participated in TIMSS 2011. There were 117 (49.2%) females, 119 (50.0%) males, and 2 teachers (0.8%) did not report gender. 15 (6.3%) of the participating teachers were under 25 years old; 86 (36.3%) of the teachers were between 25 and 29 years; 81 (34.2%) of the teachers were between 30 and 39; 29 (12.2%) of the teachers were between 40 and 49; 25 (10.5%) of the teachers were between 50 and 59, and there was one (0.4%) teacher with an age of 60 or more. Participants' experience in the profession ranged from 1 to 34 years, with a mean of 10.37 (*SD*= 8.50) years.

Results

Technology Use

Teachers were asked whether they use computers in their teaching for preparation, for their classroom instruction, and for administration (See Table 1). Most of the mathematics teachers (82.4%) and science teachers (84.7%) reported to use computers for preparation. While 64.9% of the mathematics teachers used computers for classroom instruction, a higher percentage of science teachers (81.1%) used computers for classroom instruction. In both groups, teachers less frequently preferred to use computers for administration; 20.1% of the mathematics teachers and 29.8% of the science teachers used computers for administration.

Table 1 Computer usage ways

	Mathematics Teachers		Science Teachers	
	Yes	No	Yes	No
For preparation	196 82.4%	42 17.6%	200 84.7%	36 15.3%
For classroom instruction	155 64.9%	84 35.1%	193 81.1%	45 18.9%
For administration	48 20.1%	192 79.9%	71 29.8%	167 70.2%

In order to investigate whether male and female teachers differ in terms of the ways they use technology, chi-square tests for independence (with Yates Continuity Correction) were conducted. Among mathematics teachers, no significant association was found between gender and computer use for preparation [χ^2 (1, *n*= 238)= .07, *p*= .79, phi= -.03)]; gender and computer use for classroom instruction [χ^2 (1, *n*= 239)= .38, *p*= .54, phi= -.05)]; and gender and computer use for administration [χ^2 (1, *n*= 239)= 2.42, *p*= .12, phi= -.11)]. Similarly, among science teachers, no significant association was found between gender and computer use for preparation [χ^2 (1, *n*= 234)= 1.99, *p*= .16, phi= .10)]; gender and computer use for classroom instruction [χ^2 (1, *n*= 236)= .53, *p*= .47, phi= -.06)]; and gender and computer use for administration [χ^2 (1, *n*= 236)= 1.10, *p*= .29, phi= -.08)].

Teachers who reported to use computers for their classroom instruction were further asked about their usage of computers comfortably and technical support they have in their school. Most of the mathematics teachers (90.2%) and science teachers (94.8%) reported to feel comfortable when using computers in their teaching. Most of the mathematics teachers (74.7%) and science teachers (80.7%) had ready access to computer staff in their school when they had technical problems. 77.8% of the mathematics teachers and 85.9% of the science teachers received adequate support for integrating computers in their teaching activities.

Resources used

Mathematics teachers were asked about resources they use in their mathematics class (See Table 2). Among the resources (i.e., textbooks, workbooks or worksheets, concrete objects, and computer software), textbooks were

the most commonly used resource as basis for instruction (80.8%), which was followed by workbooks or worksheets (36.6%), concrete objects (24.8%), and computer software (9.2%). About half of the participants (%54.8) used computer software for mathematics instruction as supplement while 36.0% of the teachers did not use computer software for mathematics instruction.

Table 2 Resources used by mathematics teachers

	Basis for instruction	Supplement	Not used
Textbooks	193 80.8%	40 %16.7	6 %2.5
Workbooks or worksheets	87 36.6%	147 %61.8	4 1.7%
Concrete objects or materials that help student understand quantities or procedures	59 (24.8%)	169 71.0%	10 4.2%
Computer software for mathematics instruction	22 9.2%	131 54.8%	86 36.0%

Science teachers were also asked about resources they use in their science class (See Table 3). Among textbooks, workbooks or worksheets, science equipment and materials, computer software for science instruction, and reference materials (e.g., encyclopedia, dictionary), textbooks emerged as the most commonly used resource as basis for instruction (88.2%). Computer software was the most used supplement resource for science instruction (71.9%), which was followed by reference materials (69.2%), science equipment (61.9%), and worksheets (56.5%).

Table 3 Resources used by science teachers

	Basis for instruction	Supplement	Not used
Textbooks	209 88.2%	27 11.4%	1 0.4%
Workbooks or worksheets	103 43.5%	134 56.5%	-
Science equipment and materials	83 35.2%	146 61.9%	7 3.0%
Computer software for science instruction	38 16.2%	169 71.9%	28 11.9%
Reference materials (e.g., encyclopedia, dictionary)	9 3.8%	164 69.2%	64 27.0%

Mathematics teachers were asked whether they permit students in their class use calculators during mathematics lessons. 23.2% of the teachers reported that students were permitted to use calculators with unrestricted use; 49.1% reported that students were permitted to use calculators with restricted use; and 27.6% reported that students were not permitted to use calculators. Additionally, mathematics teachers who allowed students to use calculators were asked how often students used calculators to check answer, to do routine computations, to solve complex problems, and to explore number concepts (See Table 4).

According to Table 4, 15.6 % of students never used calculator to check the answers, 42.7 % of students never used calculator to do routine computations, 14.4 % of students never used calculator to solve complex problems and 33.1 % of students never used calculator to explore number concepts. In a similar manner, 70.1 % of students used calculator in some lessons to check the answers, 46.2 % of students used calculator in some lessons to do routine computations, 61.0 % of students used calculator in some lessons to solve complex problems and 54.5 % of students used calculator in some lessons to explore number concepts. The rest of the

students used calculators in mathematics lessons at least about half of the mathematics lessons to check the answers, to do routine computations, to solve complex problems, and to explore number concepts.

Table 4 Activities using calculator in mathematics class

	Every or almost every lesson	About half the lessons	Some lessons	Never
Check answers	9 6.1%	12 8.2%	103 70.1%	23 15.6%
Do routine computations	6 4.2%	10 7.0%	66 46.2%	61 42.7%
Solve complex problems	16 11.0%	20 13.7%	89 61.0%	21 14.4%
Explore number concepts	7 4.8%	11 7.6%	79 54.5%	48 33.1%

Computer Availability and Activities using Computers

In 69.6% of the mathematics classes, students had computer(s) available to use during mathematics lessons while in 30.4% of the classes, students did not have such an opportunity. In most of the computer available classes (84.1%), computers had access to the internet. In classes, where students had computer(s) available to use, students' usage of computers to explore mathematics principles and concepts, to practice skills and procedures, to look up ideas and information, and to process and analyze data were presented in Table 5. Accordingly, teachers rarely had the students do the aforementioned activities. Students general did these activities one or four times in a month.

Table 5 Activities using computers in mathematics classes

	Every or almost every lesson	Once or twice a week	Once or twice a month	Never or almost never
Explore mathematics principles and concepts	4 5.8%	22 31.9%	29 42.0%	14 20.3%
Practice skills and procedures	9 13.0%	21 30.4%	18 26.1%	21 30.4%
Look up ideas and information	8 11.8%	22 32.4%	29 42.6%	9 13.2%
Process and analyze data	5 7.4%	22 32.4%	24 35.3%	17 25.0%

In 41.5% of the science classes, students had computer(s) available to use during science lessons while in more than half of the classes (58.5%) students did not have such an opportunity. In most of the computer available classes (92.7%), computers were connected to the internet. In classes, where students had computer(s) available to use, students' usage of computers to practice skills and procedures, to look up ideas and information, to do scientific procedures or experiments, to study natural phenomena through simulations, and to process and analyze data were presented in Table 6.

Table 6 Activities using computers in science classes

	Every or almost every lesson	Once or twice a week	Once or twice a month	Never or almost never
Practice skills and procedures	7 7.4%	39 41.5%	32 34.0%	16 17.0%
Look up ideas and information	11 11.8%	47 50.5%	30 32.3%	5 5.4%
Do scientific procedures or experiments	4 4.3%	41 44.1%	40 43.0%	8 8.6%
Study natural phenomena through simulations	10 10.6%	43 45.7%	30 31.9%	11 11.7%
Process and analyze data	7 7.5%	35 37.6%	32 34.4%	19 20.4%

Discussion

This study aimed to explore Turkish mathematics and science teachers' technology use at school by utilizing teachers' responses to TIMSS 2011 questionnaire. MONE in Turkey highly emphasizes technology integration in instruction (ÖYEGM 2008a; ÖYEGM 2008b) and research reveals positive effects of technology usage in schools (e.g. Lee et al. 2013). Therefore, this study attempted to describe mathematics and science teachers' technology use in Turkey.

When mathematics and science teachers' ways of using computers were examined, they used computers for preparation more often than they used computers for classroom instruction. Computers were used least for administration purposes. Teachers who used computers for classroom instruction generally felt comfortable when using computers in their teaching. Furthermore, when they had technical problems, they reported to have ready access to computer staff in their school and receive adequate support for integrating computers in their teaching activities. Thus, it seems that teachers' integration of computers in their instruction were well supported by the technical staff in their school. Johnson and Maddux (2008) suggested that adequate technology and administrative support contribute to teachers' teaching practices. Therefore, we see developments in Turkish school as encouraging but there is still need for improvement. Results showed that in 30.4% of the mathematics classes and 58.5% of the science classes, students do not have computers available to use during lessons. Therefore, there are many classes in Turkey where computers are absent for students' usage. According to Johnson and Maddux (2008), sufficient quality hardware, software, and connectivity (i.e. capacity) is a prerequisite for technology integration into education and, both students' and teachers' access to technology (i.e. accessibility) is important. We suggest that in Turkey more classes may be equipped with computers so that more students may access to technology in class.

Computer software was rarely used for mathematics and science instruction; 9.2% of the mathematics teachers and 16.2% of the science teachers used computer software as basis for instruction; 54.8% of the mathematics teachers and 71.9% of the science teachers used computer software as supplement for instruction; and 36.0% of the mathematics teachers and 11.9% of the science teachers did not use computer software for instruction. Textbooks were the most preferred resource used for instruction; 80.8% of the mathematics teachers and 88.2% of the science teachers used textbooks as basis for instruction. Therefore, it seems that textbooks are still major resources used by teachers in class and computer software is not utilized as a basis for instruction. Though, if teachers use computer software for instruction, they may find activities, videos, simulations, and pictures, which may be interesting for students, attract their attention, and visualize concepts for student. This may in turn increase students' engagement in the lesson. The reason for not using computers as a resource in their instruction may be due to receiving inadequate training about how to use it effectively, thus they may rely mostly on textbook resources. Teachers may be given training about advantages of using computers for instruction and effectiveness of using computers as a resource. Niess (2005) suggested that teacher-training

programs should be enriched with technological environment and pre-service teachers should have opportunity to practice in these environments to develop techno-pedagogical knowledge and skills.

When we examine activities done using computer, in mathematics classes, where students had computers available to use, students rarely used computers to explore mathematics principles and concepts, to practice skills and procedures, to look up ideas and information, and to process and analyze data. Similarly, in science classes, where students had computers available to use, students used computers rarely to practice skills and procedures, to look up ideas and information, to do scientific procedures or experiments, to study natural phenomena through simulations, and to process and analyze data (See Table 5 and 6). However, it is important that students' usage of computers for different activities in the class may contribute their learning. For instance, computer games were found to improve students' achievement (e.g. Cameron and Dwyer 2005; Kebritchi Hirumi, and Bai 2010); computer-assisted learning was associated with deep learning outcomes (Zimitat and McAlpine 2003); and computers supported classroom conversation in science and mathematics lessons (Wegerif 2004). At the end of their meta-analysis about effects of teaching and learning with technology, Lee et al. (2013) pointed out the importance of students' collaboration in groups with computers and developing students' skills through projects. Results revealed that in Turkey, students engage in very limited computer activities and they should be given more opportunity to use computers for different activities, such as exploring principles and concepts, practicing skills and procedures, looking up ideas and information, doing experiments, processing and analyzing data, which may improve students' mathematics and science learning.

Additionally, mathematics teachers were asked whether students were permitted to use calculators in class and for which purposes calculators were used. In mathematics classes, half of the students were permitted to use calculators with restricted use, however, from these students 33.1% of students never used calculators to explore number concepts (See Table 4). NCTM Curriculum and Evaluation Standards (1989), recommended that to enhance mathematics instruction, teachers need to promote use of calculators just because, calculator enables children to concentrate on understanding the mathematical concepts and develop number sense (Kieran and Guzman, 2005) without any concern about computation mistakes. However, 27.6% of the mathematics teachers reported that students were not permitted to use calculators. Therefore, we suggest mathematics teachers allow their student use calculators in lessons more frequently to check answers, do routine computations, solve complex problems, and especially to explore number concepts.

Another finding of the study was that teachers' ways of using technology did not differ in regard to gender. However, previous studies generally found that male teachers use technology more than female teachers (e.g. Hakverdi et al. 2011; van Braak et al. 2004). For instance, in a study with primary school teachers (*n*= 468), teachers' computer use was assessed through items such as "using the computer as a tool for demonstration" and "encourage pupils to search for information on the Internet" (van Braak et al. 2004 p. 410). Path analysis results showed that males used computers more than females. Similarly, in another study with science teachers (*n*= 63), males reported to integrate computers as an instruction tool more than females (Ocak and Akdemir 2008). Tough low in number, there are some studies which revealed no gender difference for teachers' technology use. Gorder (2008), studying with K-12 teachers (*n*= 174), found no difference between male and female teachers in terms of their technology integration in classroom teaching and learning. In the present study, we also found that females and males did not differ from each other in regard to their computer use for preparation, for classroom instruction, and for administration.

Conclusion

This study attempted to reveal Turkish mathematics and science teachers' technology use in their instruction. Although teachers had ready access to computer staff in their school when they had technical problems and received adequate support for integrating computers in their teaching activities, teachers used computers rarely as basis for instruction. Textbooks continued to be the major resource for teachers. In Turkey, in some classes there was no computer available to use during lessons. In computer available classes, students seldom engaged in activities done using computers. We suggest that computers should be available in more classes, teachers should use computer for instructional purposes more effectively, and students should be given more opportunity to involve in various activities by using computers like exploring concepts and practicing skills. Pre-service and in-service teacher education programs in Turkey should give training in order to encourage teachers' active technology usage at schools and thus enhance their instruction through technology. These programs may emphasize usefulness and ease of computer use, so that teachers' intention to use computers may increase (Yuen and Ma 2002). Teachers' competence and ability to organize technology related activities are important factors for effective technology integrated instruction (Gorder 2008). Therefore, it is important for teacher education

programs to train teachers about how to use technology effectively as an instructional tool and provide teachers opportunities to get experience in technology use.

Limitations of the Study

The data of the study were provided from TIMSS database and measures of teachers' technology use were based on self-reports.

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