FACTORS ASSOCIATED WITH TECHNOLOGY INTEGRATION TO ELEMENTARY SCHOOL SETTINGS: A PATH MODEL

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ABSTRACT

FACTORS ASSOCIATED WITH TECHNOLOGY INTEGRATION TO ELEMENTARY SCHOOL SETTINGS: A PATH MODEL

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In this study, a three phase Sequential Mixed Method Design was utilized to test a research based model explaining the relationships between technology integration and the factors affecting it. In the first phase, interviews were conducted with 20 elementary school teachers to identify the most common factors affecting elementary teachers' use of technologies. The qualitative findings then guided the development of a survey instrument in the second phase. In the last phase, this survey was administered to 1080 classroom teachers in Ankara. In this phase, a path analytical approach was utilized to investigate the direct and indirect effects of teaching experience, computer use in years, principal support, colleague support, technology competency, teachers' attitude and belief towards using technology and lack of time on technology integration to elementary school settings.

Our findings indicated that technology integration is a complex process affected by many factors and these factors are highly related to each other. Within all factors, teachers' technology competency has the largest direct effect on technology integration. Also, principal support, computer use in years, colleague support and teachers' attitude and belief have important influences on technology integration. The technology integration model developed in this study provides a valuable tool for both policy makers and school principals to design and develop some strategies to bring success about integrating technologies in school environments. It will help the school principals in developing a vision and plan, indicating how technology will be integrated to the lessons and how the teachers are expected to use technologies.

Keywords: Technology integration, elementary schools, path analysis, principal support, colleague support.

ÖZ

İLKÖĞRETİM OKULARINDA TEKNOLOJİ ENTEGRASYONUNU ETKİLEYEN FAKTÖRLER ÜZERİNE BİR PATH MODELİ

KARACA, Feride

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Üç aşamadan oluşan karma yöntemlerin kullanıldığı bu çalışmada teknoloji entegrasyonunu etkiliyen faktörler arasındaki ilişkileri gösteren, alanyazın ile de desteklenen bir model öne sürülüp, test edilmesi amaçlanmaktadır. İlk aşamada, teknoloji entegrasyonunu etkiliyen faktörleri ortaya çıkarmak amacı ile 20 ilköğretim öğretmeni ile görüşülmüştür. İkinci aşamada, görüşme sonuçlarına dayalı olarak araştırmacı tarafından bir anket oluşturulmuştur. En son aşamada, bu anketler Ankara'daki 1080 sınıf öğretmenine uygulanmıştır. Bu aşamada path analazi yöntemi kullanılarak, öğretmelerin mesleki deneyimi, biligisayar kullanma süreleri, okul müdürü desteği, meslektaş desteği, teknoloji yeterlilikleri, öğretmenlerin teknoloji ile alakalı tavır ve düşünceleri ve zaman eksikliği gibi faktörlerin teknoloji entegrasyonu üzerindeki doğrudan ve dolaylı etkilerinin araştırılması amaçlanmıştır.

Çalışmanın sonuçlarına bakıldığında teknoloji entegrasyonunun bir çok faktörden etkilenen karmaşık bir süreç olduğu ve bu faktörler arasında önemli ilişkler olduğu anlaşılmaktadır. Tüm faktörler göz önüne alındığında, öğretmenlerin teknoloji yeterliliklerinin teknoloji entegrasyonu üzerinde en yüksek etkiye sahip olduğu ortaya çıkmıştır. Ayrıca, okul müdürü desteği, öğretmenlerin bilgisayar deneyimi, meslektaş desteği ve öğretmenlerin teknoloji ile alakalı tavır ve düşüncelerinin teknoloji entegrasyonu üzerinde önemli etkileri olduğu görülmüştür. Bu çalışmada geliştirilmiş olan teknoloji entegrasyonu modeli, hem bu konuda karar verecek olan yetkililere, hem de okul müdürlerine, teknolojinin başarılı bir şekilde okul ortamlarına entegre edilebilmesi için ne tür stratejiler geliştirilebileceği konusunda bilgi vermektedir. Ayrıca, bu çalışma, teknoloji entegrasyonu sürecinde öğretmenlerin nasıl desteklenecekleri konusunda okul müdürlerini bilgilendirerek, onların teknoloji ile alakalı vizyon ve plan geliştirmelerine yardımcı olmaktadır.

Anahtar sözcükler: Teknoloji entegrasyonu, ilköğretim okulları, path analizi, okul müdürü desteği, meslektaş desteği.

To My Daughter

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CHAPTER 1

INTRODUCTION

This section presents the background of the study, the purpose, and the significance of the study. Definitions of terms frequently used in the manuscript are also listed in this section.

1.1. Background of the Study

Currently, various technologies have been introduced to educational settings. Since most policy makers thought that an increase in the number of technologies in schools results in a potential improvement in teaching and learning (Cuban et al., 2001; Rogers, 1999), schools are equipped with computers, Internet access, audiovisual hardware, educational software and related technologies.

In Turkey, Ministry of National Education (MNE) has allocated huge amount of budget to improve ICT infrastructure in schools. A report by the State Planning Organization (SPO) of Turkey, published in 2010, showed that MNE established 27.999 IT classes at the end of 2009. In Ankara, there are 816 IT rooms in primary schools and 649 IT rooms in secondary schools. Also, 94% of the primary and all of the secondary schools have broadband Internet access in Turkey. The number of students per computer is 30.8 in primary schools and 25.1 in secondary schools.

Nowadays, most teachers and students now have far more access to technological devices both in school and at home than ever before (Cuban, Kirkpatrick & Peck, 2001). Although more technology exists in classrooms, teachers' technology use is still low (Ertmer, 2005). According to Cuban et al. (2001), "most teachers and students are occasional to rare users (at least once a month), or they are nonusers of technology in classrooms for instruction" (p. 815). Accordingly, though technologies becoming more widely available in schools, they may not be properly used by teachers or integrated into classroom activities. A great amount of money was wasted for unused technologies in schools (Toci & Peck, 1999).

Many attempts, including "ready access to technology, increased training for teachers, and a favorable policy environment" (p. 25), took place for providing the appropriate conditions for effective technology integration; however, teachers' technology use is still low (Ertmer, 2005). A snapshot survey conducted in elementary schools in Ankara showed that most of the elementary teachers are rare users or nonusers of technology (Yüzgeç, 2003). Similarly, many studies from Turkey showed that teachers' use of computers for instructional purposes is not sufficient (Aşkar & Usluel, 2001, 2005). Teachers mostly use computers for preparation activities rather than using them for improving students' critical thinking skills and cognitive abilities (O'Dwyer, Russell & Bebell, 2003; Yıldırım, 2007). Also, Ertmer (2005) pointed out that though teachers are using technology for a variety of low level tasks, a few teachers use technologies for higher level tasks. Furthermore, Van Braak, Tondeur and Valcke (2004) emphasized that most teachers use computers for supporting their lessons, such as preparing worksheets and tracking student progress, instead of integrating computers as a teaching and learning device. Consequently, teachers' use of technologies for teaching and learning purposes are still limited.

The underlying reason is that technology integration is a slow and complex process affected by a variety of factors (Sandholtz, Ringstaff & Dwyer, 1992). In the literature, there are a long list of factors, affecting technology integration, such as teacher demographics (Inan, 2007; Koca, 2006), teacher attitude and belief towards using technology (Hermans, Tondeur, Van Braak &Valcke, 2008; Inan, 2007; O'Dwyer et al., 2003; Rogers, 1999; Teo, 2010; Tondeur, Van Keer, Van Braak, Valcke, 2008; Van Braak et al., 2004), teachers' technology related knowledge and skills (Baylor &Ritche, 2002; Hew &Brush, 2007; Pelgrum, 2001) , avalibility and accessibility (Granger, Morbey, Lotherington, Owston, & Wideman, 2002; Hew &

Brush, 2007); technical support (Dexter & Seashore, 2003), principal support (Baylor & Ritchie, 2002; Pelgrum, 2001), colleague support (Sahin & Thompson , 2007) and lack of time (Rogers, 1999; Totter, Stütz & Grote; 2006).

1.2. Purpose of the Study

The main purpose of the study is to propose and test a research based path model explaining the relationships between technology integration and factors affecting it, including teaching experience, computer use in years, principal support, colleague support, lack of time, teachers' technology competencies and teacher attitude and belief towards using technology for instructional purposes. Also, it is aimed to explore the most common factors affecting technology integration perceived by elementary school teachers. Last, it is aimed to reveal classroom teachers' perceptions about the factors affecting technology integration to elementary school settings.

1.3. Research Questions of the Study

The research questions of this study are as follows:

1. What are the most common factors affecting technology integration perceived by elementary school teachers?
2. What is the best fitting model explaining the relationships among principal support, colleague support, lack of time, teaching experience, computer use in years, teacher attitude and belief, technology competencies and technology integration by classroom teachers in elementary school settings?
3. What are the classroom teachers' perceptions about these factors influencing technology integration to elementary school settings?

1.4. Significance of the Study

Many studies have been conducted to explore the barriers that handicap technology integration efforts in education and a variety of factors and conditions were found responsible for teachers' non-use of technologies in educational settings (Baylor & Ritche, 2002, O'Dwyer et al., 2003). Since these factors are highly interrelated to each other, there was a need to address all the factors simultaneously (Rogers, 1999; Ertmer, 1999). Still, little research was conducted to see "the relative strength and importance of each factor, when considered together" (Ely, 1999, p.8). As a result, there was a need for a comprehensive model that proposes the relationships among the factors affecting technology integration in educational settings. This study is designed to address this issue by proposing and testing a research based path model that explains the relationships between technology integration and the factors that influence Turkish elementary school teachers' technology use in their lessons. It provides useful insights into understanding the complexity of technology integration in elementary school settings (Baylor & Ritche, 2002).

The success of integrating technologies into educational settings does not solely depends on the presence or absence of the single factors affecting technology integration, but rather it can be determined through a dynamic process in which some different strategies were applied simultaneously for interrelated factors (Afshari et al., 2009). Therefore, the technology integration model developed in this study will provide a valuable tool for both policy makers and school principals to design and develop some effective strategies to bring success about integrating technologies in school environments. Using the results of this study, principals will be aware of the different types of support they might provide to the teachers in order to accelerate technology integration process. Giving information about the factors affecting technology integration and the relationships between them, the results of the present study might help the school principals in developing a vision and plan, indicating how technology will be integrated to the lessons and how the teachers are expected to use technologies. Also, it will give ideas about how to support the design and delivery of technology related professional development at elementary schools. Furthermore, it would provide a valuable tool for policy makers about how to support technology integration process and allocate money for technology initiatives. Also, it will give suggestions to the policy makers about how to revise the curriculum to support successful technology integration in elementary school settings.

1.5. Definitions of Terms

Technology: In this study, technology is defined as the available technologies in the school environment, including computers, projectors, printers, scanners, television, overhead projector, DVD/VCD/Video player, television, overhead projector and instructional software.

Technology Integration: Teachers' use of technologies including computers, projectors, printers, scanners, television, overhead projector, DVD/VCD/Video player, television, overhead projector and instructional software, for instructional purposes in their lessons.

Principal Support: School principals' support for teachers on providing sufficient access and availability to instructional technologies, on providing adequate technical support and professional development opportunities and their appreciation and encouragement of teachers' use of technologies by providing rewards and incentives and modeling technology use.

Computer Use in Years: Teachers' self-reported number of years using computers

Technology Competencies: Teachers' knowledge and skills related to technology use.

Colleague Support: Colleagues' support by modeling technology use, technical problem-solving and sharing instructional media and materials.

Teaching Experience: Self-reported number of years in teaching profession.

Lack of Time: Teacher perceptions about their lack of time to learn using new technologies and to design and implement technology supported lessons.

Teacher Attitude and Belief: Teacher attitudes and beliefs on the value of technology use in classroom.

1.6. Abbreviations

MNE: Ministry of National Education

SPO: State Planning Organization

CHAPTER 2

LITERATURE REVİEW

The review of literature presented in this chapter provides a theoretical framework of this study. After a general overview of the technology integration in elementary school settings and teachers' role in this integration, six major factors affecting technology integration in educational settings and their relationships are presented. Last part titled Hypothesized Path Model proposes a model based on the previous research study findings.

2.1. Technology Integration in Elementary School Settings

In his famous book of "Diffusion of Innovations", Rogers (1995) defined "technology" as follows:

> "A technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome. A technology usually has two components: (1) a hardware aspect, consisting of the tool that embodies the technology as a material or physical object, and (2) a software aspect, consisting of the information base for the tool" (p.12).

In his definition, "technology" represents a mixture of hardware and software components and it is frequently used as a synonym of "innovation". The term "integration" was frequently used interchangeably with the term "use" in several studies (Lloyd, 2005). In this study as well, technology integration is viewed as teachers' use of ICT technologies including computer, projector, printer, scanner, television, overhead projector, DVD/VCD/Video player, and instructional software for instructional purposes in elementary school settings.

With the advances in technology, the role of the technology in instruction has been extended since it can be used "in a variety of ways, in a variety of subjects and for a variety of goals" in education (Kulik & Kulik, 1991, p.77). Although teachers may use technologies in an increasing variety of ways in educational settings, there is not a clear definition of technology integration in the literature (Bebell, Russell, O'Dwyer, 2004). Several researchers developed their own definitions of "technology" and "technology integration".

Bebel et al. (2004) acknowledged that different definitions of technology integration may vary across settings and studies. For example, Baylor and Ritche (2002) defined technology integration as "how transparently the technology was blended into the lesson, and whether it was used to convey content in ways not easily done without technology" (p. 17). Ertmer (1999) proposed that the level of technology integration cannot be determined by counting the number of available technologies or the number of hours they were used. Rather, it was better to "observe the extent to which technology was used to facilitate teaching and learning" (p. 50).

According to Baylor and Ritchie (2002), "the way technology is used in a classroom is a critical measure of its success" (p. 401). Therefore, in order to examine technology integration in educational settings, it is important to investigate how technology is incorporated into instruction. Emphasizing that todays' teachers use technologies in their courses in an increasing variety of ways, Bebell et al. (2004) examined the multidimensional nature of teachers' technology use. They presented seven general categories of technology use:

- Teachers' use of technology for class preparation
- Teachers' professional e-mail use
- Teachers' use of technology for delivering instruction
- Teachers' use of technology for accommodation

- Teacher-directed student use of technology during class time
- Teacher-directed student use of technology to create products
- Teachers' use of technology for grading (p. 50).

Using these categories, Bebell et al. (2004) proposed a multifaceted approach for measuring teachers' technology use. By this way, they provided a wider understanding of technology integration across settings. When they examined teachers' use of technologies for each of the above categories, they found that teachers used technologies more frequently for class preparation activities. Also, they showed low to moderate use of technologies for e-mail, teacher-directed student use of technology and grading purposes. They used technologies least frequently for accommodation and for the creation of student products (Bebell et al., 2004).

In Turkey, several studies were conducted regarding teachers' different ways of technology use. Gülbahar and Güven (2008) conducted a survey research to explore Turkish social studies teachers' ICT usage. They have found that teachers mostly utilized computers for accessing information on the Internet, communicating electronically, using word processing and preparing presentations. However, a small number of teachers used ICT to assist them in learning the material. Similarly, the statistics by State Planning Organization (SPO) of Turkey (2010) indicated that only 31.7 % of people used the Internet for the aim of learning. The Internet was mostly used for sending e-mails (%72.4), reading online news and magazines (70%) and sending messages to chat rooms, news groups and forums (57.8%). Also, in the literature, it is stated that teachers used computers most often for preparation activities rather than using it for improving students' critical thinking skills and cognitive abilities (O Dwyer et al., 2003; Yıldırım, 2007). Furthermore, Van Braak et al. (2004) emphasized that most teachers use computers for supporting their lessons, such as preparing worksheets and tracking student progress, instead of integrating computers as a teaching and learning device. Consequently, teachers' use of ICT for teaching and learning purposes is still limited.

After presenting different definitions of "technology integration" in education and variety of ways the teachers use technology, the following section presents the role of teachers in technology integration.

2.2. The Role of Teachers in Technology Integration

In the information age, the role of teacher has become a coach or facilitator, no longer only provider of information (Baylor &Ritchie, 2002). Lee and Reigeluth (1994) defined some of teachers' role in the information age as "technology management" and "educational resource selection" since they are required to effectively use new technologies in their lessons. Also, Dias and Atkinson (2001) emphasized that the teachers are required to "integrate technology in ways that make sure their students achieve success in learning, communications, and life skills, as well as becoming technology literate in the process" (p. 2).

Lee and Reigeluth (1994) stressed the importance of teachers' role in educational changes that "teachers should be regarded as leaders in every activity for educational change" (p. 61). It is especially true for technological changes since "the decision regarding whether and how to use technology for instruction rests on the shoulders of classroom teachers" (Ertmer, 2005, p. 26). However, most teachers in the current educational systems are "educationally conservative and accept the status quo" (p. 65). Although there is an increased access and availability of technologies in educational environments than ever before, most teachers are still "occasional to rare users (at least once a month) or they are just nonusers of technology in their lessons" (Cuban, 2001, p. 815). Also, many studies from Turkey showed that teachers' use of computers for instructional purposes is not sufficient (Aşkar & Usluel, 2001, 2005). A snapshot survey conducted in elementary schools in Ankara showed that although most of the teachers self-reported feeling moderately well in using instructional technologies, most of the elementary teachers are rare users-used technology in some courses- or nonusers of technology (Yüzgeç, 2003).

Using technologies in schools is a kind of diffusion process and it is a difficult task for teachers to adopt new technologies. Even though technological innovations usually have some benefits for potential adopters; they are not diffused and adopted rapidly (Rogers, 1995). There is a need for a length period of time for teachers to widely adopt technologies. In Roger (1995)'s "diffusion of innovations" theory, the rate of adoption is an important predictor of decision to adopt innovations and it is measured by "the number of receivers who adopt a new idea in a specified time period" (Rogers & Shoemaker, 1971, p.157). The author explained that from 49 to 87 percentage of variance in rate of adoption was explained by the perceived characteristics of an innovation. According to Rogers (1995), there were five different perceived characteristics of an innovation: (1) Relative Advantage, (2) Compatibility, (3) Complexity, (4) Triability and (5) Observability. First, *relative advantage* was defined as "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 1995, p.15). This characteristic is positively related to an innovation's rate of adoption and an increase in the perceived relative advantage of an innovation results in an increase in the rate of adoption. Second, *compatibility* is "the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters" (p.15). The rate of adoption of a new idea is highly affected by the old idea, therefore, in order to increase the rate of adoption, it should be introduced in a way that is consistent with (1) sociocultural values and beliefs, (2) previously introduced ideas, (3) user needs (Rogers & Shoemaker, 1971). Third, *complexity* is "the degree to which an innovation is perceived as difficult to understand and use" (Rogers, 1995, p.16). Complexity of an innovation is negatively related to its rate of adoption since new ideas that are simpler to understand are more easily adopted. Fourth, *trialability* is "the degree to which an innovation may be experimented on a limited basis" (p.16). Trialability of an innovation is positively related to its rate of adoption. Last, *observability* is "the degree to which the results of an innovation are visible to others" (p.16). People are more likely to adopt an innovation when they have a chance to observe the results of it. In summary, when we consider teachers' adoption to technological innovations, they are more likely to adopt technologies when they believe that the use of technologies in their lessons has great relative advantage, compatibility, trialability, observability and less complexity (Rogers, 1995).

Using Roger (1995)'s diffusion of innovations theory, Aşkar and Usluel (2003) examined teachers' rate of adoption to computers in three primary schools in Ankara, Turkey. The rate of adoption is explored in two dimensions, using computers for administrative and personal tasks. They have found that only relative advantage, observability and facilitating and impeding conditions were found to affect teachers' rate of adoption of computers for both administrative and instructional purposes. In their study, they examined teachers' perceptions about all five perceived characteristics of innovations (Rogers, 1995). First, they have found that observability is one of the important attributes in teachers' adoption to computers since the rate of adoption can be increased by observing some colleagues who use computers. Second, regarding to the relative advantage, most teachers found the use of computers beneficial for both administrative and personal tasks, including "preparation of unit plans, entering students' marks, typing examinations, communicating with e-mail, and searching on the Internet for their hobbies" (Aşkar & Usluel, 2005, p.2). Third, teachers felt using computers are moderately complex to use. Forth, though teachers do not think that computers are compatible in the teaching and learning process, they find them compatible in administrative and personal tasks.

Aşkar, Usluel and Mumcu (2006) also explored the extent to which perceived innovation attributes associated with the task related ICT use among secondary school teachers. Examining the results, complexity is found as a common innovation characteristic for all tasks, including teaching delivery, preparation and managerial tasks in schools. Another finding is that observability is an important attribute in teaching delivery. The authors stated that teachers should have a chance to observe their colleagues' use of ICT in their lessons. By this way, it would be easier to learn about using technologies and have an idea about its benefits. Finally, relative advantage and compatibility are found important for teaching preparation tasks.

This section explained the role of teachers in technology integration and how different perceived characteristics of innovation may affect technology integration in education. In the following the research studies that explore the factors which limit the teachers' use of technology in education are presented in detail.

2.3. Factors Affecting Teachers' Technology Integration in Educational Settings

In the literature, many factors were stated to be responsible for teachers' limited use of technologies in educational settings. Some researchers made a categorization of these factors, such as; first order and second order (Ertmer, 1999), internal and external (Robinson, 2003) and teacher level and school level (Inan, 2007). Ertmer (1999) proposed one of the well-known categorization: first order and second order barriers that may impede technology integration. First order barriers are extrinsic to teachers and include access to technology, institutional support, time and funding. Second order barriers are intrinsic to teachers and include teachers' beliefs and attitudes about teaching and technology and their willingness to use technology. Furthermore, in a more recent research, Inan (2007) added some teacher demographic characteristics by categorizing barriers as teacher level and school level factors. Teacher level factors include age and teaching experience, beliefs and attitudes, computer proficiency and readiness to integrate technology. School level factors include computer availability, administrative and peer support and instructional and technical support.

In addition, Rogers (1999) presented a model of barriers to technology adoption, hierarchically arranged into internal and external factors which slow or even halt the process of adopting technology in education. The internal barriers were summarized as "teacher attitude or perceptions" about a new technology. Once past those barriers, the external barriers come in view. She categorized external barriers in three headings as "availability and accessibility", "institutional and technical support", and "stakeholder development". In addition, she put "time" and "funding" in both internal and external barriers group since she thought that they can be barriers at an individual level and at an institutional level.

After a very extensive literature review and research, Ely (1999) found out eight conditions that facilitate technology adoption in schools. These were (1) dissatisfaction with status quo, (2) existence of knowledge and skills, (3) availability of resources, (4) availability of time, (5) rewards or incentives exist, (6) participation, (7) commitment and (8) leadership.

Similarly, Aşkar and Usluel (2003) explored the facilitating and impeding conditions affecting computer use in three primary schools. The facilitating conditions included providing technology related in-service training opportunities, necessary hardware, technical support and some extra budget for teachers who know how to use technology. In addition, having credit from the school administration, social and school pressures are found to be some facilitating conditions for using computers. On the other hand, the impeding conditions included lack of hardware, software and materials, lack of technical support and insufficient IT lab organization and infrastructure.

Another research study (Pelgrum, 2001) listed 10 most frequently mentioned problems to technology integration by conducting a worldwide survey in 26 countries. These problems are categorized under material and non-material conditions. The material conditions include "insufficient peripherals, not enough copies of software and insufficient number of computers that can simultaneously access the WWW" (p.173). The second most frequently stated condition was a nonmaterial condition that teachers did not have sufficient knowledge and skills regarding to the use of ICT. Other non-material conditions include "the difficulty to integrate ICT in instruction, scheduling enough computer time for students, insufficient teacher time, and the lack of supervisory and technical staff' (p.173).

Although in these studies the barriers to teachers' technology integration are categorized similar to Ertmer's (1999) as extrinsic and intrinsic to teachers, the individual items in these groups differ. Therefore, in this part, aforementioned factors will be discussed individually without any higher-order categorization.

2.3.1. Teacher Demographics

In the literature, many studies were conducted to examine the effects of teachers' demographics, such as age, gender, teaching experience, computer experience, subject characteristics, type of school, educational degree etc., on teachers' use of technologies.

For instance, Koca (2006) examined Turkish teachers' ICT acceptance and ICT use depending on the type of school, gender, teaching experience, subject and educational degree. Only type of school and teaching experience variables made a significant difference with regard to teachers' frequency of ICT usage. She found that novice teachers used ICT more frequently than the experienced teachers. Also, Russell, Bebel, O'Dwyer and O'Connor (2003) revealed that novice teachers have more confidence for using technologies other than experienced teachers. Similarly, Bussey et al. (2000) found that there was a negative relationship between years of teaching and adoption to technology in education. When the teachers' teaching experience in years increases, their intention to use technology decreases. Also, Russell et al. (2003) revealed that novice teachers have more confidence for using technologies than experienced teachers. Inan (2007) supported this idea that the new teachers feel better prepared to use technologies as they have been trained about technology use during their pre-service education. Consequently, there is a negative relationship between teachers' ICT usage and teaching experience in years (Koca, 2006).

In addition, Drent and Meelissen (2007) found that computer experience directly influenced teachers' innovative use of ICT. Furthermore, Rozell and Gardner (1999) revealed that computer experience predicted user attitude and having more computer experience means having more favorable attitudes towards the use of computers. Also, Bradlow, Hoch and Hutchinson (2002) found that users with more online experience are likely to have more computer proficiency.

2.3.2. Principal Support

Although teachers seemed to be the most important change agents in the technology integration process, the role played by school principals is also very important since they play a leadership role as „gatekeepers' (Baylor & Ritchie, 2002; Pelgrum, 2001). They impact teachers' professional experiences in a variety of ways through "communication, job design and autonomy, the provision of learning opportunities and resources, and the nature and extent of feedback given to teachers" (Singh & Billingsly, 1998, p.229). They are responsible to direct and facilitate changes with the use of their leadership abilities and by developing a shared vision.

The NETS-A standards specify the school principals' responsibilities in terms of developing a shared vision among all stakeholders in the school community and encouraging them for using technology (ISTE, 2009). Also, they are required to provide adequate time, funding and access to technological resources technical services and professional development opportunities for the school personal. Therefore, principal support factor have a variety of dimensions to consider since they have many different responsibilities in the technology integration process. In order to categorize principal support, Littrell et al. (1994) used the House (1981)'s social support framework, which categorized support in four dimensions (1) Emotional Support, (2) Appraisal Support, (3) Informational Support, and (4) Instrumental Support (cited in Littrell, Billingsley, & Cross, 1994). The authors conducted a study to explore the importance of each of these support types. The findings confirmed the order suggested by House (1981). Emotional support, which is the most important type of support, was related to principal's contribution on how valuable teachers feel in the school by the use of such strategies as "maintaining open communication, showing appreciation, taking an interest in teachers' work and considering ideas" (p.297). Principals' appraisal support associated with "providing constructive feedback about their work, information about what constitutes effective teaching, and clear guidelines regarding job responsibilities" (p.298). Instrumental support included "providing necessary materials, space and resources, ensuring adequate time for teaching and non-teaching duties" (p.298). Finally, informational support included "providing teachers with opportunities to attend workshops, conferences, and take courses and encouraging professional growth" (p.307)

Considering the categorization of principal support provided by Littrel et al. (1994), the researchers made a new categorization of principal support that applies to classroom teachers' technology integration processes in elementary school settings in Turkey. In the present study, principal support factor included three dimensions: (1) Material Support, (2) Attitudinal Support, (3) Technical Support. Each type of support will be explained in the following sections separately.

(1) Material Support

In the present study, material support was defined as a support from school principals through providing access and availability to useful, relevant and up-to-date instructional technologies. Teachers would not have a chance to integrate technologies into the curriculum unless they have access to sufficient technologies (Hew & Brush, 2007). Granger at al. (2002) supported this idea by expressing that it is almost impossible to integrate technologies into curricula without having appropriate instructional media and materials, which results in frustration and resistance about the use of technologies among teachers. Therefore, examining the teachers' needs, school principals should try to provide necessary instructional media and materials.

Having appropriate technologies in the schools does not mean that teachers have easy access to these technologies (Brush et al., 2008). According to SPO (2010) statistics, the number of teachers per computer is 23.8 in primary schools and 16.5 in secondary schools. Therefore, teachers still have some difficulties in accessing computers in Turkish elementary schools. Gülbahar and Güven (2008) supported this finding that Turkish teachers still have problems with accessing ICT resources and in-service training opportunities. Consequently, the authors emphasized that it should be one of the primary goals of the school principals to provide adequate access to technologies in the schools.

On the other hand, most of the technologies in the schools are located in IT classes, so the teachers from "non IT" subjects are at a disadvantage in accessing these technologies (Selwyn, 1999). Scheduling of IT rooms is a big problem in Turkish basic education schools since most schools didn’t set up any policies yet (Yıldırım, 2007). Thereof, time conflicts might arise with other teachers who want to use the same material in their courses (Hew & Brush, 2007). Also, there are a limited number of computers in IT classes, which is not enough for the students in Turkish Basic education schools (Yıldırım, 2007). Therefore, several students have to share one computer, which makes an inevitable chaos in the class. Accordingly, although technological devices might be available in some schools, there is no guarantee that teachers have easy access to these technologies. In order to facilitate „transparent’ use of IT resources, the school principals should allocate more budgets for providing more technologies in the classrooms so that teachers can readily use these technologies whenever they need (Selwyn, 1999).

(2) Technical Support

In this study, technical support included the support from school principals through providing teachers with adequate technical support services and professional development opportunities including in-service trainings, workshops, conferences etc.

Although the schools are equipped with many technologies, they are useless due to lack of technical support and training (Rogers, 1999). Lawson and Comber (1999) addressed the need for a qualified technical staff in school environments that there should be “an independent and proactive support ICT coordinator who has both financial responsibility and enough time and status to plan and implement strategies for technology integration” (p.51). Actually, it is one of the most important problems in Turkish Basic education schools since most teachers complained about that either most schools do not have any computer teacher or those who were appointed were not much qualified (Yıldırım, 2007).

Granger et al. (2002) acknowledged that “appropriate full time technical support and significant opportunities for teacher education in ICT use are as necessary as up-to-date equipment if teachers are to move toward curricular integration and meaning making” (p.487). However, most countries did not yet aware of the importance of providing facilities to keep teachers up-to-date with regard to new technologies. Although the school principals provide some different in-service training programs for teachers in Turkey, teachers complain about the quality and effectiveness of these training programs (Yıldırım, 2007). Yıldırım (2007) stated that teachers criticized the centralized approach of Ministry of Education, since they did not consider teachers' specific needs during the design and delivery of the in-service trainings. To solve this problem, Baylor and Ritchie (2002) recommended making a need analysis by surveying teachers in order to design professional development programs to accommodate to their needs. Also, most training sessions were given in a seminar format and the teachers don't have much opportunity to apply what they have learned. Therefore, teachers should have a chance of experimenting with technologies before implementing it in their classrooms (Albirini, 2006). Last, most training programs were given during the summer break; instead, the in-service trainings should be a part of the contracted school year (Yıldırım, 2007).

Rogers (1999) defined technical support as "the user services or media specialists who assist staff in using and maintaining different technologies" (p.8) and stated that not providing enough or qualified technical support might severely hinder technology adoption. Dexter at al. (2002) found that by providing a high quality of technology support, teachers use technology more frequently with students in a wider variety ways. In essence, the author recommended that the "quality of technical support" should have the following elements:

> (1) Customized one-on-one help, (2) frequent teacher participation in on-going, technology oriented professional support among teacher peers; (3) professional development content which emphasizes the instructional, and not just the technical needs of teachers; and (4) access to a broad range of technology resources (p.268).

(3) Attitudinal Support

In the present study, attitudinal support described as the school principals' appreciation and support of teachers for the use of technologies through "modeling technology use, planning and explaining a vision, rewarding teachers as they strive to use technology, and sharing leadership" (Baylor & Ritchie, 2002, p.397). Support from school administration is important in encouraging the teachers to get involved and dedicate their time to the technology integration process. If teachers perceive that the administrator values and uses educational technology, they can more widely use technologies in their lessons. As a result, school principals should encourage teachers' effective use of technologies with the presence of role models, rewards, incentives, recognition, and encouragement. With the use of some incentives and rewards, teachers would know that their work is appreciated (Schwab, Jackson & Schuler, 1986). The same point is made by Littrell et al. (1994)::

> By exercising recognition and approval providing constructive feedback, and encouraging professional growth, principals communicate the teachers their work is meaningful and that they are valued (p.299)

2.3.3. Colleague Support

Since "teachers need each other for team teaching and planning, technical problem-solving, assistance and learning" (Granger et al.,2002, p.486), colleagues should have a chance to interact each other as they explore new technologies (Ertmer, 2005). Rogers (1995) specified that colleagues are one of the best sources since the new idea is communicated through some interpersonal channels to someone with similar characteristics. Rogers explained that:

> "…most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation. This dependence on the experience of near peers suggests that the hearth of the diffusion process consists of the modeling and imitation by potential adopters of their network partners who have adopted previously" (p.18) .

Observing some teachers who use technologies effectively in their courses not only give information about how to accomplish the same task but also increase their confidence for performing it successfully (Ertmer, 2005). Also, Aşkar and Usluel

(2003) found that teachers' rate of adoption is affected by observing colleagues' use of computers. Furthermore, Rogers (1995) point to the importance of the observability of an innovation since teachers are more likely to adopt an innovation when they observe the possible outcomes of it. Similarly, Aşkar and Usluel (2005) emphasized that:

> "It is not only the computer being observed as a technological tool but also its benefits, teachers using computers in their administrative and personal tasks can easily be observed by other teachers through personal communication channels in a short time very easily" (p.2).

Similarly, observing and communicating with some colleagues who successfully use technologies in their lessons, teachers would be aware of the new technologies, their consequences and relative advantages over the traditional ones. The colleagues communicate the relative advantage of the use of technologies by sharing and discussing their technology related experiences and ideas. Oncu et al. (2008) supported this idea by stating that:

> Meeting with colleagues who are technologically advanced enables teachers to see the potential of technologies that they were unfamiliar with or that they never had considered using in their classrooms …. Overall, then a colleague's influence not only is a prompt for teacher awareness about the technology options available, but it also provides encouragement and reassurance for the teacher to see that things can be safely done as well as providing confirmation that the technology will, in fact work in their classrooms. (p.32)

On the other hand, in Turkish Basic Education Schools, teachers complain about lack of collaboration among teachers since "the teachers were not able to share their experiences and best practices of ICT use in their fields" (Yıldırım, 2007, p.181). This might be because of the fact that teachers have limited school time to work together, share experiences and watch another teacher using technologies. Cuban et al.(2001) summarized this idea that "few teachers shared common periods to plan; there was little time to observe colleagues' classrooms; and there was even less time to prepare for five classes a day" (p.828). On the other hand, Lee and Reigeluth (1994) emphasized the importance of teacher collaboration since it should be one of the major themes in school restructuring. Therefore Singh & Billingsly (1998) suggests that the school principals should create a collegial environment in the schools by encouraging teachers to have shared goals and values and by providing facilities for collaboration and professional growth. When teachers feel supported by their colleagues to use technologies and assist each other and solve problems together, they are more likely to use technologies in their lessons.

2.3.4. Teacher Attitude and Belief towards Using Technology

Teachers' technology attitudes and beliefs is one of the most important factors that explain technology integration since the decision regarding the use of technology for instructional purposes ultimately depends on the teachers (Ertmer, 2005). Without having a positive attitude towards technology, teachers will not use technology in their lessons (Zhao & Frank, 2003; Teo, 2009), which likely to results in the loss of all the investments for providing technological devices and professional development opportunities (Toci & Peck, 1998).

Çağıltay et al. (2001) found that Turkish teachers mostly have positive beliefs related to computer use. The results of their study indicated that the teachers mostly expressed that computers increase the quality of education and the use of computers increases students' knowledge and skills, interests and motivation towards lesson. Also, O'Dwyer et al. (2004) indicated that positive beliefs about technology had a positive effect on all types of teachers' technology use.

As presented before, according to Rogers (1995), the rate of adoption of a new idea is highly affected by the old idea, therefore, in order to increase the rate of adoption, it should be introduced in a way that is consistent with (1) sociocultural values and beliefs, (2) previously introduced ideas, (3) user needs (Rogers & Shoemaker, 1971). He emphasized the importance of the compatibility of an innovation that an idea that is not compatible with teachers' existing beliefs will not be accepted easily (Rogers, 1995). Ertmer (2005) proposed that teachers use technology in a way that is consistent to their personal beliefs, so it becomes important to introduce the technology in a way that is appropriate for teachers' belief systems and valuable for their current practices. Therefore, she recommended use of some strategies, including some personal experiences (some simple practices that are successful), vicarious experiences (observing successful teachers or sample lessons), as well as social and cultural influences, which have potential to make positive impacts on teacher beliefs about technology.

2.3.5. Teachers' Technology Competencies

In the literature, lack of specific technology knowledge and skills has been identified a major barrier to technology integration (Hew & Brush, 2007). Pelgrum (2001) point to the importance of technology competencies by saying that technology will not be used unless teachers provided with the skills and knowledge necessary to integrate it to the curriculum. On the other hand, teachers with more ICT competencies are more likely to use technologies in many different ways (Dexter et al., 2002) Baylor and Ritche (2002) emphasized that teachers must reach and maintain a certain degree of ICT competencies in order to integrate technologies into educational settings. Having technology competencies helps teachers to become more efficient in daily tasks such as "communicating with parents, keeping records, doing research in their subject domain, and preparing presentations" (p.402).

Furthermore, Dusick and Yıldırım (2000) stated that the teachers should have necessary knowledge and skills in order to answer to the requirements of information age. However, most Turkish teachers lack the necessary knowledge and skills related to technology use and so they need to have some professional support (Gülbahar & Güven, 2008).

2.3.6. Teachers' Lack of Time

In many articles, teachers' lack of time to learn new technological skills and to prepare new instructional materials, were stated as important barriers to the adoption to new technologies (Rogers, 1999). Ely (1999) summarized this idea by saying that: "Implementers need time to acquire knowledge and skills, plan for use, adopt, integrate and reflect upon what they are doing" (p.4). Since teachers are "busy, dedicated and practical people with little control over their time" (Toci & Peck, 1998, p. 23), it could be a challenge for them to allocate adequate time to learn new technologies, design and implement technology supported lessons and evaluate their impact on the students.

In an empirical study, Albirini (2004) found that most participant teachers perceived that class time was too limited for computer use. Also, in a recent research, Gülbahar and Güven (2008) revealed that Turkish social studies teachers complained about the limited class time for ICT usage. Finding extra time for ICT in the curriculum was a difficult task for Turkish Basic Education school teachers since the curriculum was heavily loaded with various subjects and activities (Yıldırım, 2007). Teachers were required to cover all the subjects in a school year, therefore they could not find enough time to use ICT in their lessons. Moreover, ICT related activities required more preparation time than the traditional activities. In order to solve this problem, adequate time should be provided for teachers for using technologies in the class environment (Yıldırım, 2007).

2.4. Relationship among Variables Affecting Teachers' Technology Integration

As explained in the previous parts, there are many factors affecting technology integration and they are highly interrelated to each other (Rogers, 1999). Many studies were conducted to determine the relationships between the factors affecting technology integration. To explore these relationships among the factors affecting technology integration, the researcher examined: some (1) literature based (Hew &Brush, 2007) and empirical models (Van Braak et al., 2004; Robinson, 2003; Inan, 2007, Teo, 2009) and (2) the individual relationships between factors affecting technology integration

2.4.1. The relationships in models

Based on the literature, Hew and Brush (2007) constructed a tentative model to identify the relationships among the variables affecting technology integration (see Figure 2.1). They conducted an extensive literature review by examining empirical studies from 1995 to 2006 in the United States and countries abroad. They used constant comparative method and reached six main categories of barriers: (1) resources, (2) knowledge and skills, (3) institution, (4) attitudes and beliefs, (5) assessment, (6) subject culture. In this model, technology integration was thought to be directly influenced by four factors: teachers' attitudes and beliefs towards using technology, teachers' knowledge and skills, the institution, and the resources. Also, subject culture and assessment are thought to influence technology integration. Although the model developed by Hew and Brush (2007) has a sound research support, no empirical research was conducted to test and validate the model.

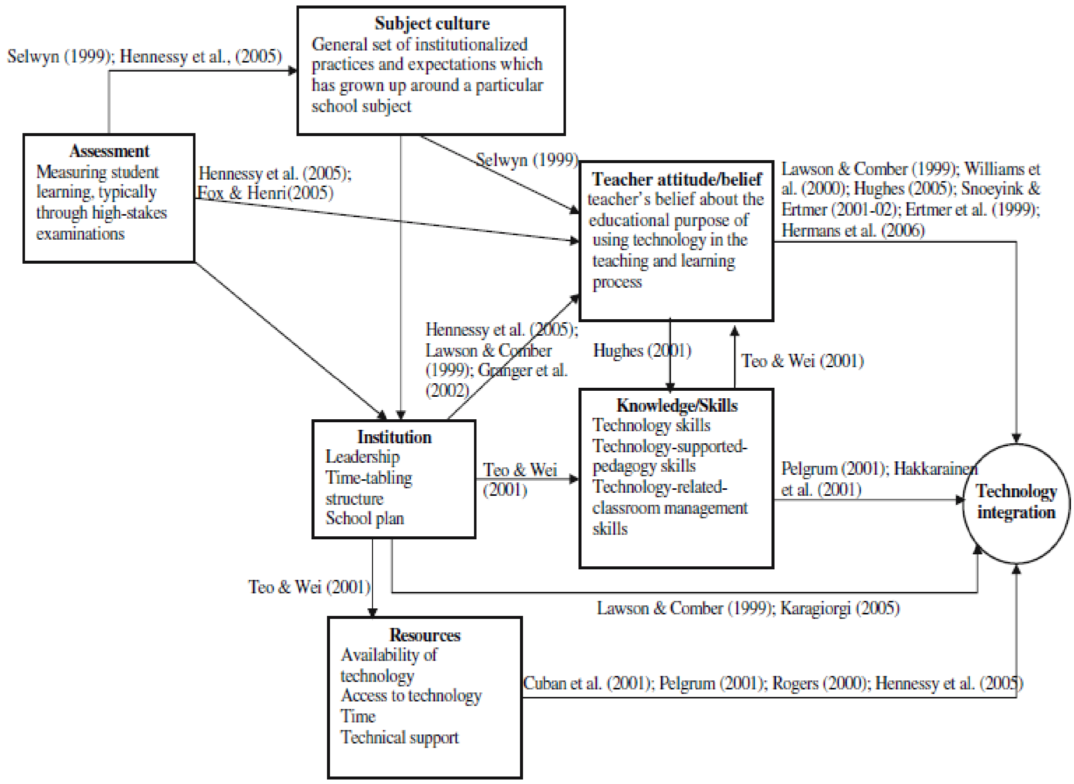

Figure 2.1 Model showing the relationships among the various barriers (Hew&Brush, 2007). Reprinted with permission.

There are also some empirically validated models explaining the relationships among variables. In the following parts, four models by Van Braak et al. (2004), Robinson (2003), Inan (2007) and Teo (2009) will be explained in detail.

Van Braak et al. (2004) conducted a path analysis with 468 primary school teachers in order to examine the effects of demographics, computer related experience and attitude measures on different types of computer use (see Figure 2.2). The results of the study showed that attitudes towards computers in education contribute significantly to the explanation of class use of computers. Also, technological innovativeness, computer training and gender have direct effects on class use of computers. Furthermore, prior computer experience had positive indirect effects on attitudes towards computers in education. This study contributes to the literature by examining the effects of some individual factors on different types of computer use. However, this study did not explore the contextual and school level factors to gain more insights into teachers' class use of computers.

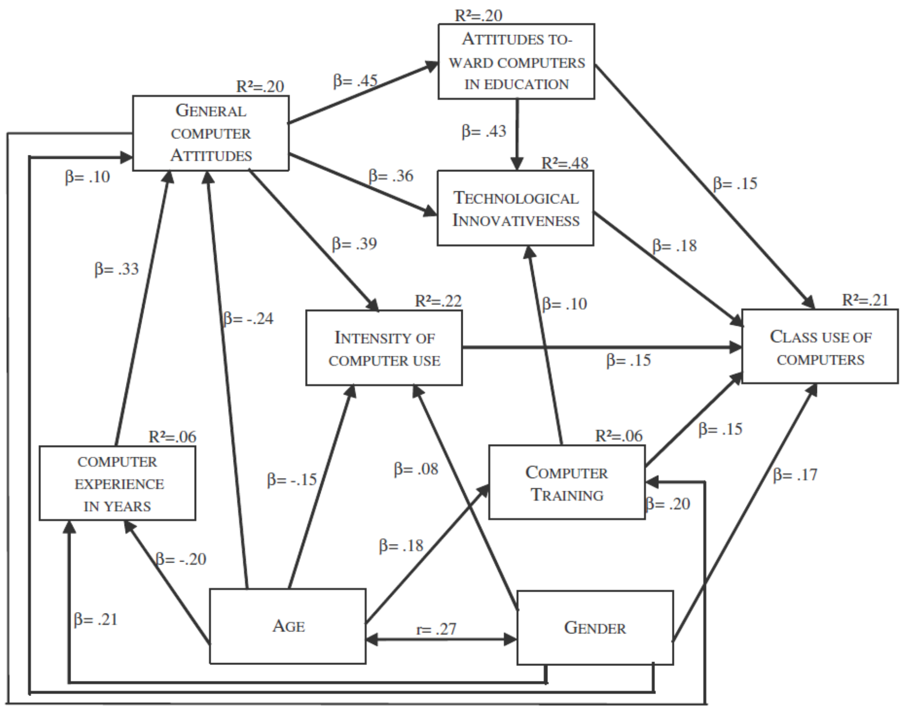

Figure 2.2 Path Model of Class use of Computers (Van Braak et al., 2004). Reprinted with permission.

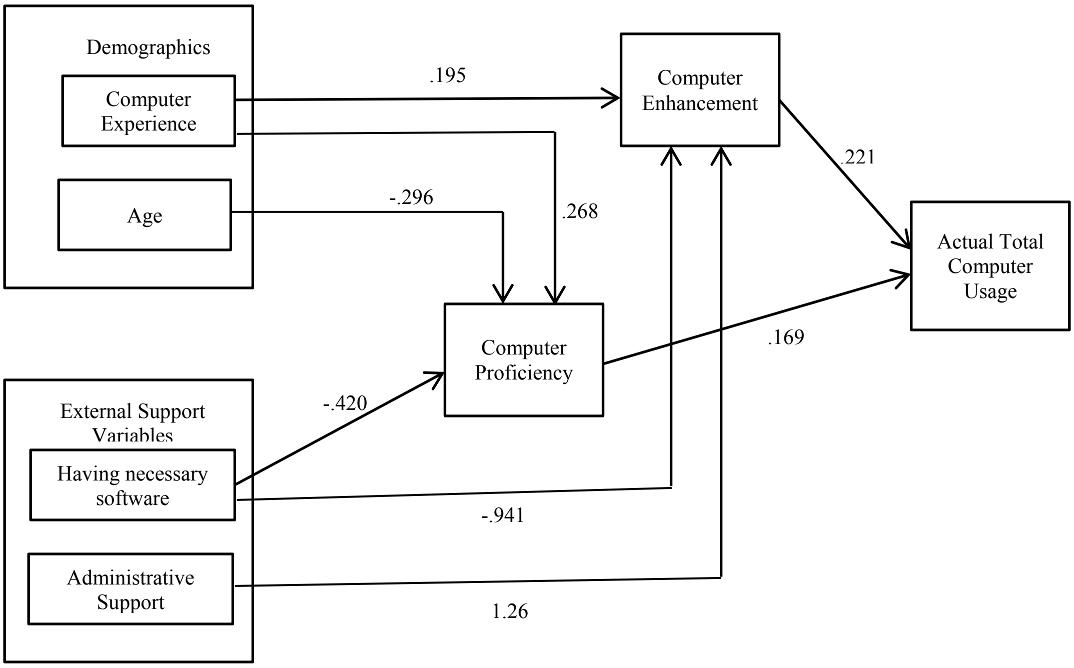

Figure 2.3 Path Model of Actual Total Computer Usage, adapted from Robinson, 2003.

Similar to Van Braak et al. (2004), Robinson (2003) constructed a path model for teachers' use of computers and examined the relationships between some demographics, external and internal support variables and actual use of computers in Michigan charter schools (see Figure 2.3). The demographic variables include gender, age, teachers' education level, school level, computer experience and previous computer training; the internal support variables include perceived usefulness and computer proficiency; and the external support variables include having necessary software, administrative and technical support. The results indicated that teachers' computer usage for enhancement activities and their computer proficiency levels directly affected teachers' actual total computer usage. These variables explained %45 of variance in teachers' total computer usage.

The strength of the study conducted by Robinson (2003) is that, it is an extended version of Technology Acceptance model (Davis, 1989) and the most popular model in predicting technology acceptance across various contexts (Teo, 2009). However, his study was limited to 116 teachers from 5 private charter schools, which are likely to be different from traditional schools. Therefore, the results may not be generalized to other educational settings.

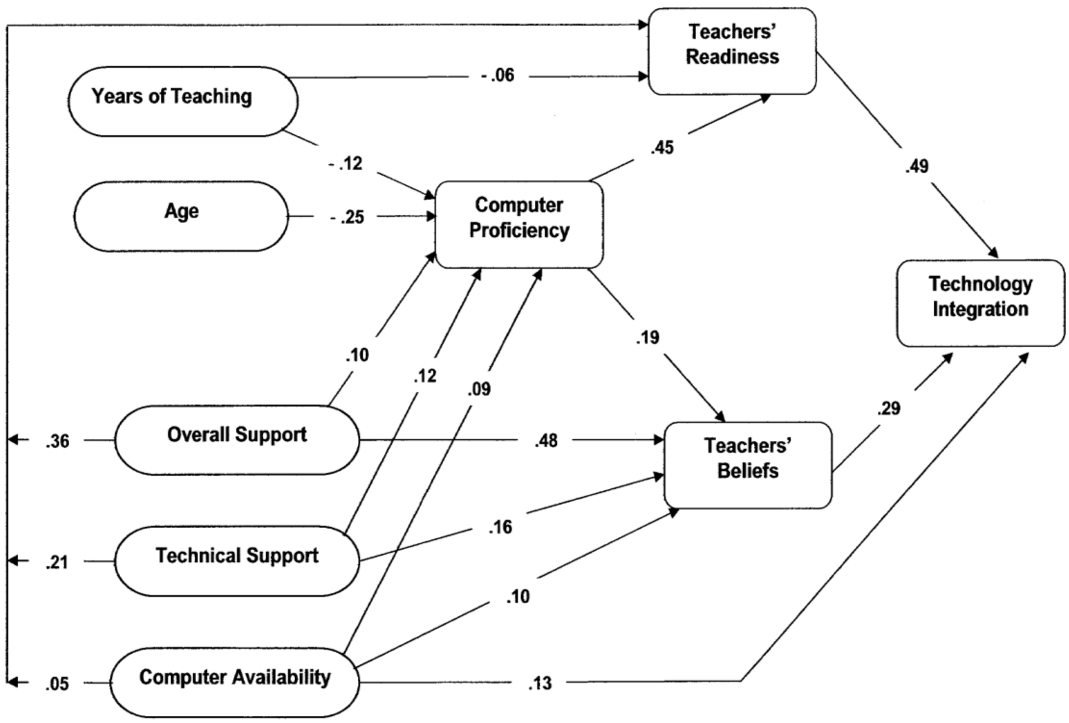

Figure 2.4 Path Model of Teachers' Technology Integration (Inan, 2007). Reprinted with permission.

In a recent study, Inan (2007) used path analysis in order to examine direct and indirect effects of teacher level and school level factors on teachers' technology integration (see Figure 2.4). The path model developed by Inan (2007) considered some previous path models (Mathews & Guarino, 2000; Robinson, 2003; Van Braak et al. 2004) and tried not to repeat some limitations of them. The model was an extended version of Robinson (2003)'s and it included both teacher and school level factors that affect teachers' technology use. In his model, the teacher level factors included age and teaching experience, computer proficiency, teachers' beliefs and teachers' readiness and the school level factors included overall support, technical support and computer availability. The results indicated that only teachers' readiness, teachers' beliefs and computer availability have direct effects on technology integration. Teachers' belief was affected by teachers' computer proficiency and all the school level variables, including overall support, technical support and availability of computers. Also, age and years of teaching has negative direct effects on computer proficiency.

In addition to these path models, Teo (2010) proposed a structural model by integrating two popular models, Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989) and Theory of Planned Behaviour (TBP) (Ajzen, 1991). In Teo's model, attitude towards computer use had the largest effect on teachers' behavioral intention to use computers. The author proposed that when teachers believe that technology is useful and it has a potential to improve their teaching performance, they are more likely to use it in a variety of ways.

2.4.2. Individual relationships

Apart from the studies that provided models for technology integration, there are several other empirical studies that examined the individual relationships among the technology integration and the variables affecting it. Albrini (2006) conducted a study to examine the relationships between high school EFL teachers' attitudes and the factors that are found to be influencing these attitudes, including computer attributes, cultural perceptions, computer competence and computer access. Among these variables, computer attributes, cultural perceptions and computer competence were found to affect teachers' attitudes towards ICT significantly. The author emphasized that increasing teachers' ICT competencies may foster their positive attitudes toward using ICT and eventually result in teachers' use of computers in their lessons. Similarly, Gülbahar and Güven (2008) found that teachers' computer competency is a significant predictor of Turkish social studies teachers' attitudes towards the use of computers.

Also, some studies were conducted to examine the effects of collegial support in educational settings. Using Learning/Adoption Trajectory model (Sherry, Billig, Gibson, & Tavalin, 2000) as a framework, Sahin and Thompson (2007) seek to determine whether the adoption level of instructional technology can be predicted by some predetermined factors. The crucial finding in this study was that collegial interaction significantly predicted technology adoption. Therefore, the authors summarized that interaction and collaboration with colleagues improve faculty members' technology adoption level.

The effect of principal support on colleague support was shown in a study conducted by Singh and Billingsley (2001). They constructed a model to examine the effects of principal and peer support on teachers' commitment to teaching profession. To test the model, they collected data from a large number of public school teachers (N=9,040). The results of the study showed that both peer support and principal support directly affected teachers' commitment to teaching profession. Also, the largest direct effect in the model was that of principal leadership/support on peer support. The results revealed that when principals support teachers' work positively, teachers are more likely to work cooperatively, which eventually results in a collegial school environment.

Also, there is some literature that shows the effects of both teacher attitude and colleague support on technology integration. For example, a study conducted by Lin and colleagues (2003) revealed that effectiveness of integrating IT into teaching was significantly predicted by colleague support and teachers' attitude. Also, the effects of collegial support on teachers' attitudes were emphasized by many researches, but little empirical research was conducted to explore its effects. Ertmer (2005) pointed to the influence of the colleague support on teachers' beliefs by stating that "change in teacher beliefs regarding the value of technologies are most likely to occur when teachers were socialized with their colleagues to think differently about technology use" (p.35).

Though teachers' lack of time to learn new technological skills, to prepare new instructional materials, and also to allocate time in their lessons were stated as important barriers to the adoption to new technologies (Rogers, 1999), few empirical research studies were conducted to see its effects. Since teachers need extra time to learn using technology, for training and exploring the technology (Vanatta & Fordham, 2004), teachers' lack of time is likely to affect their technology competencies.

2.5. Hypothesized Path Model

In the first part of the present study, some interviews were conducted with elementary school teachers to determine the factors that influence the most to the teachers' technology integration in elementary school settings in Ankara. Seven factors were determined as the most relevant factors that may have potential influence, "Teaching experience", "Computer use in Years, "Principal support", "Colleague Support", "ICT competencies", "Teacher Belief and Attitudes", "Lack of Time". These factors were similar to the factors found by Hew and Brush (2007) and identified as possible sources of barriers for technology integration: resources, knowledge and skills, institution, attitudes and beliefs, assessment, and subject culture.

After determining the most important factors affecting technology integration, a literature review was made to examine the relationships of these factors to each other and to the teachers' technology integration. Then, a path model is developed based on the research findings in the literature (see Figure 2.5). The models developed by Hew and Brush (2007) and Inan (2007) served as a guide while determining the direct and indirect influences among the factors.

Figure 5 shows the relationships between these factors. The links represent the hypothesized path and the arrows show the direction of the influences based on review of literature. The hypothesized model includes four blocks of variables. The first block is exogenous variables, including teaching experience, computer use in years, teachers' lack of time to use technology, and principal support. The second block has only one variable, colleague support. The third block includes of teachers' attitudes and beliefs towards using technology and their ICT competencies. Technology integration which is an endogenous variable is situated in the final block of the model. Except for computer use in years and lack of time, all the variables in the model were hypothesized to directly influence technology integration. Colleague support was hypothesized to be influenced by principal support. ICT competencies were hypothesized to be directly influenced by all the exogenous variables and colleague support. Teacher attitude and belief towards using technology was hypothesized to be directly influenced by principal support, colleague support and ICT competencies. Examining the indirect effects, except for teacher attitude and beliefs towards using technology, all the variables were hypothesized to indirectly influence technology integration. The model was hypothesized and tested as presented in the following chapters.

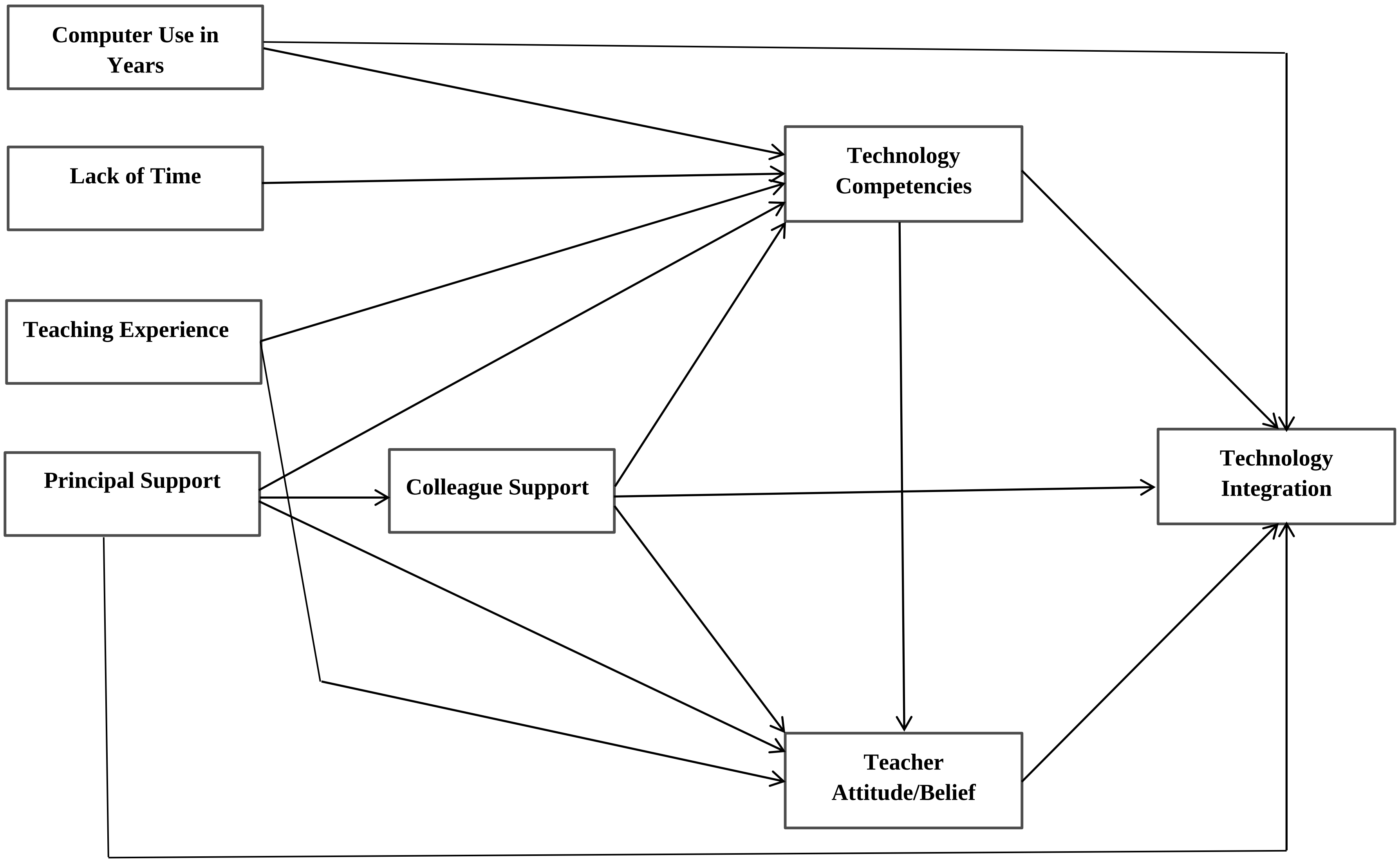

Figure 2.5 Hypothesized Path Model

2.6. Summary

In this section, a literature review about technology integration in elementary school settings and teachers' role in this integration were provided. Also, some literature review were presented about the factors affecting technology integration and some detailed information were provided about six major factors affecting technology integration in educational settings. In addition, the relationships among these factors are presented by giving information about previous research studies and models that show the relationships among the variables affecting technology integration. Based on these previous research study findings, a technology integration path model was proposed in the last part of this section. In the following sections, this path model is tested using a path analytical approach.

CHAPTER 3

METHODOLOGY OF THE STUDY

This section presents the research questions and the research design of the study. Also, the research method of the study was presented in this section to give information about all the phases of the study in detail.

3.1. Research Questions

1. What are the most common factors affecting technology integration perceived by elementary school teachers?
2. What is the best fitting model explaining the relationships among principal support, colleague support, lack of time, teaching experience, computer use in years, teacher attitude and belief, technology competencies and technology integration by classroom teachers in elementary school settings?
3. What are the classroom teachers' perceptions about the factors influencing technology integration to elementary school settings?

3.2. Research Design

According to Straus and Corbin (1998), useful research can be accomplished with various combinations of qualitative and quantitative methods. Also, "by combining several lines of sight, researchers obtain a better, more substantive picture of reality" (Berg, 2001, p.4). Therefore, using both qualitative and quantitative research methods (see Figure 3.1), a mixed methods approach was utilized in the present study. Creswell and Clark (2007) defined Mixed Methods research as follows:

> Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approach in many faces in the research project. As a method; it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone (p.5).

The aim of qualitative research is to have information about a particular phenomenon in depth, and in quantitative research, the intent is to explore how the collected data fits an existing theory (Creswell & Clark, 2007). Benefitting from both qualitative and quantitative methods, mixed methods research design aims to have a better understanding of the research problem (Bergman, 2008; Creswell & Clark, 2007).

The design of the study was shown in Figure 3.1. Since quantitative and qualitative data collections are implemented in different phases and are connected in different ways, a three phase Sequential Mixed Method Design was used in this study. The results of one method were used to develop and inform the other method, though the priority was given to the quantitative data collection and analysis.

In the first phase of the study, qualitative data were collected to identify the most common factors that influence elementary school teachers' use of technologies in their lessons. The qualitative findings then guided the development of items and scales of a quantitative survey instrument. Later in a pilot study, the researcher implemented and validated the instrument using quantitative methods. Consequently, in this part, quantitative and qualitative methods are connected through the development of the instrument items (Creswell & Clark, 2007).

In the last phase, the survey instrument was administered to explore the relationships between factors affecting technology integration using the path model which was constructed based on the research findings in the literature in Chapter 2 (see Figure 2.5). Finally, this research based model was tested using a path analytical approach.

DESIGN OF THE STUDY

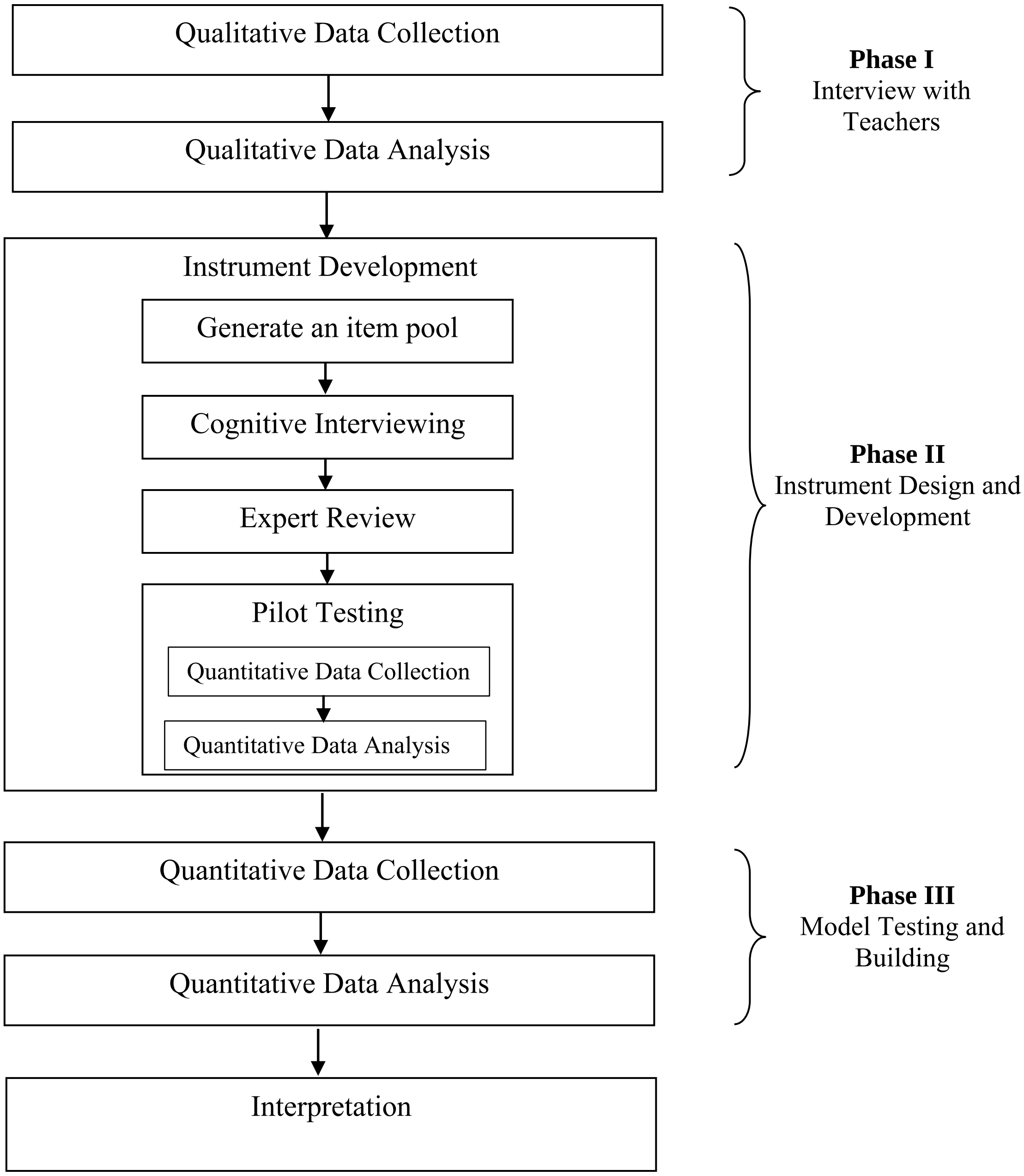

Figure 3.1 The design of the study

3.3. Research Method

This study was conducted in three main phases. First, interviews were conducted with elementary school teachers. Second, an instrument was developed based on the interview results. Third, the survey instrument was administered to elementary school teachers to test a research based model. A summary of research method were shown in Table 3.1. In the following parts, each phase will be explained in detail.

Table 3.1 A Summary of Research Method

Study Phase	Research Question	Data Source	Data Collection	Data Analysis	Finding
Phase I Interview with teachers	**1.** What are the most common factors affecting technology integration perceived by elementary school teachers?	20 elementary school teachers	Interviews	Qualitative data analysis - Organize the data -Code the data -Generating categories, themes and patterns -Percentages and frequencies for each category of factors	The most common factors affecting technology integration: Principal support, Colleague support, Lack of time, Technology competencies, Teacher attitude/belief, Computer use in years, Teaching experience
Phase II Instrument Development		218 elementary school teachers	"Survey of Technology Integration in Elementary School Settings"	-Exploratory Factor Analysis	Revised and validated instrument: "Survey of Technology Integration in Elementary School Settings"
Phase III Model Testing and Building	**2.** What is the best fitting model explaining the relationships among principal support, colleague support, lack of time, teaching experience, computer use in years, teacher attitude and belief, technology competencies and technology integration by classroom teachers in elementary school settings?	1030 classroom teachers	Validated instrument: "Survey of Technology Integration in Elementary School Settings"	-Path Analysis	Technology Integration Model
	3. What are the classroom teachers' perceptions about the factors influencing technology integration to elementary school settings?	1030 classroom teachers	Validated instrument: "Survey of Technology Integration in Elementary School Settings"	-Descriptive data analysis	

3.3.1. Phase I: Interview with teachers

The purpose of this phase is two folds. The first aim is to identify the main factors perceived by teachers as being important to technology integration into the elementary school settings. Second aim is to develop a background to create an instrument to be utilized in the quantitative phase. By conducting one-on-one interviews, the researchers explored and identified the main factors affecting teachers' technology use and the variety of their technology use in the elementary school settings in Ankara. The preferred method in this phase were qualitative since this study investigated a deeper understanding of the teachers' lived experiences about technology use which can be better captured by face to face interaction through qualitative methods (Straus & Corbin, 1998).

The qualitative part of the study was conducted in a public elementary school located in the western part of the Ankara, in Turkey. In the selection of the school, the researcher used Criterion Sampling Method which tries to review and study the cases that meet some predetermined criterion of importance (Patton, 1987). Since the aim of the study was to identify a comprehensive list of factors affecting technology integration and finding the most frequent ones, it was important to have a diversity of responses from teachers. Therefore, the researchers selected a school which has a variety and large quantity of media and materials. The principal of the school was also very innovative and supportive of teachers' use of technologies.

While deciding on the participants, maximal variation sampling strategy was used to have participants from different subject areas that are most likely to hold different perspectives on central phenomenon (Creswell & Clark, 2007). The sample consists of 20 teachers, including 5 Classroom, 4 Technology and design, 2 English, 2 Turkish, 2 Science and Technology, 2 Math, 1 Social Science, 1 Preschool and 1 Music teachers. There were 16 female (80%) and 4 male (20%) teachers participated in this study.

3.3.1.1. Data Collection

One-on-one semi-structured interviews were conducted with elementary school teachers. The researcher used a schedule of interview questions that include questions about teachers' use of technologies in their lessons (see Appendix B). The researcher asked those questions in a systematic and consistent order through unscheduled probes that arise from the interview process itself (Berg, 2001). The interviews took approximately 45 minutes and all the sessions were tape recorded.

3.3.1.2. Data Analysis Methods

The qualitative analysis was conducted in two main steps. In the first step, the researcher followed some steps suggested by Marshall and Rossman (1999). The researcher transcribed the interviews; made a "line by line analysis" aimed to have a greater analysis of what the concepts mean; and coded the data by giving a name that represents concepts with similar characteristics. After the coding process, the concepts were grouped and categorized under more abstract explanatory terms that are categories or themes. Several categories of factors affecting technology integration emerged from the qualitative data.

In order to identify the main factors that contribute the most to the technology integration in elementary school settings according to the perceptions of teachers, the qualitative data were quantized by counting the number of occurrences in each emerging category for each of the participant teachers (Miles & Huberman, 1994). The frequencies of the emerging categories of factors were written on a table to find out the most common and frequently stressed factors that affect elementary teachers' technology use (see Table 3.2). The factors were arranged based on the highest frequencies and also frequencies of most frequently stressed factors were shown in bold. Examining the Table 3.2., teacher attitude and belief towards technology principal support, teachers' technology competencies, colleague support, computer experience, lack of time, and teaching experience were found to be most common and frequently stressed factors affecting technology integration. Therefore, the researchers decided to develop an instrument that includes measurement scales for each of these factors.

Table 3.2 Frequencies of factors affecting technology integration

Factors affecting Technology Integration	*F*
Teacher Attitude and Belief towards technology	**91**
Principal Support	**87**
Technology Competencies	**54**
Colleague Support	**45**
Computer Experience	**33**
Lack of Time	**31**
Teaching Experience	**17**
Subject Culture	10
Student Support	9
Previous Training on Technology Use	8
Technology Related Classroom Management Skills	7
Students' Grade Level	4
Age	3
Gender	1
Assessment	2

Second, the qualitative data analysis was used to develop a background to create an instrument to be utilized in the quantitative phase, which will be explained in detail in the following part.

3.3.2. Phase II: Instrument Design and Development

The purpose of this phase was to create and validate a survey instrument. Using the data coming from the qualitative part of the study, the survey instrument with the title "Survey of Technology Integration in Elementary School Settings" was developed to collect data for this study (see Appendix D). It included 5 main sections: Part I of the instrument included some demographic information about the respondents, including: (1) gender, (2) age, (3) teaching experience, and (4) educational level. Part II contained some questions about teachers' technology use including, (1) computer use in years (2) frequency of computer use in a day, (3) frequency of technology use in the lessons. Also, Part II of the instrument included a subscale, named "technology integration scale" which included 10 items about teachers' technology use for instructional purposes. This subscale was on a scale of 1 to 5 where 1 represents "Never", and 5 represents "Always". Part III of the instrument included teacher technology perception scale, which consisted of 4 subcategories and 28 items of 5-point Likert scale, ranging from "strongly disagree" to "strongly agree". The subcategories were "principal support" including 13 items, "colleague support" with 4 items, "teacher beliefs and attitudes" including 7 items, and "time" including 4 items. Part 4 included "technology competencies scale", which includes 15 items. In this scale, scores were based on a 5 point rating scale, ranging from "not competent" to "very competent". Finally, part 5 included some questions about availability of some technologies in teachers' home and in their class.

3.3.2.1. Instrument Development

The development of the survey instrument in this study was completed in four main steps. First, the questionnaire items were written using the qualitative data analysis results. Second, some cognitive interviews were conducted to determine whether the questions were clear and understandable. Third, the draft instrument was reviewed by several experts in the field. Finally, a pilot study was conducted to test and validate the instrument. The end product of the pilot study was a revised instrument ready to be administered to classroom teachers in Ankara. In the following parts, the procedures for instrument development will be described in detail.

(1) Generate an Item Pool

In this part, the questionnaire items were written with respect to gathered qualitative data along with the identified factors affecting technology integration. Most of the items were directly quoted from the interview transcripts. At the end, an initial item pool was formed. Then, examining the literature, the researcher made some revisions on the items in this initial item pool.

(2) Cognitive Interviewing

The aim of cognitive interviewing is to understand the questionnaire from respondents' perspective, how they perceive and interpret questions so that the researcher will have a chance to see the potential problems before administering the surveys (Drennan, 2003). In this study, 1 classroom teacher and 2 research assistants working in the field of Education were interviewed to understand whether the respondents interpret the items as intended. They were asked to talk about the draft questionnaire in terms of item content, item clarity, wording, clarity of directions and overall appearance of the survey.

In general, all the respondents liked the survey instrument, and they made some suggestions about how to improve it. For example, the classroom teacher commented on the scalar categories of the subscales since he thought that they were somehow vague. Then, the researcher made some revisions on the scalar categories. Furthermore, the research assistants made some suggestions about the draft instrument. One of them suggested shortening the directions so that the teachers would be bored with long directions. Some revisions were made on wording of items and overall appearance of the survey depending on the suggestions of those participants. Accordingly, this review was used to improve measurement validity by assessing the validity of self-reported survey items (Karabenic et all, 2007). Finally the revised survey instrument with an attached cover letter was sent to a panel of experts.

(3) Review by Panel of Experts

The survey instrument was submitted to several experts in the field of Education to assess whether the items adequately sample the domain of interest (Crocker & Algina, 1996). This review was used to assess the face and content validation of the instrument. The panel of experts consisted of 1 professor, 4 assistant professors and 1 specialist Dr. from Computer Education and Instructional Technologies department and 1 assistant professor from Educational Sciences department. Content validity testing sheets (see Appendix A) were provided to them. They were asked to evaluate whether the items related to the factors intended to measure. Thus, some changes were made on the survey by adding or removing some items and wording of some items based on the feedbacks of the faculty members. Finally, a pilot test was conducted for the revised instrument.

(4) Pilot Testing of Instrument

In this step, the questionnaire was checked for validity and reliability as well as recognizing poor items and necessary revisions. A pilot study was conducted with a convenience sample of 218 elementary school teachers in Ankara. The participants were predominantly female (66.5%, n=145) (See Table 3.3). Nearly half of the participants were classroom teachers (46.8%, n=102), and most of them had a bachelor's degree (72%, n=157). The teaching experience of the teachers ranged from 1 to 38 years (M=19, SD= 9.53) and the computer experience of teachers ranged from 1 to 24 years (M=8, SD= 4.3).

Table 3.3 Characteristics of Sample for the Pilot Study (N=218)

Variables	*F*		*P(%)*	
Gender				
Male	73		33.5	
Female	145		66.5	
Educational Degree				
Associate degree	46		21.1	
Bachelor's degree	157		72	
Master's degree	13		6	
Doctorate degree	2		0.9	
Subject area				
Classroom	102		46.8	
English	21		9.6	
Turkish	13		6.0	
Math	13		6.0	
Science and Technology	8		3.7	
Social Sciences	8		3.7	
Computer	2		0.9	
Technology and design	14		6.4	
Music	1		0.5	
Visual arts	6		2.8	
Physical Sciences	4		1.8	
Religious Culture	6		2.8	
Kindergarten	14		6.4	
Special education	3		1.4	
Guidance	3		1.4	
	Minimum	**Maximum**	**M**	**SD**
Age	22	60	43	8.6
Teaching Experience	1	38	19	9.53
Computer use in years	1	24	8	4.3

In order to identify the main factor structures, exploratory factor analysis (EFA) was used to analyze the data since it enables to "describe and summarize data by grouping together variables that are correlated" (Tabachnic & Fidell, 2007, p.609). Preacher and MacCallum (2003) defined EFA as "a method of discovering the number and nature of latent variables that explain the variation and covariation in a set of measured variables" (p.13).

First, the researcher checked for the assumptions of exploratory factor analysis. Kolmogorov-Smirnov and Shapiro-Wilk normality tests, histograms, Q-Q plots, skewness, and kurtosis were used to check multivariate normality assumption. Multivariate Normality assumption is not met according to Kolmogorov-Simirnov and Shapiro- Wilk tests. However, these tests have their limitations with large sample sizes since it is very easy to get significant results from small deviations from normality (Field, 2005; Tabachnick& Fidell, 2007). Therefore, other tests of normality were used to make a decision about multivariate normality. Examining the histograms and Q-Q plots, the distribution of all the variables seemed to be normal. Similarly, all the skewness and kurtosis values were near to zero, therefore we can state that all the variables are relatively normally distributed.

According to Fabrigar et al. (1999), if the data are relatively normally distributed, maximum likelihood is the preferable method for factor extraction as it “allows for the computation of a wide range of indexes of the goodness of fit of the model” (p.277). Therefore, maximum likelihood is used as the factor extraction method. In addition, there might be some relationships between the factors; therefore, oblique rotation was used as the rotation method as it allows correlations among factors. In the data there were 3 cases with standardized scores in excess of 3.29 ($p < .001$), which were potential outliers (Tabachnick & Fidell, 2007). Also, box plots showed the same outliers with the same cases. In order to check the effects of these outliers, the mentioned cases were deleted and analyses were conducted again. Deletion of these data did not influence the results significantly based on the re-examination of the results. Tabachnick and Fidell (2007) stated that if the deletion of the outliers do not truly change the results, it is not necessary to delete the identified outliers. Therefore, the researcher continued with the analysis without deleting any cases.

Examining the missing values in the data, there were some items, which had more than 10% missing values. Tabachnick and Fidell (2007) explained that “if the missing values are concentrated in a few variables and those variables are not critical to the analysis…the variables with missing values are profitably dropped” (p.66). Therefore, 3 items in the technology perception scale and 2 items in technology integration scale were dropped before conducting factor analysis.

In the following, the results of three exploratory factor analyses on teacher technology perception scale, technology integration scale and technology competencies scale are presented.

Results of Factor Analysis for Teacher Technology Perception Scale

Examining the assumptions, KMO=.91 indicates that data were appropriate for factor analysis. Also, Bartlett's test of sphericity was found to be statistically significant, χ^2 (378)=4231.56, p=.00. This finding also suggested that the population correlation matrix is not an identity matrix and suitable for factor analysis.

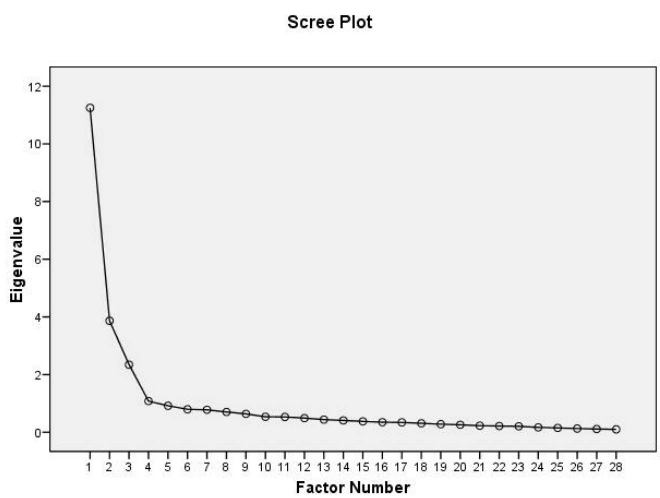

Figure 3.2 Scree Test for Common Factor Solution for Technology Perception Scale

Fabrigar et al. (1999) recommended relying on multiple criteria while deciding on the appropriate number of factors. Therefore, four criteria were used in this study: (1) the scree test, (2) Eigen values greater than 1, (3) randomly splitting the data (4) interpretability of the factor solution. First, examining the scree plot (See Figure 3.2), there were 3 or 4 data points above the last break point. Second, according to eigenvalue criterion, four factors seemed to emerge in the instrument. Third, the data were split randomly and examined the stability of the solution across the two halves (Fabrigar et al., 1999). Examining both halves, the best "simple structure" was reached with a four factor solution. Finally, considering relevant theory and previous research, having four factors was the most interpretable and theoretically sensible solution. Consequently, the researchers decided to retain 4 interpretable factors, which explained %66.2 of the variance in the correlation matrix (see Table 3.4).

Of the 34 items administered, 6 items were removed from the questionnaire either because they loaded on more than one factor, or because their factor coefficients were lower than .40. These findings led to the final form of the scale with 28 items on four factors.

Examining Table 3.4, all of the factor loadings are greater than .40 and the factor loadings of .30 and .40 are acceptable (Hair et al., 2006). The first factor (13 items), accounting for 40.17% of the variance in the correlation matrix, appeared to represent "principal support" of teachers in the technology integration process. The second factor (7 items), accounting for 13.80% of the variance, was related to "teacher attitude and belief" toward using technology. The third factor (4 items), accounting for 8.37% of the variance, was associated with "lack of time" available for teachers' technology use. The last factor (4 items), accounting for 3.86% variance, was related to "colleague support" for teachers' use of technology.

Table 3.4 Items and Factor Loadings of Teacher Technology Perception Scale: Eigenvalues and Percentage of Variance

Item Number	Factor Loading			
	1	2	3	4
Item 2	**.885**	.025	-.029	.088
Item 1	**.816**	-.034	-.025	-.047
Item 16	**.805**	.016	.041	-.067
Item 15	**.717**	.040	.104	-.122
Item 6	**.716**	-.099	.019	.072
Item 14	**.712**	-.085	.007	-.084
Item 4	**.706**	.106	.024	.026
Item 7	**.686**	-.038	-.044	-.155
Item 10	**.650**	-.083	.034	-.195
Item 5	**.645**	-.091	-.179	.036
Item 3	**.624**	.018	.014	-.135
Item 8	**.575**	-.113	-.049	-.260
Item 17	**.543**	-.034	.262	-.010
Item 20	.002	**-.909**	-.090	.057
Item 21	-.033	**-.897**	.006	-.008
Item 18	.106	**-.803**	-.026	.137
Item 19	.042	**-.799**	-.014	.120
Item 23	-.020	**-.784**	-.059	-.114
Item 24	-.091	**-.659**	.089	-.145
Item 22	.073	**-.618**	.051	-.067
Item 27	.058	.069	**.736**	.119
Item 26	-.012	.027	**.713**	-.114
Item 28	-.014	.064	**.687**	.059
Item 25	-.003	-.124	**.643**	-.038
Item 12	.144	-.027	-.052	**-.760**
Item 13	.162	-.051	.092	**-.723**
Item 9	.296	-.056	-.019	**-.478**
Item 11	.207	-.048	-.107	**-.411**
Eigenvalues	11.25	3.86	2.34	1.08
% of Variance	40.17	13.80	8.37	3.86

Internal consistency of the "technology perception scale" (Reliability analysis): Crocker and Angelina (1986) defined the reliability as "the desired consistency (or reproducibility) of test scores" (p.105). In this study, the internal consistency of the three scale scores was estimated by the Cronbach alpha coefficient, yielding a coefficient of .94 for "principal support", .87 for "colleague support", .91 for “teacher attitude and beliefs”, .79 for “lack of time”. The reliability estimates of .7 or higher suggests good reliability (Hair et al., 2006), so all of these scales showed good reliability values.

Results of Factor Analysis for Technology Integration Scale:

KMO=.88 indicated that data were appropriate for factor analysis. Also, Bartlett’s test of sphericity was found to be statistically significant, χ^2 (45)=5990.27, *p*=.00. This finding also suggested that the data were suitable for factor analysis.

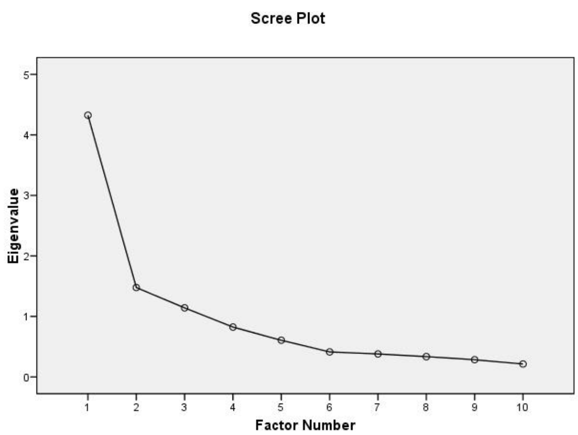

Figure 3.3 Scree Test for Common Factor Solution for Technology Integration Scale

Examining the scree plot (See Figure 3.3), there was one data point above the last break point, which shows 1 factor solution. Therefore, the researcher decided to retain 1 interpretable factor, which explained %43.25 of the variance in the correlation matrix.

Table 3.5 Items and Factor Loadings of Technology Integration Scale: Eigenvalues and Percentage of Variance

	Factor Loading
Item 6	.760
Item 5	.711
Item 8	.705
Item 3	.660
Item 7	.640
Item 2	.554
Item 9	.510
Item 1	.494
Item 10	.486
Item 4	.472
Eigenvalues	4.33
% of Variance	43.25

At the beginning of the analysis, two items had been removed from the scale since they had many missing data, which is more than 5% of the all sample. Also, according to exploratory factor analysis results, 2 more items were removed from this scale because their factor coefficients were lower than .40. These findings led to the final form of the scale with 10 items on one factor (see table 3.5), which is related to teachers' "technology integration".

Internal consistency of the "technology integration scale": The internal consistency of the scale score estimated by the Cronbach alpha coefficient was .84, which showed good reliability estimates for this scale (Hair et al., 2006)

Results of Factor Analysis for Technology Competencies Scale:

Examining KMO value, KMO=.94 indicates that data were appropriate for factor analysis. Also, Bartlett's test of sphericity was found to be statistically significant, χ^2 (105) =11270.93, p=.00, so that the data were suitable for factor analysis.

Examining the Scree test (see Figure 3.4), only one factor seemed to emerge. Therefore, the researcher decided to retain 1 interpretable factor, which explained

%52.44 of the variance in the correlation matrix. These findings led to the final form of the scale with 15 items on one factor (see table 3.6), which is related to "Technology competencies" of the elementary school teachers.

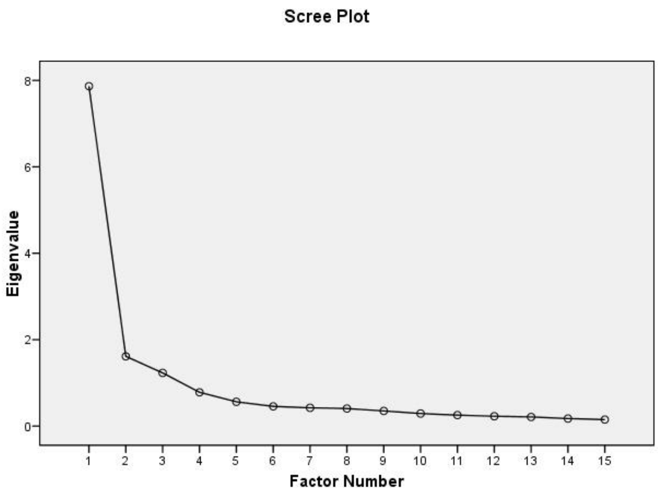

Figure 3.4 Scree Test for Common Factor Solution for Technology Competencies Scale

Table 3.6 Items and Factor Loadings of Technology Competencies Scale: Eigenvalues and Percentage of Variance

	Factor Loading
7	.869
6	.829
9	.828
10	.810
8	.782
5	.771
4	.742
1	.711
13	.681
11	.649
2	.607
12	.594
14	.565
15	.438
3	.431
Eigenvalues	7.87
% of Variance	52.44

Internal consistency of the "Technology Competencies" scale: The internal consistency of the scale score estimated by the Cronbach alpha coefficient was .93, which showed high reliability estimates for this scale (Hair et al., 2006)

In summary, the survey instrument with the title "Survey of Technology Integration in Elementary School Settings" was revised depending on the pilot study results. It included 3 different subscales. First one is "technology integration scale" which contained 10 items about teachers' technology use for instructional purposes. Second one is "teacher technology perception scale", which consisted of 4 subcategories and 28 items. The subcategories were "principal support" including 13 items, "colleague support" with 4 items, "teacher beliefs and attitudes" including 7 items, and "time" including 4 items. Third scale is "technology competencies scale", which includes 15 items about teachers' technology competencies. The revised instrument was ready to be used in the third phase of the study.

3.3.3. Phase III: Model Testing and Building

The purpose of this phase is two folds. The first aim of this phase is to find out classroom teachers' perceptions about the factors affecting their technology integration to elementary school settings. In the first phase of the study, the factors, including principal support, colleague support, teachers' technology competencies, teacher belief and attitude towards using technology, lack of time, computer use in years and teaching experience, were found as the most common factors affecting technology integration perceived by the elementary school teachers in Ankara. Therefore, depending on the literature, a research based path model, which included all these factors, were constructed, as presented in Chapter 2 (See Figure 2.5). The second aim of this phase is to test this research based path model explaining the relationships between technology integration and the factors affecting it.

3.3.3.1. Data Collection

3.3.3.1.1. Participants Selection

The population of the study included all classroom teachers in elementary schools in Ankara and accessible population of the study consisted of all classroom teachers in the central metropolitan districts of Ankara, including Altındağ, Çankaya, Gölbaşı, Keçiören, Mamak, Pursaklar, Sincan and Yenimahalle. Although Akyurt, Çubuk, Kalecik, Ayas, Elmadağ, and Kazan districts were officially included in the metropolitan districts of Ankara, they were not included in the study because they do not possess metropolitan district characteristics much with regard to their long distance from the center of the city. Etimesgut district was not included in the sample due to the problems in the manageability of the data collection task (number of teachers: 9648).

Since, it was difficult to obtain a list of all teachers in the population; "elementary schools" were chosen as cases rather than the teachers within them. In this study, a two stage sampling method was used to select the participant schools. First, in order to decide the number of participant schools, the procedures in clustering method was used (Gay, Mills & Airasian, 2009). Second, in order to select the participant schools, purposive sampling method was used by asking an expert about the schools that might be most beneficial for the aim of this study. Overall, while deciding on the sample of the study, the researcher went through some steps similar to Gay and colleagues (2009, p.130).

Sampling procedure:

Identify and define the population: The target population of the study includes all classroom teachers in elementary schools in Ankara. Total number of elementary schools in Ankara is 900 and there are 12190 classroom teachers, including 3957(32.46%) men and 8233(67.54%) women teachers according to Ankara educational statistics department (2010).

The accessible population of the study consists of all classroom teachers in the central metropolitan districts of Ankara, including Altındağ, Çankaya, Gölbaşı, Keçiören, Mamak, Pursaklar, Sincan and Yenimahalle. Total number of elementary schools in these determined districts are 527, and there are 9648 teachers in these schools. There are 2978(31%) men and 6670 (69%) women teachers in this accessible population. Therefore, the accessible population is quite similar to target population regarding teachers' gender.

Determine the desired sample size: In this research, the desired sample size is around 1000, considering both the need for large sample size for path analysis (Schumacker & Lomax, 2004) and the feasibility of the data collection process as well.

Identify and Define a Logical Cluster: The logical cluster in this research is an "elementary school".

List all the cluster that make up the population of clusters: The list of all schools in the selected districts of Ankara includes 527 schools according to Ankara educational statistics department (2010).

Estimate the average number of population members per cluster: Average number of classroom teachers in all the schools in the accessible population is 18 (total number of elementary school teachers in the accessible population divided by the total number of schools in the accessible population: 9648/527).

Determine number of clusters needed: The number of clusters (schools) to be selected equals to desired sample size, 1000, divided by the estimated size of a cluster, 18. The number of schools needed: 1000/18=55, which is nearly 10% of all the schools in chosen metropolitan districts of Ankara.

Selection of Clusters: Since the required number of schools is nearly 10% of all the schools in chosen metropolitan districts of Ankara, it was logical to select nearly 10% of schools from each district. While selecting the schools, the researchers used purposive sampling method. Asking an expert, an assistant manager of Management of National Education in Ankara, the researchers tried to reach the schools that are most appropriate for the aim of the study. Criteria for this selection were three fold:

- ✓ All the schools should have IT classes
- ✓ The staff of the schools should be somehow permanent so that they have a culture of technology use in those schools.
- ✓ Selected schools are likely to represent all schools in Ankara.

Based on these criteria the expert recommended 54 schools, which include about %10 of the schools from each chosen district of Ankara.

Consequently, the sample of the study included all teachers in each 54 schools. The survey instrument was sent all the teachers in the participant schools. Therefore, the intended sample of the study consists of 1781 teachers, 569 (32%) men, 1212 (68%) women teachers. Again, the sample is quite similar to both the accessible and target population on gender. Since gender might be a critical variable for the aim of the study, we can state that the sample is representative of the accessible population (Gall, Gall & Borg, 2007).

3.3.3.1.2. Questionnaire Administration

The survey instrument "Survey of Factors Affecting Technology Integration in Elementary School Settings" (see Appendix D) developed by the researcher in the previous part of the present study, used to collect some quantitative data. After having permissions from Ministry of National Education in Ankara, the questionnaires were sent to the participant schools by the Ministry of National Education in each district, including Altındağ, Çankaya, Gölbaşı, Keçiören, Mamak, Pursaklar, Sincan and Yenimahalle. The data were collected in one month duration between May and June, 2010. The Ministry of National Education in each selected district sent the survey packages to each participant schools. The survey packages consisted of the cover letters and survey questionnaires for all the teachers in the participant schools. The cover letter included the purpose of the study, explanation of the survey instrument, assurance of confidentiality and some contact information. In total, the survey instrument was sent to 1781 classroom teachers in 54 public elementary schools in the metropolitan districts of Ankara (See Table 3.7). After one month period, the completed surveys in the packages were collected from each participant schools by the Ministry of National Education in each intended district. Then, these survey packages were sent back to the researcher. As shown in Table 3.7, a total of 1080 classroom teachers completed the questionnaire with a response rate of 61%.

In this study, the cases which have less than 25% missing values were considered for the participation rate calculation. There were 50 cases with more than 25% missing values. These cases were excluded from any further analysis. Accordingly, the data coming from 1030 classroom teachers were used in this study and the return rate for overall data collection on eligible responses was calculated as 58%.

Table 3.7 Participant information in each metropolitan district of Ankara

District	Altındağ	Çankaya	Gölbaşı	Keçiören	Mamak	Sincan	Pursaklar	Yenimahalle	Total
Total number of public elementary schools	66	104	32	75	98	55	15	82	527
Total number of classroom teachers	1206	1640	309	1956	1436	1330	266	1505	9648
Number of participant schools	7	10	4	8	8	7	2	8	54
Participant schools in the district level (%)	10.6	9.6	12.5	10.7	8.2	12.7	13.3	9.8	10.2
Number of intended participants	227	268	90	362	212	334	54	234	1781
Intended participants (%)	18.8	16.3	29.1	18.5	14.8	25.1	20.3	15.5	18.5
Number of participant teachers	179	189	42	199	147	140	27	157	1080*
Survey return rate (%)	78.9	70.5	46.7	55.0	69.3	41.9	50.0	67.1	61*
Participant teachers in the district level (%)	14.8	11.5	13.6	10.2	10.2	10.5	10.2	10.4	11.2

* The cases which have less than 25% missing values were considered for the participation rate calculation. Therefore, the data coming from 1030 classroom teachers were used in this study and the return rate for overal data collection on eligible responses was calculated as 58%.

Characteristics of the Participants

The participants included 1080 classroom teachers, which included 11.2% of all the teachers in the metropolitan districts of the Ankara (See Table 3.7). Also, the numbers of classroom teachers in each district of the Ankara were represented in Table 3.7. Approximately 10 percent of teachers in each district were participated in the present study. The characteristics of the sample were given in Table 3.8. The participants in this study were predominantly female (71.9%, n=777). Although most of the teachers have a bachelor's degree (75.6%, n=817), there were a few teachers with Masters' (5.4%, n=58), and Doctorate degree (0.4%, n=4). The teaching experience of teachers ranged from 1 to 42 years with a mean of 17. Finally, the duration of classroom teachers' technology use ranged from 0 to 25 years with a mean of 8 years.

Table 3.8 Characteristics of Sample for the Study (N=1080)

Variables	*N*		*N (%)*	
Gender				
Male	301		27.9	
Female	777		71.9	
Educational Degree				
Associate degree	180		16.7	
Bachelor's degree	817		75.6	
Masters' degree	58		5.4	
Doctorate degree	4		0.4	
	Minimum	**Maximum**	**M**	**SD**
Age	18	60	40.5	7.60
Teaching Experience	1	42	17	8.29
Computer use in years	0	25	8	4.22

3.3.3.2. Data Analysis

Variables

The main variables, their description, data sources and scales used in the path model are presented in Table 3.9.

Table 3.9 Description and Scales of Variables

Variables	Description	Scale
Teaching Experience	Self-reported number of years in teaching profession *Questionnaire Item:* How many years have you been teaching?	Demographics
Computer use in years	Self-reported number of years using computers *Questionnaire Item:* How many years have you been using computers?	Demographics
Technology Integration	Teachers' use of technologies including computers, projectors, printers, scanners, television, overhead projector, DVD/VCD/Video player, television, overhead projector and instructional software, for instructional purposes in their lessons. *Question: How often do you use technologies in your lessons for the following purposes?* Prepare Lesson Plan Access Information Resources Develop instructional materials Develop tests and exam questions Present lesson Demonstrate sample applications Drill and practice Revise lesson Communicate with students Communicate with other teachers	Technology Integration Scale (1= Never to 5= Always)

Table 3.9 (Continued)

Principal Support	School Principal' support for teachers on providing sufficient access and availability to instructional technologies, on providing adequate technical support and professional development opportunities, and their appreciation and encouragement of teachers' use of technologies by providing rewards and incentives, and modeling technology use. Questionnaire Items: Q1.All technological devices in our school are kept in good working condition and updated regularly Q2. Whenever I need, I can readily use all the technologies in our school. Q3. There are sufficient technologies in my class to answer my needs Q4. Whenever I need, I can readily use IT classes. Q5. In our school, I don't have any difficulties in accessing instructional software and ready-made instructional materials. Q6. I don't have much difficulty in accessing the internet in the school. Q7. When I come across a technology related problem in our school, I can easily obtain technical assistance. Q8. School administrators are generally supportive of teachers' technology use in the lessons. Q10. School administrators become a role model for us by using technological devices effectively. Q14. Adequate in-service training opportunities are provided in our school. Q15. Several facilities (i.e. trainings, workshops, sample lessons) that encourage teachers' technology use are organized in our school. Q16. Adequate technical support is provided in our school. Q17. The school administration rewards the teachers verbally or in a written way for using technologies effectively in their lessons.	Technology Perception Scale (1= Strongly disagree to 5= Strongly agree)

Table 3.9 (Continued)

Colleague Support	Colleagues' support by modeling technology use, technical problem-solving and sharing instructional media and materials. *Questionnaire Items:* Q9. Most teachers in our school are supportive of technology use in the lessons. Q11. Some teachers become a role model for us by using technological devices effectively in their lessons. Q12. In our school, the teachers help each other about technology use. Q13. We share technology supported instructional materials with the teachers in our school.	Technology Perception Scale (1= Strongly disagree to 5= Strongly agree)
Teacher Attitude/Belief	Teacher beliefs and attitudes on the value of technology use in classroom. *Questionnaire Items:* Q18. The use of technology increases students' participation to the lessons. Q19. The use of technology positively impact students' achievement in the lessons Q20. The use of technology increases students' interest to the lesson. Q21. The use of technology increases the permanency of the learning. Q22. I want to have more information about technology use in lessons. Q23. I find technology supported lessons so entertaining. Q24. Technology use makes the lessons more student centered.	Technology Perception Scale (1= Strongly disagree to 5= Strongly agree)

Table 3.9 (Continued)

Technology Competencies	Teachers' knowledge and skills related to technology use. *Question: What is your competency level for the following statements?* Q1.Use of word processing (i.e. Word) programs Q2.Use of spreadsheets (i.e. Excel) Q3.Use of database management (i.e. Access) programs Q4.Use of presentation software (i.e. PowerPoint) Q5.Use of Internet Browsers (i.e. Internet Explorer) Q6.Use of Internet Search Engines (i.e. Google) Q7.Downloading documents and software from the Internet Q8.Sending and checking e-mails. Q9.Use of various memory devices such as CD, DVD and flash memory Q10.Use of printer Q11.Use of scanner Q12.Use of projection Q13.Use of CD, DVD and video player Q14.Use of television Q15.Use of overhead projector	Technology Competencies Scale (1= not competent to 2= very competent)
Lack of Time	Teacher perceptions about their lack of time to learn using new technologies and to design and implement technology supported lessons. *Questionnaire Items:* Q25. Preparation for technology supported lesson takes too much time. Q26. Using technology in lessons takes too much time. Q27. I can't find enough time to learn the use of technologies in the lessons. Q28. Due to heavy load of curriculum, I can't allocate adequate time to use technologies in the lessons.	Technology Perception Scale (1= Strongly disagree to 5= Strongly agree)

Statistical Procedures

In this phase of the study, descriptive data analysis and path analysis were used to analyze the data. First, in order to find out classroom teachers' perceptions about the factors influencing technology integration, some descriptive statistics were performed using Statistical Package for Social Sciences (SPSS 15).

Second, path analysis was conducted to investigate the direct and indirect effects of teaching experience, computer use in years, principal support, colleague support, time, teacher attitude and belief and technology competencies, on technology integration to elementary school settings. One of the primary advantages of path analysis is that it enables to measure the direct and indirect effects of each variable on other variables in the model, so it becomes easier to compare the effects of different variables (Allen, 1997; Olabatuyi, 2006). Also, path models are very useful for investigating the interrelationships among a set of variables since researchers have a chance to "simultaneously assess various types of relations among variables and rigorously examine and compare similarities among and the differences between groups of study" (Olabatuyi, 2006, p.12).

There are two kinds of variables in path analysis. First one is endogenous variables, whose variation was explained by the causal model, and they were caused by at least one variable in the path model (Gall, Gall &Borg, 2007; Mertler&Vanatta, 2005; Olabatuyi, 2006). Second one is exogenous variables, which affect the endogenous variables and their variation is not explained by the model. Rather, they are considered to be influenced by other variables outside the causal model. Also, in path analysis, it is possible to use "multiple measures as both independent and dependent variables" (Olabatuyi, 2006, p.12), and endogenous variables might serve as both independent and dependent variables (Klem, 1995). In this study, principal support, lack of time, computer use in years and teaching experience are exogenous variables of the proposed model. Colleague support, teacher attitude and belief, technology competencies, and technology integration are endogenous variables of the model. On the other hand, colleague support, teacher attitude and belief and technology competencies serve as both independent and dependent variables in the model.

According to Gall, Gall and Borg (2007), the procedures to conduct path analysis involves three main steps:

> (1) formulate hypothesis that causally link the variables of interest…(2) select or develop measures of variables that are specified by the hypothesis… (3) compute statistics that show the strength of the relationship between each pair of variables that are causally linked in the hypothesis… Finally, you must interpret the statistics to determine whether they support or refute the theory. (pp. 364-365)

In this study, the researchers followed a similar procedure recommended by Gall, Gall and Borg (2007). First, a research based path model representing the causal structures among the variables of interest, was constructed. Second, a questionnaire, including scales for measuring each variable in the path model, was developed. Third, conducting some statistical analysis, the researchers tested the overall fit of the model to the data in order to understand whether this research based model is consistent with the observed data.

To determine causal connections between the variables in the path model, some statistical procedures were conducted by using Amos 16, developed by Arbuckle (2007). Using Amos, it is possible to draw and test a model graphically and it provides valuable output information, which includes "type of least squares, data distribution, bootstrap options, residuals, standardized and unstandardized path estimates, and modification indices (Clayton & Pett, 2008, p.286). Also, direct, indirect and total effects are shown in Amos outputs. Allen (1997) defined the direct effect of a variable as "its effect on a dependent variable, controlling for the effects of both causally prior and intervening variables" (p.165). The direct effects are displayed by straight arrows from one variable to another in the path diagram (Klem, 1995). On the other hand, indirect effects include chains of straight arrows and it happens when a variable influences an endogenous variable through its effect on some other variable (Mertler & Vanatta, 2005). According to Hair et al. (2006), indirect effects are consistent with mediation and a mediation effect occurs when “a third variable/construct intervenes between two other related constructs” (p.866). Last, the total effects can be estimated by summing direct and indirect effects of a variable on another.

Finally, the overall fit of the initial model was assessed by using some different fit statistics: Chi-square statistics, Root Mean Square Error Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI) and Tucker Levis Index (TLI). Chi-Square test discovers the degree of fit between the causal model and the observed data (Olabatuyi, 2006). The researchers should be interested in obtaining a non-significant chi-square value since “it indicates that sample covariance matrix and the reproduced model-implied covariance matrix are similar” (Schumacker & Lomax, 2004, p.81). However, Chi-square value should be used with caution since it is very sensitive to sample size. When the sample size is above 200, the Chi-square statistics has a tendency to show a significant value. Therefore, if the sample size is large, some alternative fit indices should be considered. The next index for consideration was Root Mean Square Error of Approximation (RMSEA) (Steiger & Lind, 1980). Values less than .05 are considered to be good, values between .05 and 0.8 considered to be adequate, and values greeter than .10 indicates a poor fit (Browne & Cudeck, 1993). Therefore, the smaller the values of RMSEA, the better the model fit. The last indices for consideration were CFI, NFI and TLI indices, which are classified as incremental fit indices and they can provide information about practical significance (Bentler & Bonett, 1980). CFI, NFI and TLI scores higher than .90 indicate an acceptable fit. Accordingly, as suggested by Hoyle (1995), the researchers used several fit indices to evaluate the overall fit of the model.

CHAPTER 4

RESULTS

In this chapter, the results of the study are represented in two main sections: (1) Descriptive data analysis, (2) Path Analysis. Before presenting the results, some information about the data screening and missing value analysis processes was provided.

Data Screening and Missing Values

In this study, the cases which have less than 25% missing values were considered for the participation rate calculation. There were 50 cases with more than 25% missing values. These cases were excluded from any further analysis. All the variables in the remaining data have less than 5% missing values. The variable that had the highest number of cases with missing values was "computer use in years" (4.5%). In other variables, missing values are less than 3%. In the descriptive data analysis, the missing values are reported in the tables.

Before proceeding to any other statistical test, the remaining missing values were analyzed to see whether there was any obvious pattern. Missing value analysis results showed that the data are not missing completely at random (MCAR) $X^2(5728) = 6866.67, p = .00$. When the data is not MCAR, the listwise, pairwise and regression methods can lead to biased estimates, so EM estimation should be used to estimate the means, correlations and covariances (SPSS Inc., 2007). Therefore, before conducting path analysis, EM estimation was used to deal with missing values.

4.1. Descriptive Results

Descriptive data analysis was conducted to find out classroom teachers' perceptions about the factors influencing technology integration to elementary school settings. The descriptive statistics are based on a total of 1030 classroom teachers. The results of descriptive data analysis were represented under four headings: (1) Teachers' use of technologies for instructional purposes, (2) Teacher perceptions about the factors affecting technology integration, (3) Teachers' perceived technology competencies and (4) Technology availability in home and class.

4.1.1. Teachers' Technology Use

Descriptive statistics about classroom teachers' technology use are provided in this part. First, some frequencies will be reported about teachers' computer experience. Second, some information will be provided about frequency of teachers' technology use in their courses. Finally, some statistics will be presented about how often teachers use technologies for instructional purposes.

4.1.1.1. Computer Experience

The duration of classroom teachers' computer use ranged from 0 to 25 years, *M*=8 (Median=8, Mode=10). Furthermore, the frequency of teachers' computer use in a day was shown in Table 4.1. Examining the table, most teachers used computers less than one hour (43.9%) or 1 to 3 hours (40.9%) in a day. Few teachers (9%) used technology more than 3 hours in a day. 44 teachers (4.3%) pointed out that they "never" used computers in a day.

Table 4.2 displays the frequency of classroom teachers' technology use in their courses. Most teachers reported to use technologies sometimes (37.4%) and often (35.5%) in their courses. In addition, only 36 teachers (3.5%) proposed that they never use technologies in their courses.

Table 4.1 Frequency of teachers' computer use in a day

	F	*P(%)*
Never	44	4.3
Less than 1 hour	452	43.9
1-3 hours	421	40.9
More than 3 hours	93	9
Total	1030	
Missing	20	

Table 4.2 Teachers' technology use in courses

	F	*P(%)*
Never	36	3.5
Seldom	125	12.1
Sometimes	385	37.4
Often	366	35.5
Always	92	8.9
Total	1004	
Missing	26	

4.1.1.2. Teachers' Technology Use for Instructional Purposes

On a five point frequency scale (1=Never, 2=Seldom, 3=Sometimes, 4=Often, 5=Always), the participants rated the frequency of their technology use for instructional purposes. Examining the mean scores (see Table 4.3) and frequencies (see Table 4.4), the teachers rated that they mostly used technologies for class preparation purposes, including accessing information resources (M=4.0, SD=1.15), creating test and exam questions (M=3.89, SD=.99) and developing instructional materials (M=3.87, SD=.92). They moderately used technologies for delivering instruction, including drill and practice (M=3.61, SD=1.05), demonstrations and simulations (M=3.23, SD=1.06), presenting (M=3.11, SD=1.07), and revising lesson (M=3.09, SD=1.09). The participant teachers used technologies least frequently for communicating with teachers (M=2.78, SD=1.08) and students (M=2.72, SD=1.10).

Table 4.3 Technology Use for Instructional Purposes: Descriptive Statistics (1=Never, 2=Seldom, 3=Sometimes, 4=Often, 5=Always)

Type of technology use	*M*	*Mdn*	*Mode*	*SD*	*Var*	*Ran*
Prepare Lesson plan	3.62	4.00	4	1.15	1.3	4
Access Information Resources	4.10	4	4	.85	.72	4
Develop instructional materials	3.87	4	4	.92	.86	4
Creating tests and exam questions	3.89	4	4	.99	.99	4
Present lesson	3.11	3	3	1.07	1.16	4
Demonstrations and simulations	3.23	3	3	1.06	1.18	4
Drill and practice	3.61	4	4	1.05	1.10	4
Revise lesson	3.09	3	3	1.09	1.20	4
Communicate with students	2.72	3	3	1.10	1.21	4
Communicate with other teachers	2.78	3	3	1.08	1.17	4

Table 4.4 Technology Use for Instructional Purposes: Frequencies and Percentages

Type of technology use	*Never* *f(P)*	*Seldom* *f(P)*	*Sometimes* *f(P)*	*Often* *f(P)*	*Always* *f(P)*	*Missing* *f(P)*
Prepare Lesson plan	71 (7%)	95 (9%)	238 (23%)	368 (36%)	254 (25%)	4 (0%)
Access Information Resources	7 (1%)	36 (%3)	173 (17%)	444 (43%)	370 (36%)	0
Develop instructional materials	19 (2%)	52 (5%)	244 (24%)	437 (42%)	272 (27%)	6 (0%)
Develop tests and exam questions	29 (3%)	63 (6%)	211 (21%)	412 (40%)	310 (30%)	5 (%0)
Present lesson	100 (10%)	157 (15%)	386 (38%)	295 (29%)	88 (9%)	4 (0%)
Demonstrations and simulations	81 (8%)	139 (13%)	372 (36%)	335 (33%)	101 (10%)	2 (0.2%)
Drill and practice	45 (4%)	95 (9%)	292 (28%)	381 (37%)	216 (21%)	1 (%0.1)
Revise lesson	104 (10%)	167 (16%)	381 (37%)	280 (27%)	96 (9%)	2 (0.2%)
Communicate with students	184 (18%)	211 (20.5%)	398 (39%)	186 (18%)	51 (5%)	0
Communicate with other teachers	139 (14%)	251 (24%)	408 (40%)	158 (15%)	74 (7%)	0

4.1.2. Teacher Perceptions about the Factors Affecting Technology Integration

On a five point agreement scale, ranging from "strongly disagree" to "strongly agree", participants rated their perceptions about the factors affecting technology integration. They answered questions about 4 main factors: (1) principal support, (2) colleague support, (3) teacher attitude and beliefs towards using technology and (4) lack of time. Teachers' responses for the questions about each factor will be discussed in the following parts.

4.1.2.1. Principal Support

On a five point agreement scale of 1 to 5, where 1 represented (strongly disagree) and 5 represented (strongly agree), participants rated their preferences about support provided by the school principals in their schools. The mean scores and frequencies were provided in Table 4.5 and Table 4.6 respectively. Most teachers rated that school principals were generally supportive of their technology use in the lessons (*M*=3.84, *SD*=1.16). Also, participants mostly rated that they didn't have much difficulty in accessing the Internet in the school (*M*=3.80, *SD*=1.23) and whenever they need, they can readily use all the technologies in their schools (*M*=3.66, *SD*=1.16). Also, the participant teachers mostly rated that they can readily obtain technical support and assistance when they come across a technology related problem in their school (*M*=3.75, *SD*=1.14), but the teachers' ratings for the organization of some professional support facilities (i.e. trainings, workshops, sample lessons) (*M*=3.16, *SD*=1.24) were somehow low. Also, the ratings for teachers' access to IT classes (*M*=3.27, *SD*=1.29) and the sufficiency of technological devices (*M*=3.13, *SD*=1.45) in the classes were low. Furthermore, the least preferred item was about rewarding issues that the school administration rewards the teachers verbally or in a written way for using technologies effectively in their courses (*M*=2.72, *SD*=1.32).

Table 4.5 Teacher perceptions about principal support: Descriptive Statistics (1=Strongly Disagree, 5=Strongly Agree)

	M	*Mdn*	*Mode*	*SD*	*Var*	*Ran*
All technological devices in our school are kept in good working condition and updated regularly	3.38	3	3	1.22	1.50	4
Whenever I need, I can readily use all the technologies in our school.	3.66	4	5	1.16	1.37	4
There are sufficient technologies in my class to answer my needs	3.13	3	5	1.45	2.09	4
Whenever I need, I can readily use IT classes.	3.27	3	3	1.29	1.67	4
In our school, I don't have any difficulties in accessing instructional software and ready-made instructional materials.	3.49	4	4	1.17	1.36	4
I don't have much difficulty in accessing the internet in the school.	3.80	4	5	1.23	1.50	4
When I come across a technology related problem in our school, I can easily obtain technical assistance.	3.75	4	5	1.14	1.30	4
School administrators are generally supportive of teachers' technology use in the lessons.	3.84	4	5	1.16	1.35	4
School administrators become a role model for us by using technological devices effectively.	3.69	4	4	1.12	1.25	4
Adequate in-service training opportunities are provided in our school.	3.37	3	3	1.15	1.33	4
Several facilities (i.e. trainings, workshops, sample lessons) that encourage teachers' technology use are organized in our school.	3.16	3	3	1.24	1.53	4
Adequate technical support is provided in our school.	3.43	4	4	1.15	1.34	4
The school administration rewards the teachers verbally or in a written way for using technologies effectively in their courses.	2.72	3	3	1.32	1.75	4

Table 4.6 Teacher perceptions about principal support: Frequencies and Percentages

	1 *f(P)*	*2* *f(P)*	*3* *f(P)*	*4* *f(P)*	*5* *f(P)*	*Missing* *f(P)*
All technological devices in our school are kept in good working condition and updated regularly	83 (8%)	167 (16%)	293 (28%)	248 (24%)	235 (23)	4 (0.4%)
Whenever I need, I can readily use all the technologies in our school.	42 (4%)	150 (15%)	236 (23%)	290 (28%)	309 (30%)	3 (0.3%)
There are sufficient technologies in my class to answer my needs	201 (19%)	168 (16%)	202 (20%)	212 (21%)	245 (24%)	2 (0.2%)
Whenever I need, I can readily use IT classes.	123 (12%)	167 (16%)	257 (25%)	257 (25%)	213 (21%)	13 (1.3%)
In our school, I don't have any difficulties in accessing instructional software and ready-made instructional materials.	67 (6.5%)	136 (13%)	278 (27%)	311 (30%)	232 (23%)	6 (0.6%)
I don't have much difficulty in accessing the internet in the school.	65 (6.3%)	102 (10%)	198 (19%)	270 (26%)	392 (38%)	3 (0.3%)
When I come across a technology related problem in our school, I can easily obtain technical assistance.	38 (4%)	116 (11%)	251 (24%)	282 (27%)	339 (33%)	4 (%0.4)
School administrators are generally supportive of teachers' technology use in the lessons.	47 (5%)	91 (9%)	236 (23%)	264 (26%)	390 (38%)	2 (0.2%)
School administrators become a role model for us by using technological devices effectively.	45 (4%)	106 (10%)	263 (26%)	322 (31%)	293 (28%)	1 (0.1%)
Adequate in-service training opportunities are provided in our school.	69 (7%)	158 (15%)	310 (30%)	289 (28%)	194 (19%)	10 (1%)
Several facilities (i.e. trainings, workshops, sample lessons) that encourage teachers' technology use are organized in our school.	119 (12%)	187 (18%)	306 (30%)	238 (23%)	173 (17%)	7 (0.7%)
Adequate technical support is provided in our school.	71 (7%)	137 (13%)	304 (30%)	305 (30%)	209 (20%)	4 (0.4%)
The school administration rewards the teachers verbally or in a written way for using technologies effectively in their courses.	248 (24%)	210 (20%)	254 (24%)	191 (19%)	116 (11%)	11 (1.1%)

4.1.2.2. Colleague Support

On a five point agreement scale (1= strongly disagree to 5= strongly agree), participants rated some statements about colleague support in their schools according to their preferences. The mean scores and frequencies were presented in Table 4.7 and Table 4.8 respectively. Examining the tables, it was found that the participant teachers mostly rated that teachers help each other about technology use (*M*=3.80, *SD*=1.08) and some teachers has become a role model by using technological devices effectively in their courses (*M*=3.74, *SD*=1.08).

4.1.2.3. Teacher Attitude and Belief towards Using Technology

On a five point agreement scale (1= strongly disagree to 5= strongly agree), participants rated a series of attitude and belief statements regarding technology use in lessons. The mean scores and frequencies were shown in Table 4.9 and 4.10 respectively. After examination of the tables, the participant teachers mostly desire to have more information about technology use in their lessons (*M*=4.47, *SD*=0.85) and they find technology supported lessons so entertaining (*M*=4.42, *SD*=0.81). Other mostly preferred items were about technology's positive impacts on students' interest to the lesson (*M*=4.36, *SD*=0.82), permanency of learning (*M*=4.34, *SD*=0.84) and students' achievement in the lessons (*M*=4.29, *SD*=0.86).

Table 4.7 Teacher perceptions about colleague support: Descriptive Statistics (1=Strongly Disagree, 5=Strongly Agree)

	M	*Mdn*	*Mode*	*SD*	*Var*	*Ran*
Most teachers in our school are supportive of technology use in the lessons.	3.68	4	4	1.06	1.13	4
Some teachers become a role model for us by using technological devices effectively in their lessons.	3.74	4	4	1.08	1.17	4
In our school, the teachers help each other about technology use.	3.80	4	4	1.08	1.17	4
We share technology based instructional materials with the teachers in our school.	3.67	4	4	1.08	1.18	4

Table 4.8 Teacher perceptions about colleague support: Frequencies and Percentages

	1	*2*	*3*	*4*	*5*	*Missing*
	f(P)	*f(P)*	*f(P)*	*f(P)*	*f(P)*	*f(P)*
Most teachers in our school are supportive of technology use in the lessons.	29 (3%)	112 (11%)	280 (27%)	334 (32%)	267 (26%)	8 (0.8%)
Some teachers become a role model for us by using technological devices effectively in their lessons.	32 (3.1%)	107 (10%)	251 (24%)	334 (32%)	299 (29%)	7 (0.7%)
In our school, the teachers help each other about technology use.	33 (3%)	98 (10%)	234 (23%)	340 (33%)	323 (31%)	2 (0.2%)
We share technology based instructional materials with the teachers in our school.	33 (3%)	122 (12%)	264 (26%)	340 (33%)	269 (26%)	2 (0.2%)

Table 4.9 Teacher attitudes and beliefs towards using technology: Descriptive Statistics (1=Strongly Disagree, 5=Strongly Agree)

	M	*Mdn*	*Mode*	*SD*	*Var*	*Ran*
The use of technology increases students' participation to the lessons.	4.12	4	5	1.01	1.03	4
The use of technology positively impact students' achievement in the lessons	4.29	4	5	.86	.74	4
The use of technology increases students' interest to the lesson.	4.36	5	5	.82	.67	4
The use of technology increases the permanency of the learning.	4.34	5	5	.84	.70	4
I want to have more information about technology use in lessons.	4.47	5	5	.85	.73	4
I find technology supported lessons so entertaining.	4.42	5	5	.81	.66	4
Technology use makes the lessons more student centered.	4.14	4	5	.92	.84	4

Table 4.10 Teacher attitudes beliefs towards using technology: Frequencies and Percentages

	1 *f(P)*	*2* *f(P)*	*3* *f(P)*	*4* *f(P)*	*5* *f(P)*	*Missing* *f(P)*
The use of technology increases students' participation to the lessons.	21 (2%)	59 (6%)	179 (17%)	292 (28%)	479 (47%)	0 (0%)
The use of technology positively impact students' achievement in the lessons	7 (0.7%)	35 (3%)	127 (12%)	348 (34%)	512 (50%)	1 (0%)
The use of technology increases students' interest to the lesson.	4 (0.4%)	28 (2.7%)	119 (12%)	323 (31%)	555 (54%)	1 (0.1%)
The use of technology increases the permanency of the learning.	7 (0.7%)	27 (3%)	118 (12%)	317 (31%)	540 (52%)	21 (2.0%)
I want to have more information about technology use in lessons.	10 (1%)	34 (3%)	83 (8.1%)	240 (23%)	662 (64%)	1 (0.1%)
I find technology supported lessons so entertaining.	7 (1%)	27 (3%)	90 (9%)	303 (29%)	600 (58%)	3 (0.3%)
Technology use makes the lessons more student centered.	12 (1%)	38 (4%)	181 (18%)	355 (35%)	440 (43%)	4 (0.4%)

4.1.2.4. Technology Competencies

On a five point scale (1= not competent to 5= very competent), the participant teachers were asked to rate their level of technology competencies. The mean scores and frequencies were presented in Table 4.11 and Table 4.12 respectively. Participant teachers were most competent in the use of an old technology, the television (*M*=4.29, *SD*=1.11). Also, their competency levels for the use of Internet applications were somehow high. These competencies included using Internet search engines (*M*=4.08, *SD*=1.10), downloading documents and software from the Internet (*M*=3.85, *SD*=1.19), using Internet browsers (*M*=3.79, *SD*=1.17) and sending and checking e-mails (*M*=3.77, *SD*=1.27). Furthermore, they have good competency levels for the use of various memory devices such as CD, DVD and flash memory (*M*=4.01, *SD*=1.10) and use of printer (*M*=3.93, *SD*=1.18). Respectively, teachers felt themselves more competent on the use of Microsoft Office applications including Word Processing programs (*M*=3.45, *SD*=1.20), and presentation software (i.e. Power Point) (*M*=3.11, *SD*=1.25), while use of spreadsheets (i.e. Excel) (*M*=2.86, *SD*=1.20) and database management programs (i.e. Access) (*M*=2.34, *SD*=1.18) received the lowest competence rankings.

Table 4.11 Teachers' Perceived Technology Competencies: Descriptive Statistics (1=Not competent, 5=Very Competent)

	M	*Mdn*	*Mode*	*SD*	*Var*	*Ran*
1. Use of word processing (i.e. Word) programs	3.45	3	3	1.20	1.44	4
2. Use of spreadsheets (i.e. Excel)	2.86	3	3	1.20	1.45	4
3. Use of database management (i.e. Access) programs	2.34	2	1	1.18	1.40	4
4. Use of presentation software (i.e. PowerPoint)	3.11	3	3	1.25	1.57	4
5. Use of Internet Browsers (i.e. Internet Explorer)	3.79	4	5	1.17	1.37	4
6. Use of Internet Search Engines (i.e. Google)	4.08	4	5	1.10	1.21	4
7. Downloading documents and software from the Internet	3.85	4	5	1.19	1.41	4
8. Sending and checking e-mails.	3.77	4	5	1.27	1.60	4
9. Use of various memory devices such as CD, DVD and flash memory	4.01	4	5	1.10	1.20	4
10. Use of printer	3.93	4	5	1.18	1.40	4
11. Use of scanner	3.32	3	5	1.35	1.81	4
12. Use of projection	3.74	4	5	1.25	1.55	4
13. Use of CD, DVD and video player	4.01	4	5	1.11	1.22	4
14. Use of television	4.29	5	5	1.11	1.23	4
15. Use of overhead projector	3.89	4	5	1.26	1.59	4

Table 4.12 Teachers' Perceived Technology Competencies: Frequencies and Percentages

	1 *f(P)*	*2* *f(P)*	*3* *f(P)*	*4* *f(P)*	*5* *f(P)*	*Missing* *f(P)*
1. Use of word processing (i.e. Word) programs	74 (7%)	139 (14%)	315 (31%)	249 (24%)	249 (24%)	4 (0%)
2. Use of spreadsheets (i.e. Excel)	151 (15%)	263 (26%)	289 (28%)	215 (21%)	105 (10%)	7 (1%)
3. Use of database management (i.e. Access) programs	310 (30%)	282 (27%)	255 (25%)	113 (11%)	58 (6%)	12 (1%)
4. Use of presentation software (i.e. PowerPoint)	122 (12%)	214 (21%)	288 (28%)	227 (22%)	173 (17%)	6 (1%)
5. Use of Internet Browsers (i.e. Internet Explorer)	53 (5%)	95 (9%)	219 (21%)	292 (28%)	359 (35%)	12 (1%)
6. Use of Internet Search Engines (i.e. Google)	38 (4%)	58 (6%)	178 (17%)	257 (25%)	495 (48%)	4 (0%)
7. Downloading documents and software from the Internet	56 (5%)	85 (8%)	218 (21%)	260 (25%)	405 (39%)	6 (1%)
8. Sending and checking e-mails.	77 (8%)	95 (9%)	211 (21%)	237 (23%)	401 (39%)	9 (1%)
9. Use of various memory devices such as CD, DVD and flash memory	37 (4%)	63 (6%)	198 (19%)	279 (27%)	446 (43%)	7 (1%)
10. Use of printer	55 (5%)	76 (7%)	199 (19%)	253 (25%)	444 (43%)	3 (0%)
11. Use of scanner	115 (11%)	197 (19%)	225 (22%)	213 (21%)	273 (27%)	7 (1%)
12. Use of projection	69 (7%)	111 (11%)	215 (21%)	252 (25%)	380 (37%)	3 (0%)
13. Use of CD, DVD and video player	36 (4%)	71 (7%)	186 (18%)	275 (27%)	446 (23%)	16 (2%)
14. Use of television	45 (4%)	47 (5%)	110 (11%)	182 (18%)	630 (61%)	16 (2%)
15. Use of overhead projector	70 (7%)	89 (9%)	177 (17%)	222 (22%)	458 (45%)	14 (1%)

4.1.2.5. Lack of Time

On a five point agreement scale (1= strongly disagree to 5= strongly agree), participants rated some statements about time issues related to technology use for instructional purposes. The results were arranged according to mean scores (see Table 4.13) and frequencies (see Table 4.14). Examining tables, it was found that teachers mostly have time problems during preparation for technology supported lessons (*M*=3.37, *SD*=1.22). Also, some teachers thought that use of technologies in the lesson took too much time (*M*=3.03, *SD*=1.26). The least preferred item was about having difficulties in allocating adequate time to learn the use of technologies in the lessons (*M*=2.71, *SD*=1.28).

4.1.3. Technology Availability in Home and Class

The teachers were asked to mark the technologies that are available in their home or classroom environment. The frequencies of the teachers that have each of the following technologies at home and at school were presented in Table 4.15. Most teachers had computer (95.9%) and television (89.7%) in their home. Also, most of them had DVD/VCD/ Video Player (80.1%) and printer (75.7%) at home. A small number of teachers had projector (1.4%) and overhead projector (0.7%) in their home. Also, examining the table, most teachers had computers (50.8%) and projectors (52.1%) in their classes. Furthermore, many teachers had television (39.2%) and DVD/VCD/ Video Player (39%) in their classes. On the other hand, only 134 teachers had scanners (13%) in their classes.

Table 4.13 Teacher perceptions about lack of time: Descriptive Statistics (1=Strongly Disagree, 5=Strongly Agree)

	M	*Mdn*	*Mode*	*SD*	*Var*	*Ran*
Preparation for technology supported lesson takes too much time.	3.37	3	4	1.22	1.49	4
Using technology in lessons takes too much time.	3.03	3	3	1.26	1.59	4
I can't find enough time to learn the use of technologies in the lessons.	2.71	3	3	1.28	1.66	4
Due to heavy load of curriculum, I can't allocate adequate time to use technologies in the lessons.	2.85	3	3	1.31	1.74	4

Table 4.14 Teacher perceptions about lack of time: Frequencies and Percentages

	1 f(P)	*2 f(P)*	*3 f(P)*	*4 f(P)*	*5 f(P)*	*Missing f(P)*
Preparation for technology supported lesson takes too much time.	102 (9.9%)	132 (13%)	284 (28%)	302 (29%)	204 (20%)	6 (0.6%)
Using technology in lessons takes too much time.	159 (15%)	189 (18%)	279 (27%)	260 (25%)	137 (13%)	6 (0.6%)
I can't find enough time to learn the use of technologies in the lessons.	230 (22%)	233 (23%)	271 (26%)	178 (17%)	111 (11%)	7 (0.7%)
Due to heavy load of curriculum, I can't allocate adequate time to use technologies in the lessons.	208 (20%)	212 (21%)	269 (26%)	197 (19%)	141 (14%)	3 (03%)

Table 4.15 Available technologies in home and classroom: Frequencies and Percentages

	Home		*Classroom*	
Technologies	*F*	*p*	*f*	*p*
Computer	988	95.9%	523	50.8%
Projector	14	1.4%	537	52.1%
Printer	780	75.7%	177	17.2%
Scanner	426	41.4%	134	13%
DVD/VCD/ Video Player	825	80.1%	402	39%
Television	924	89.7%	404	39.2%
Overhead Projector	7	0.7%	276	26.8%
Instructional Software	227	22%	215	20.9%

4.2. Path Analysis Results

Amos 16.0 software was used to test the hypothesized model presented in Figure 2.5. This model predicted classroom teachers' technology integration to elementary school settings by seven variables: principal support, colleague support, lack of time, teaching experience, computer use in years, teacher attitude and belief and technology competencies. In this study, as suggested by Schumacker and Lomax, "the amount of influence rather than a cause and effect relationship is assumed and interpreted by direct, indirect, and total effects among variables" (p.56). Therefore, the term "effect" has been used as synonym with the term "influence" in this study.

This section starts with some preliminary analysis results and continues with the presentation of the path model estimates.

4.2.1. Preliminary analysis

Since path analysis is an extension and simple application of multiple regression (Mertler&Vanatta, 2005; Olabatuyi, 2006), the model estimation should satisfy the asumptions of multiple regression. Each assumption was discussed separately in the following parts.

Multicollinearity

Table 4.16 shows the bivariate correlations between variables. According to Tabachnick and Fidell (2007), bivariate correlation between two variables should be less than .90 to meet the multicollinearity assumption. As shown the Table 4.16, these correlations are not higher than 0.90. Although the highest correlation is between Principal support and Colleague support ($R=.77$ $p<.01$), all the VIF values are below 10 and tolerance statistics all above .2 (Field, 2005, p. 196), therefore the data meet the multicollineartiy assumption.

Table 4.16 Pearson product-moment correlations between measures of technology integration

Measures	1	2	3	4	5	6	7	8
(1) Technology Integration	1							
(2) Technology Competencies	.48**	1						
(3) Teacher Attitude/Belief	.35**	.34**	1					
(4) Colleague Support	.33**	.26**	.45**	1				
(5) Principal Support	.32**	.28**	.40**	.77**	1			
(6) Lack of Time	-.03	-.13**	.08**	.08**	.12**	1		
(7) Teaching Experience	-.09**	-.22**	-.09**	.08**	.13**	.09**	1	
(8) Computer use in years	.27**	.44**	.13**	.01	.05	-.12**	-.25**	1

*p<.05, two-tailed; **p<.01, two-tailed.

Normality of the Residuals and Linearity

The assumption of normality states that residuals are normally distributed with a mean of zero (Field, 2005). First, in order to check the normality assumption, histogram and P-P plot was examined. As shown in Figure 4.1, histogram of residuals and Figure 4.2, Normal P-P plot, errors are normally distributed.

Second, in order to check the linearity assumption, "P-P Plots" were examined. As presented in Figure 4.2, the points on the graph take the form of a line and there are no curvilinear patterns. Therefore, there is a linear relationship between the dependent variable and independent variables. Accordingly, linearity assumption was not violated.

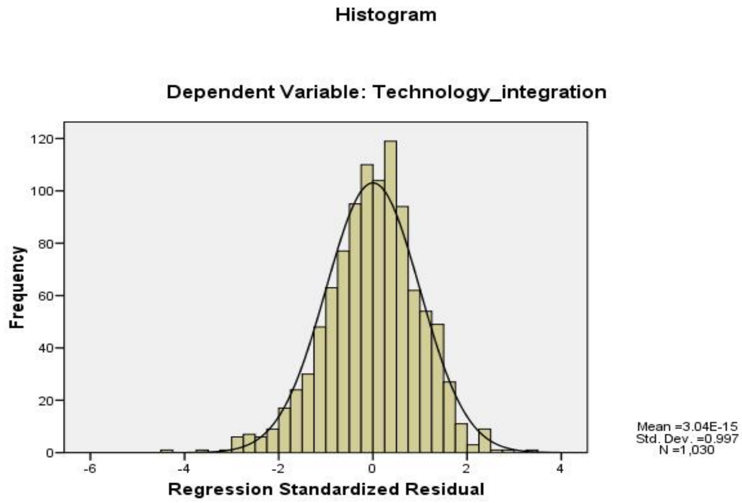

Figure 4.1 Histogram of Residuals

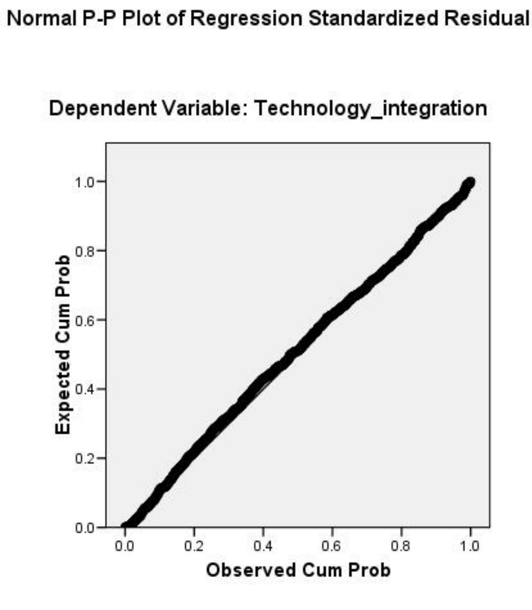

Figure 4.2 Normal P-P plot of Residuals

Homoscedasticity

According to Field (2005), in order to meet homoscedasticity assumption, the variance of the residual terms should be constant at each level of the independent variables. Homoscedasticity assumption was checked by visual examination of the scatter plot of the standardized residuals. Examining Figure 4.3, the points are evenly dispersed around zero and no pattern existed in the scatter plot. Thus, homoscedasticity assumption was not violated.

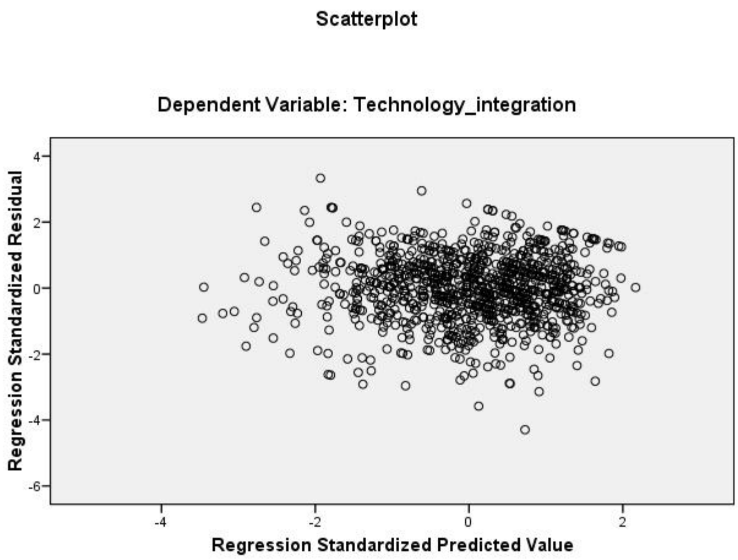

Figure 4.3 Scatter Plot of Predicted Value and Residual

Influential Observation and Outliers

Scatterplots, residual plots, Cook's distance, leverage statistics and Mahalonobis distance tests were used to check this assumption. According to Scatter plots and residual plots, there are few outliers. According to Cook's Distance M=0.001 and

SD=0.003, min value=.000 and max value=0.023. There is no problematic situations examined in Cook's distance since all the values are lower than 1 (Field, 2005).

The average leverage value was calculated as 0.1 by the formula given by Stevens (2009). He recommends the use of three times the average as a cut-off point for the influential cases so we are looking for the cases larger than .03. According to the leverage statistics, there were no values higher than .03 and no extreme values influence the regression model

Mahalanobis distances "measure the distance of cases from the mean of the predictor variables" (Field, 2005, p.165). According to Hair et al. (2006), the Mahalanobis D^2divided by the number of variables involved (D^2/df) exceeding 3 or 4 in large samples can be seen as possible outliers. Examining the values for Mahalanobis distances, all the (D^2/df) values were lower than 4.

In summary, examining scatterplots, residual plots, cook's distance, leverage statistics and mahalanobis distance tests, there were no influential cases in the data.

Independence of Error

Independence of error means that the residual terms should be uncorrelated (Field, 2005). Durbin-Watson coefficient test was used to check this assumption. According to this test, the values less than 1 and greater than 3 show some cause for concern. In this analysis, d= 1.69, so independence of error assumption was met.

After checking the assumption, factor analysis was conducted to establish the construct validity of the factors. As shown in Table, our priori pattern of factor loadings found in the pilot study was confirmed with the actual data. Also, the scales for all these 6 factors showed good reliability values.

Table 4.17 Items and Factor Loadings for the Factors Influencing Technology Integration

Factors and Items in the questionnaire	Factor Loading	Internal Consistency (Cronbach alpha coefficient)
Factor 1: Technology Integration		
Item 6	.836	
Item 8	.834	
Item 5	.819	
Item 7	.715	
Item 9	.684	.89
Item 3	.638	
Item 10	.576	
Item 2	.544	
Item 4	.528	
Item 1	.493	
Factor 2: Principal Support		
Item 2	.862	
Item 1	.780	
Item 16	.750	
Item 4	.738	
Item 7	.728	
Item 6	.678	.93
Item 8	.670	
Item 15	.629	
Item 10	.615	
Item 17	.597	
Item 5	.567	
Item 14	.557	
Item 3	.393	
Factor 3: Colleague Support		
Item 13	-.865	
Item 12	-.841	.91
Item 11	-.725	
Item 9	-.523	

Table 4.17 (Continued)

Factor 4: Teacher Attitude and Belief		
Item 20	-.933	
Item 19	-.889	
Item 21	-.886	
Item 23	-.843	.93
Item 22	-.753	
Item 24	-.715	
Item 18	-.599	
Factor 5: Lack of Time		
Item 27	.811	
Item 28	.768	.85
Item 26	.762	
Item 25	.684	
Factor 6: Technology Competencies		
Item 1	.772	
Item 2	.616	
Item 3	.390	
Item 4	.696	
Item 5	.806	
Item 6	.828	
Item 7	.872	
Item 8	.817	.94
Item 9	.853	
Item 10	.862	
Item 11	.705	
Item 12	.708	
Item 13	.771	
Item 14	.593	
Item 15	.544	

4.2.2. Path Model Estimates

Based on the literature, a hypothetical path model was developed (see Figure 4.4). The hypothetical model was tested with Path analysis using Amos 16 software. The estimated path coefficients were also presented in Figure 4.4. Among the path estimates in the model, all the hypothesized direct effects were found significant. Also, the results were compared to model fit criteria. The overall fit of the model was assessed by using some different fit statistics: Chi-square statistics, Root Mean Square Error Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI) and Tucker Levis Index (TLI). Although the chi-square (χ^2 =17.75, df =8) had a statistical significance level of .023, chi-square statistics are highly dependent on sample size. With larger sample sizes, such as the one in the present research (n=1030), the chi-square statistics has a tendency to show a significant value (Schumacker & Lomax, 2004). Therefore, alternative fit indices should be examined. The other fit indices for the model provided reasonably good fit. Root Mean Square Error of Approximation (RMSEA) was .034 which showed a close fit. Furthermore, the values of Comparative Fit Index (CFI), Normed Fit Index (NFI), and Tucker-Levis Index (TLI) were .99, .99 and .98 respectively. All these scores were higher than .90, which indicated an acceptable fit (Bentler & Bonett, 1980). As a result, all these fit indices suggested a good fit and it provided a reasonable explanation of the hypothetical model.

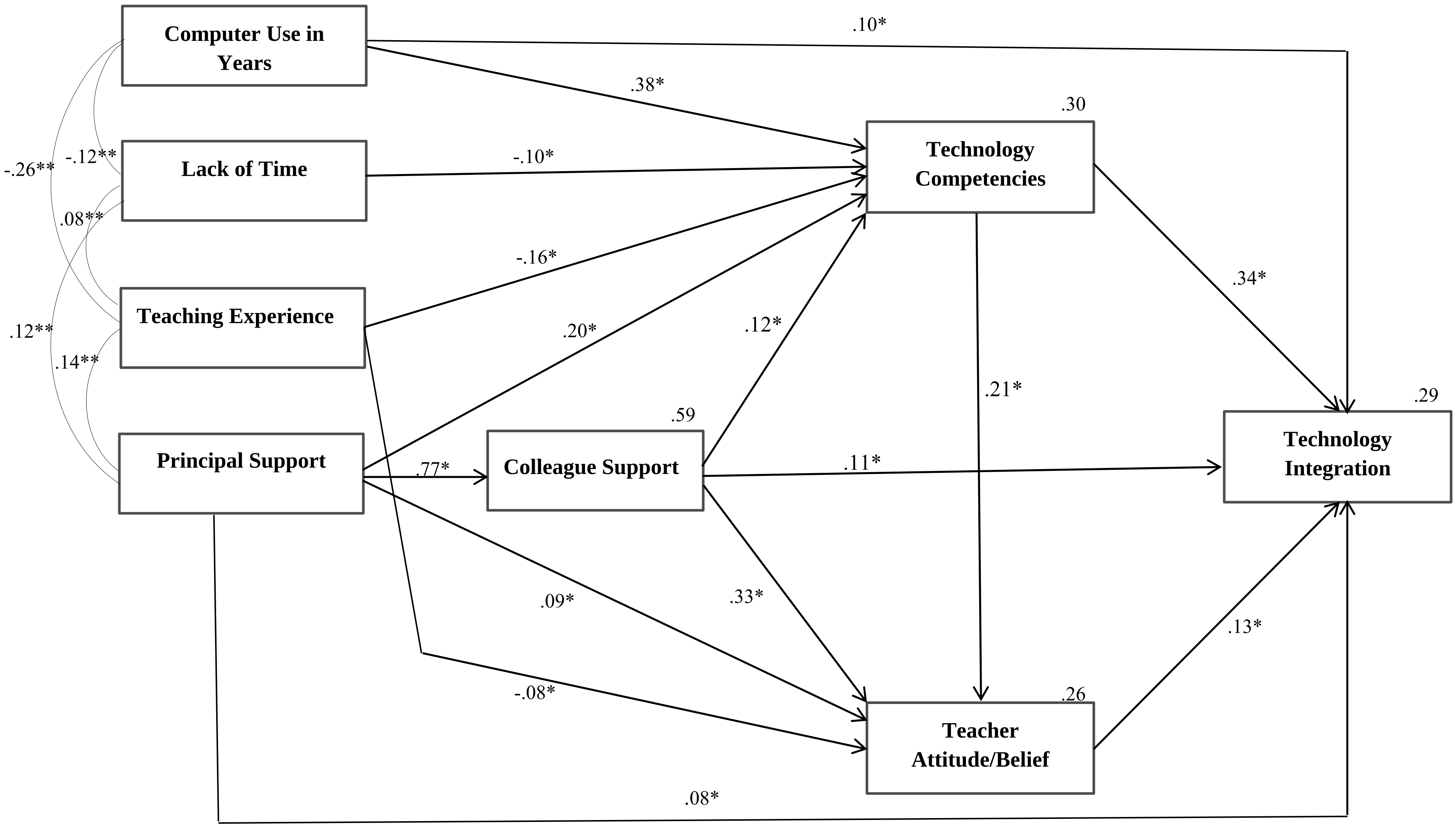

Figure 4.4 Estimated Path Model

4.2.2.1. Description of the Model: Direct, Indirect and Total Effects

The hypothetical model and the associated path estimates were presented in Figure 4.4. The direct, indirect and total effects on each independent variable were discusses separately in the following parts.

Effects on Technology Integration

The direct, indirect and total effects for the Hypothesized Path Model were presented in Table 4.18 and the variables were arranged based on the highest total effects on each of the endogenous (dependent) variables. Examining the table, the seven variables in the model explained 29% of the variance of the technology integration. Among the 7 variables, computer use in years, principal support, colleague support, technology competencies and teacher attitude and beliefs showed significant direct effects on technology integration. Teachers' technology competencies (Beta=.339) had the strongest direct effect on technology integration. Teacher attitude and belief (Beta=.132) and colleague support (Beta=.113) can be considered as medium effects on technology integration. Also, principal support (Beta=.081) had a small direct effect on technology integration. Despite its small direct effect, principal support showed the strongest indirect effect on technology integration since all the other independent variables, including colleague support teachers' technology competencies and teacher attitude and belief partially mediated the relationships between principal support and technology integration. Furthermore, computer use in years (Beta=.140) and colleague support (Beta=.087) indicated a significant positive indirect effect on technology integration. Moreover, the indirect effects of teaching experience and lack of time showed a negative direction.

All the variables showed significant total effect on technology integration. Teachers' technology competency was the most important variable with highest total effect on technology integration because of its strong direct influence on technology integration. Also, principal support was important variable in the model due to its high indirect effect on technology integration. The third important variable in the model is computer use in years since it both had some direct and indirect effects on technology integration. Colleague support was the fourth important variable in the model, followed by teacher attitude and beliefs, which have a medium direct effect on technology integration. Finally, teaching experience and lack of time had the weakest total effect on technology integration.

Effects on Technology Competencies

As shown in Table 4.18, all the hypothesized paths were found significant for explaining teachers' technology competencies. Teaching experience, computer use in years, lack of time, principal support and colleague support explained 30% variance in teachers' technology competencies. Computer use in years (Beta=.383) had the strongest positive direct effect on teachers' technology competencies, followed by principal support (Beta=.203). Teaching experience (Beta=-.165) and lack of time (Beta=-.114) had a significant negative direct effect on teachers' technology competencies. The higher the values of these variables mean the lower the teachers' technology competencies.

With regard to indirect effects, only principal support showed a significant indirect effect on technology competencies (Beta=.091). Examining the total effects on technology competencies, computer use in years (Beta=.383) showed the highest total effect on technology competencies. Also, principal support (Beta=.294) showed a strong total effect on technology competencies because of its both direct and indirect effects.

Effects on Teachers' Attitude and Belief

Examining Table 4.18, colleague support, technology competencies, principal support and teaching experience had significant direct effects on teachers' attitude and belief towards using technology in elementary school settings. These variables explained 26% variance in teachers' technology attitude and belief towards using technology. Colleague support (Beta=.333) had the strongest direct effect, followed by teachers' technology competencies (Beta=.210). Also, principal support (Beta=.086) and teaching experience (Beta=-.081) had small direct effects on teachers' attitude and belief. With regard to indirect effects, most variables showed significant indirect effects on teachers' attitudes and beliefs. In spite of its small direct effects, principal support (Beta=.317) had a strong indirect effect, since colleague support partially mediated the relationships between principal support and teachers' attitude and beliefs. In addition, computer use in years (Beta=.080) and teaching experience (Beta=-.034) had significant indirect effects on teacher attitude and belief with the mediator role of technology competencies. Examining the total effects, colleague support (Beta=.358) had the strongest total effect on teacher belief and attitudes. Furthermore, principal support showed the second highest total effect on teacher attitudes and beliefs with the mediator role of colleague support.

Effects on Colleague Support

Examining the literature, only principal support was hypothesized to influence colleague support in the hypothetical model. Supporting the previous research studies, principal support explained 59 % variance in colleague support and it had a strong direct effect on colleague support (Beta=.766).

Table 4.18 Description of the Model: Direct, Indirect and Total Effects

Variables			
Endogenous (Dependent) Variable Technology Integration			
Exogenous (Independent) Variables	Direct Effects	Indirect Effects	Total Effects
1. Technology Competencies	.339**	.028**	.367**
2. Principal Support	.081*	.240**	.321**
3. Computer Use in Years	.098**	.140**	.238**
4. Colleague Support	.113**	.087**	.201**
5. Teacher Attitudes and Beliefs	.132**	-	.132**
6. Teaching Experience	-	-.070**	-.070**
7. Lack of Time	-	-.038**	-.038**
$R^2 = .29$			
Endogenous (Dependent) Variable Technology Competencies			
Exogenous (Independent) Variables	Direct Effects	Indirect Effects	Total Effects
1. Computer Use in Years	.383**	-	.383**
2. Principal Support	.203**	.091*	.294**
3. Teaching Experience	-.161**	-	-.161**
4. Colleague Support	.119**	-	.119*
5. Lack of Time	-.104**	-	-.104**
$R^2 = .30$			
Endogenous (Dependent) Variable Teacher Attitudes and Beliefs			
Exogenous (Independent) Variables	Direct Effects	Indirect Effects	Total Effects
1. Principal Support	.086*	.317**	.402**
2. Colleague Support	.333**	.025*	.358**
3. Technology Competencies	.210**	-	.210**
4. Teaching Experience	-.081**	-.034**	-.115**
5. Computer Use in Years	-	.080**	.080**
6. Lack of Time	-	-.022**	-.022**
$R^2 = .26$			
Endogenous (Dependent) Variable Colleague Support			
Exogenous (Independent) Variable	Direct Effects	Indirect Effects	Total Effects
1. Principal Support	.766**	-	.766**
$R^2 = .59$			

*p<.05, two-tailed; **p<.01, two-tailed.

Summary of Path Estimates

The summaries of key findings with the estimated path model (see Figure 4) are presented below:

- Teachers' technology integration is highly influenced by their technology competencies both directly and indirectly.
- Teachers' attitudes and beliefs towards using technology directly influence classroom teachers' technology integration to elementary school settings.
- Colleague support directly and indirectly influences teachers' technology integration to elementary school settings.
- Despite its small direct effects, principal support shows the strongest indirect effect on technology integration since colleague support, teachers' technology competencies and teacher attitude and belief partially mediated the relationships between them.
- Computer use in years both directly and indirectly influences teachers' technology integration to elementary school settings.
- Teachers' technology competencies and teacher attitude and belief partially mediate the relationships between teaching experience and technology integration.
- Lack of time has a small negative indirect effect on technology integration.
- Computer use in years has the strongest direct effect on teachers' technology competencies.
- Principal support directly and indirectly influences teachers' technology competencies.
- Colleague support directly influences teachers' technology competencies.
- Teaching experience and lack of time have negative direct effects on teachers' technology competencies.
- Colleague support has the strongest direct effect on teachers' attitude and beliefs towards using technology.
- Teachers' technology competencies directly influence teachers' attitudes and beliefs.

- Although principal support has a small significant direct effect on teacher attitude and belief, it has a strong indirect effect, since colleague support partially mediated the relationships between principal support and teachers' attitude and beliefs.
- Teaching experience both directly and indirectly influences teachers' attitude and beliefs through the mediator role of teachers' technology competencies.
- Technology competency mediates the indirect effects of computer use in years on teachers' attitude and beliefs towards using technology.
- The largest influence in the model is that of principal support on colleague support. Principal support has a strong positive effect on colleague support.

CHAPTER 5

DISCUSSION AND CONCLUSION

In this part, the major findings of the study are summarized and discussed in light of the related literature. Consequently, recommendations for both research and practice were made together with the implications of the study.

5.1. Discussion

The main purpose of this study is to test a research based model explaining the relationships between technology integration and the factors affecting it. This study utilized a three phase Sequential Mixed Method Design, in which the results of one phase were used to develop and inform the other phase. In the first phase, qualitative data was collected to identify the most common factors that influence elementary school teachers' use of technologies in their lessons. The qualitative findings then guided the development of a quantitative survey instrument in the second phase. In the last phase, the survey instrument was administered to test a research based model showing the relationships between technology integration and factors affecting it. In this phase, a path analytical approach was utilized to investigate the direct and indirect effects of teaching experience, computer experience in years, principal support, colleague support, lack of time, teacher attitude and belief, and technology competencies on technology integration to elementary school settings. Also, some descriptive information was provided about teachers' perceptions of the factors affecting technology integration to elementary school settings.

In this three phase Sequential Mixed Method Design, the priority was given to the quantitative data collection and analysis, as presented in Chapter 3. The role of qualitative methods was only to develop a background to create an instrument to be utilized in the quantitative phase. Therefore, the following discussions are based on quantitative data analysis results. In this part discussion about the descriptive findings is followed by the discussion about path analysis findings.

5.1.1. Discussion about Descriptive Findings

The results of the study indicated that the participant teachers used technologies mostly for lesson preparation activities, rather than for delivering instruction. This finding was supported by the literature that teachers used computers most often for lesson preparation activities rather than using it for improving students' critical thinking skills and cognitive abilities (O Dwyer et al., 2004; Yıldırım, 2007). Ertmer (2005) also pointed out that although teachers are using technology for a variety of low level tasks, a few teachers use technologies for higher level tasks. A possible explanation might be that teachers still lack necessary skills to use technologies for higher level tasks (Yüzgeç, 2003). This idea was supported by our findings that teachers have low competency levels for the use of programs, application of which to the classroom instruction may require students to do such higher level tasks, such as spreadsheets and database management software. Furthermore, Van Braak et al. (2004) emphasized that most teachers use computers for supporting their lessons, such as preparing worksheets and tracking student progress, instead of integrating computers as a teaching and learning device. Consequently, teachers' use of technologies for teaching and learning purposes are still limited.

In order to increase teachers' in-class use of technologies in Turkey, Ministry of National Education (MNE) has allocated a huge amount of budget to improve ICT infrastructure in schools. A report by State Planning Organization (SPO) of Turkey (2010) showed that MNE established 27.999 IT classes at the end of 2009. Also, there are 816 IT rooms in primary schools and 649 IT rooms in secondary schools in Ankara. However, the results of the present study indicated that teachers still have some problems with accessing the computer classes. Yıldırım (2007) explained the most important problem related to access to IT rooms was crowded classrooms, thus several students had to share one computer. Also, the author proposed that scheduling IT rooms was difficult for the teachers who want to use these rooms at the same time, and no policies were prepared about it in most of the schools. Consequently, though technological devices might be available in some schools, there is no guarantee that teachers have easy access to these technologies.

In order to facilitate „transparent' use of IT resources, Selwyn (1999) recommended locating more technologies in the classrooms so that teachers can readily use these technologies whenever they need. But, the results of the present study indicated that teachers have low ratings for the sufficiency of the technological devices in their classes. In order to improve teachers' technology use in the classroom environment, Ministry of National Education developed a nationwide project which is called as FATIH project (Increasing Opportunities and Improvement of Technology Movement) (Ministry of National Education, 2011). This project is aimed to make information and communication technologies as a main component of education and to increase teachers' and students' effective use of technologies. According to this project, 620.000 classrooms in 40.000 schools in Turkey will be equipped with notebooks, projectors and Internet connections in three years. On the other hand, Kayaduman, Sırakaya and Seferoglu (2011) discussed the feasibility of FATIH project since teachers lack the necessary knowledge and skills to use technologies. In order this project to be successful, the authors recommended that some in-service training opportunities related to technology use in the classroom should be provided for teachers.

The results of the present study indicated that most participant teachers can readily obtain technical assistance when they come across a technology related problem in their schools and adequate technical support has been provided in their schools. However, teachers' ratings for the organization of some professional development activities (i.e. trainings, workshops, sample lessons) in their schools were somehow low. Similarly, in a recent research by Gülbahar and Güven (2008), teachers complained about the lack of professional development opportunities. The authors emphasized the need for some in-service professional development opportunities, in which teachers have a chance to share their experiences related to technology use and discuss new technologies. In addition, Aşkar et al. (2006) expressed that some school based solutions would be more effective in the technology integration process. Therefore, the school principals should provide some "technical support, on-going teacher professional development, early familiarity with the ICT, sharing best practices as well as barriers and difficulties in real teaching-learning environments" (p.150) in order to increase teachers' technology use.

Although Ministry of National Education (MNE) provides some different in-service training programs for teachers in Turkey, teachers complain about the quality and effectiveness of these training programs (Yıldırım, 2007). Yıldırım (2007) stated that, teachers criticized the centralized approach of Ministry of National Education, since they did not consider teachers' specific needs during the design and delivery of the in-service trainings. Similarly, Aşkar et al. (2006) emphasized the importance of this issue by expressing that "the content and outcomes of the development and training program should be consistent with the knowledge, skills and abilities of the teacher involved" (p.142). Therefore, in order to reveal teachers' specific needs associated with technology use, a need analysis should be conducted via surveys (Aşkar et al. 2006, Baylor & Ritchie, 2002). Depending on the need analysis results, appropriate professional development facilities, including workshops, in-service training opportunities etc., should be designed for each school. Also, most in-service training sessions were given outside of the classroom environment (Glazer& Hannafin & Song, 2005) and the teachers don't have much opportunity to apply and evaluate what they have learned (Yıldırım, 2007). Therefore, teachers should have a chance to experimenting with technologies before implementing it in their classrooms (Albirini, 2006).

The results of the present study also showed that the school principals did not use much incentive mechanisms by rewarding the teachers verbally or in a written way for using technologies effectively in their lessons. Yıldırım (2007) talked about a similar problem that there were a lack of incentives to encourage teachers or students to use technologies in Turkish Basic education schools. He added that "teachers need recognition and encouragement for their timely and effective use of

ICT" (p.181). Also, Gülbahar and Güven (2008) found that rewarding teachers' technology use efforts was an important factor that encourages teachers' technology use. However, the authors stated that teachers mostly complained about absence of rewards system and inefficiency of guidance and support by administration to encourage teachers' technology use.

Another important finding of the present study is that teachers support each other about technology use in many ways. First, the participant teachers help each other about technology use and share technology based instructional materials with their colleagues. This finding was supported by Gülbahar and Güven (2008), and they revealed that teachers mostly prefer to have professional support about ICT from their colleagues. This is possibly because of that teachers find the colleagues the most familiar person to themselves and more effective communication is likely to happen when two or more individuals have similar characteristics. (Rogers, 1995). Second, the findings of the present study indicated that some teachers have become a role model by using technological devices effectively in their courses. According to Aşkar et al. (2006), by observing other teachers, who use technologies effectively in the lessons, teachers would be aware of the new technologies and their advantages for teachers. Therefore, the classroom activities should be open for all teachers in the schools and they should have a chance to observe colleagues' ICT usage in the lessons. By this way, it would be easier for the teachers to learn to use new technologies.

Also, the findings of the present study showed that teachers mostly have positive attitudes and beliefs towards the use of technologies in the lessons. They find technology supported lessons entertaining and also they want to have more information about technology use in lessons. Similarly, Çağıltay et al. (2001) found that Turkish teachers mostly have positive beliefs related to computer use since they expressed that computers increase the quality of education and the use of computers increases students' knowledge and skills, interests and motivation towards lesson. Having positive attitudes about technology use was an important factor explaining technology integration since the decision regarding the use of technology for instructional purposes highly depends on the teachers (Ertmer, 2005).

Although teachers have positive attitudes and beliefs towards technology use in their lessons, they had some problems with allocating time for preparing technology supported materials and using technologies in their lessons. Using technologies in the lessons requires the use of some teaching methods and strategies different from current practices (Aşkar et al., 2006). Therefore, technology supported activities requires more preparation time than the traditional activities (Yıldırım, 2007). That might be the reason for one of our findings that teachers could not find enough time for preparing technology supported materials and using technologies in their lessons. This finding was also supported by Cuban et al. (2001) that teachers did not have enough time to find and evaluate educational software and materials, and to integrate technologies into their daily teaching. Similarly, Gülbahar and Güven (2008) found that Turkish social studies teachers complained about the limited class time for ICT usage. According to Yıldırım (2007), finding extra time for the use of technologies was a difficult task for Turkish Basic Education school teachers due to heavy load of curriculum. The author added that teachers are required to cover all the subjects in a school year so that they cannot find enough time to use technologies in their lessons. In order to solve this problem, the participant teachers in Yıldırım (2007) suggested that the curriculum should be redesigned in a way that adequate time was provided for the use of ICT in their lessons.

5.1.2. Discussion about Path Analysis Findings

In this study, a path analytical approach was utilized to investigate the direct and indirect effects of teaching experience, computer use in years, principal support, colleague support, lack of time, teacher attitudes and beliefs, and technology competencies, on technology integration to elementary school settings. Eventually, the hypothesized model was supported by our findings and indicated that technology integration is a complex process affected by many factors (Sandholtz, Ringstaff & Dwyer, 1992). Below, the direct and indirect effects of each factor on the other factors were presented and discussed under the light of the literature.

5.1.2.1. Teaching Experience

The findings of the present study showed that although the direct effect of teaching experience on technology integration is not significant, it has negative, indirect and total effects on technology integration. Also, teaching experience has negative direct effects on teachers' technology competencies and teachers' attitudes and beliefs towards using technologies. In his path model, Inan (2007) provides similar findings and indicates that teaching experience directly influences computer proficiency and indirectly influences technology integration. The negative relationship was supported by Koca (2006) that novice teachers used ICT more frequently than the experienced teachers. Similarly, Bussey et al. (2000) found that there is a negative relationship between years of teaching and adoption to technology education. Thereof, when the teachers' teaching experience decreases, their intention to use technology increases (Bussey et al., 2000; Koca, 2006). Also, Russell, Bebel and O'Dwyer (2003) revealed that novice teachers have more confidence for using technologies than experienced teachers. Inan (2007) supported this idea that the new teachers feel better prepared to use technologies as they get some training about technology use during their pre-service education. Also, Van Braak et al. (2004) stated that higher computer training leads to higher computer use for lesson preparation, teaching and learning activities. Furthermore, Dusick and Yıldırım (2000) found that number of computer courses taken was significantly influenced teachers' computer competencies, their attitudes and their use of computers for instructional purposes. Therefore, new teachers, who take some computer courses about technology use during their pre-service education, are more likely to be competent in using technologies and more likely to develop positive attitudes for using technologies.

5.1.2.2. Computer Use in Years

Computer use in years both directly and indirectly effects teachers' technology integration to elementary school settings. This finding was supported by Hermans et al. (2008) that computer experience has significant effects on teachers' class use of computers. Similarly, Drent and Meelissen (2007) found that computer experience directly influenced teachers' innovative use of ICT. Becker (2000) explained that teachers, who have more computer experience, would have better practices of teaching, they would be more comfortable and more confident about using computers, and so the teachers with more years of experience in using computers are more likely to use technologies in variety of ways in their lessons.

In addition, our findings indicated that computer use in years was the most important variable predicting teachers' technology competencies. Bradlow, Hoch and Hutchinson (2002) found that users with more online experience are likely to have more computer proficiency. It is also emphasized in the literature that the people with high computer experience, are more likely to develop high abilities in computer related tasks and therefore, are more likely to show higher performance in these tasks (Evans & Simkin, 1989; Rozell & Gardner, 1999; Rozell & Gardner, 2000). Similarly, the results of our study indicated that teachers who have more years of experience with the use of computers, are likely to develop more technology competencies. It is summarized by Becker (2000), that "developing expertise in using computers in teaching comes with time and experience- time spent using computers and time spent learning to teach well" (p.284).

Also, the present study indicated that computer use in years has indirect effects through the mediator role of teachers' technology competencies, although not very strong. The present finding was partially supported by Van Braak et al. (2004) path model, which indicated that prior computer experience had positive indirect effects on attitude towards computers in education. Therefore, with more years of experience, teachers are likely to develop more technology competencies, and so they are likely to develop more favorable attitudes towards using technologies.

5.1.2.3. Principal Support

Principal support was an important variable in the present study since it had significant influences on all endogenous variables: technology integration, technology competencies, teacher attitude and belief and colleague support. Although it had a small direct effect on technology integration, it had the second highest importance of variables affecting technology integration because of its indirect effects. Inan (2007) provides similar findings, and indicates that overall school support had the highest total effect on technology integration, resulting mostly from its indirect effects. In the present study, the indirect effects of principal support are through the partial mediation of the other endogenous variables: teachers' technology competencies, colleague support and teacher attitude and belief. By explaining the direct effects of principal support on these variables, it would be possible to explain its indirect effects on technology integration.

First, principal support directly and indirectly influences teachers' technology competencies. The present findings was partially supported by Inan (2007) path model, which showed that contextual factors associated with school characteristics, such as availability of computers, technical support and overall support directly influenced teachers' computer proficiencies. Since the technologies used in the educational environments are somehow complex, teachers need to develop new skills and knowledge for using technologies (Aşkar et al., 2006). According to Aşkar et al. (2006), providing some technical and professional support opportunities, the school principal should try to decrease the perceived complexity of technologies. Also, Baylor and Ritche (2002) emphasized the effect of school principals on teachers' ICT competencies by stating that providing positive feedback, training and technical support opportunities leads to improvements in teachers' ICT skills. Consequently, if the school principals provide sufficient technical and professional support, teachers feel more competent to use technology.

Second, principal support has some direct and indirect effects on teachers' attitude and beliefs. This finding is partially support by Inan (2007) path model, which indicated that school level variables, including overall support, technical support and computer availability strongly influenced teachers' beliefs. In addition, Lumpe and Champers (2001) provided a category of contextual factors, such as resources, professional development, Internet access, quality software, administrative support, parental support, teacher support, technical support, influencing teachers' beliefs about technology use. The school principals can affect teachers' attitude and belief towards using technology by appreciating and encouraging teachers' use of technologies through "modeling technology use, planning and explaining a vision, rewarding teachers as they strive to use technology, and sharing leadership" (Baylor & Ritchie, 2002, p.397). With the use of some incentives and rewards, teachers would know that their work is appreciated and valued by the school principals (Schwab, Jackson & Schuler, 1986). If teachers perceive that the administrator values and uses educational technology, they can more widely use technologies in their lessons.

Although principal support has a small direct effect on teacher attitude and belief, it has a strong indirect effect, since colleague support partially mediated the relationships between principal support and teachers' attitude and beliefs. Bandura (1977) stressed the importance of rewarded modeling that when the teachers observe some model teachers, who were praised for their action; they are more likely to show the same behavior. The author also talks about the motivator effects of rewarded modeling that people are motivated to exhibit the same behavior as well as they believe that they will get similar advantages. Therefore, the school principals might promote teachers' positive attitudes towards the use of technologies in the lessons by praising, promoting and announcing the model teachers who use technologies effectively in their lessons.

Also, its indirect effects through the mediator role of colleague support can be explained by Wood and Bandura (1989) that "people are motivated by the success of others who are similar to themselves" (p.363). Also, Rogers(1995) supported this idea by expressing that teachers are more likely to be affected directly from their colleagues rather than the school principals since more effective communication is likely to happen when two or more individuals have similar characteristics, such as beliefs, education and social status etc. (Rogers, 1995). Rogers (1995) explained that:

> "More effective communication occurs when two or more individuals are homophilous. When they share common meanings, a mutual subcultural language, and are alike in personal and social

> characteristics, the communication of new ideas is likely to have greater effects in terms of knowledge gain, attitude formation, and change, and overt behaviour change. When homophily present, communication is therefore likely to be rewarding to both participants in the process" (p.19).

Lunenberg and Ornstein (1996) also emphasized the importance of effective communication channels between the school administrators and the teachers since it plays a vital role in accomplishing the goals of the school. On the other hand, acording to Lee and Reigeluth (1994), there are few communication channels between teachers and school principals. This is possibly because of the school principal's authoritative position since "principals are middle level bureaucrats whose role was to implement the expectations of their district officers" (Dexter et al. 2003, p.3). Therefore, as indicated in our model, school principals are more likely to effect teachers' attitudes and beliefs through the mediator role of their colleagues to whom they feel more close, friendly and familiar. Glazer et al. (2005) explained that teachers feel close to other teachers quickly because of "common responsibilities, shared language and emotional impact of teaching children and adolescents" (p.59).

Therefore, the school principals can affect teachers' attitudes and beliefs by creating a collegial school environment. This finding was supported by Lam et al. (2010) that when the teachers perceive that their schools are strong in collegiality, they are more likely to show positive attitudes for using educational innovations.

Finally, the largest direct effect in our model was that of principal support on colleague support, in which principal support has a strong direct effect on colleague support. This finding was supported by Singh and Billingsley (2001) model, in which they examined the effects of principal and peer support on teachers' commitment to teaching profession. Similar to the findings of the present study, the largest direct effect in their model was that of principal leadership/support on peer support. The authors explained this result by stating that:

> "When principals foster shared goals, values and professional growth, solidarity and a supportive learning community are likely to result. In other words, when the principal's leadership is perceived as strong and positive, teachers are more likely to work cooperatively and share a common sense of purpose" (p.237).

When these statements are applied to technology integration, we can state that school principals are more likely to enhance teachers' use of technologies in their lessons by fostering a collegial school environment. When teachers feel that school principals support their work positively by "fostering shared goals, values and professional growth" (Singh & Billingsley, 2001, p.230), they are more likely to work cooperatively and share a common sense of purpose, which eventually results in a collegial school environment.

In addition, Drent and Meelissen (2007) revealed that school support strongly influences personal entrepreneurship, which means having professional contacts, such as colleagues and experts, for his professional development for in the use of ICT. The authors also found that school support influences the innovative use of ICT through the mediator role of personal entrepreneurship. Therefore, in order to increase teachers' use of ICT for instructional purposes, the authors also suggests that the school principals should provide a collegial school environment in which teachers have a chance to offer assistance and support about technology use to each other.

In the NETS-A standards, the school principals are responsible for developing a school-wide shared vision for technology integration and providing appropriate technological resources, conditions and school climate by fostering effective collaboration and communication among the teachers (ISTE, 2009). To do this, school principals should provide some in-service training and follow up support opportunities for teachers by creating a collegial school environment, in which teachers have a chance for "peer coaching and peer dialog to ensure successful utilization of new technologies" (Gülbahar & Güven, 2008, p.38). Therefore, the school principals should organize some professional support facilities in order to "promote cooperative projects and sharing of experiences and expertise" (Gülbahar & Güven, 2008, p.47). To do this, Glazer et al. (2005) recommended a professional development model with the name "cognitive apprenticeship model", in which teachers take on-site support and in-time training from their peers during the school day. Getting help from more experienced in and familiar with the use of technologies in their lessons, the less experienced teachers gather necessary knowledge, skills and strategies to design and develop their own technology integration activities.

5.1.2.4. Colleague Support

One of the most interesting findings of the present study is that colleague support has direct effects on all the other dependent variables, including technology integration, teacher attitude and belief towards using technology and teachers' technology competencies. Each of these effects will be discussed in following.

The effects of colleague support on technology integration in our model was partially supported by Sahin and Thompson (2007), who found that collegial interaction significantly predicted technology adoption. Thus, the authors emphasized that interaction and collaboration with colleagues improve the adoption of technologies. Also, Drent and Meelissen (2007) proposed that teachers who have professional contacts, such as colleagues and experts, for their professional development in the use of ICT, are more likely to use ICT innovatively in their lessons. Also, Becker (2000) emphasized the importance of creating social networks of computer user teachers that teachers should have access to other people from whom they can learn and share their technology related experiences. Furthermore, Glazer et al. (2005) point to the importance of creating collegial environments on technology integration by expressing that:

> "A strong collegial environment is needed to integrate technology effectively, where teachers share ideas, model best practices, ask difficult questions, and support one another where and when it is most needed" (p.58)

Teachers can support each other about technology use in many ways. For example, Ertmer (2005) emphasized the importance of vicarious experiences on teachers' beliefs that observing some model teachers who use technologies effectively in their courses not only give information about how to accomplish the same task but also increase their confidence for performing it successfully. Bandura (1977) emphasized the importance of vicarious reinforcements that when people observe others' successful experiences, they are more likely to behave in a similar way. Also, Becker (2000) stressed the importance of model teachers by expressing that the number of computer using teachers in a school is strongly related to the presence of exemplary computer using teachers. The author explained that exemplary computer using teachers have a potential to create an environment in which many teachers use computers.

Also, Aşkar and Usluel (2003) found that teachers' rate of adoption is affected by observing colleagues' use of computers. In another article, Aşkar and Usluel (2005) emphasized that:

> "It is not only the computer being observed as a technological tool but also its benefits, teachers using computers in their administrative and personal tasks can easily be observed by other teachers through personal communication channels in a short time very easily" (p.2).

Rogers (1995) point to the importance of the observability of an innovation since teachers are more likely to adopt an innovation when they observe the possible outcomes of it. By observing colleagues, the teachers would be aware of the relative advantages of using technologies in the classroom environment. Furthermore, Rogers (1995) stated that diffusion of technologies is a social process, in which "one individual communicates the ideas of a new innovation to one or several others" (p.18). The new idea is communicated through some interpersonal channels to someone with similar characteristics. Rogers explained that:

> "…most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like

> themselves who have previously adopted the innovation. This dependence on the experience of near peers suggests that the hearth of the diffusion process consists of the modeling and imitation by potential adopters of their network partners who have adopted previously" (p.18).

This might explain the direct effect of colleague support on technology integration since teachers are most likely to be effected by their peers, who have previously adopted the technologies. According to Rogers (1995), colleagues are one of the best sources to convey some evaluative information about the effects of an innovation. Observing and communicating with some colleagues who successfully use technologies in their lessons, teachers would be aware of the new technologies, its consequences and relative advantages over the traditional ones. Dusick and Yıldırım (2000) revealed that the most influential factor in stimulating the faculty members use of computers was their perceptions about the advantages of it. The colleagues communicate the relative advantage of the use of technologies by sharing and discussing their technology related experiences and ideas. Therefore, through colleague support, teachers are more likely to develop positive attitudes towards using technologies. This explains the second direct effect in model that colleague support has a strong positive effect on teacher attitude and belief towards using technology. Similarly, Ertmer (2005) emphasized that "change in teacher beliefs regarding the value of technology was more likely to occur when teachers were socialized with their peers to think differently about technology use" (p.35). Also, the author further stated that in order to implement new ideas in the classrooms, teachers need to be supported and challenged by their colleagues. Therefore, teachers should share technology related experiences with their colleagues. However, it is reported that teachers have limited time to share and discuss their technology related experiences and to observe colleagues' classes. Cuban et al. (2001) remarked that:

> "The structure of the six-period day made it difficult for teachers trained in separate disciplines to adopt innovations and engage in school reforms that required them to cross subject boundaries and team with

> other teachers. Few teachers shared common periods to plan; there was little time to observe colleagues' classrooms; and there was even less time to prepare for five classes a day. The cellular organization, time schedule, and departmental boundaries considerably reduced cross-fertilization of ideas within and across departments. Innovations that encouraged diversified teaching approaches, including the use of computers to enhance instruction, occurred in a few classes where teachers shared ideas, planned and watched one another teach" (p.828).

Therefore, teachers should be provided with adequate time and location for interacting, communicating and sharing technology related experiences with each other (Schwab, 1986).

Cağıltay et al. (2001) explained that since teachers need to change their instructional approaches, the use of technologies is a difficult task for teachers. According to Rogers (1995), complexity is one of the important characteristics of innovations. Aşkar and Usluel (2005) disclosed that teachers found using computers moderately complex. In order to solve this problem, Bandura (1977) emphasized the importance of observing other teachers by explaining that people learn faster when they observe others' success and failure. Also, Wood and Bandura (1989) expressed that "people can extend their knowledge and skills on the basis of information conveyed by modelling influences" (p.362).

Therefore, observing other teachers' successful use of technologies, teachers could gather some technology related knowledge and skills. Consequently, all these literature can explain the third direct influence of colleague support on teachers' technology competencies in our study.

Also, using computers in the lessons requires the use of some teaching methods and strategies different from current practices, so it becomes more complex and difficult to use technologies in the lessons. Therefore, teachers need to have some technology related assistance and support. The results of the present study showed that most participant teachers reported that they help each other about technology use.

Similarly, Gülbahar and Güven (2008) found that teachers mostly preferred to have professional support about ICT usage from their colleagues. Having support from their colleagues, teachers develop some technology competencies.

5.1.2.5. Technology Competencies

Teachers' technology competencies were found to be the most important factor that affects teachers' technology integration to elementary school settings. This finding was partially supported by Inan (2007), who indicated that teachers' computer ability level, which is called as computer proficiency, was found to be one of the most important factor affecting technology integration. Also, in Robinson (2003)'s path model, teachers' computer proficiency has significant direct effects on teachers' actual total computer usage. Also, Dexter et al. (2002) stated that teachers with more ICT competencies were more likely to use technologies in a variety of ways. Furthermore, Dusick and Yıldırım (2000) revealed that faculty members' computer competencies directly affected their computer use in the classroom. The authors emphasized that "an effective way to encourage faculty to use computers in the classroom is to increase their level of competency" (p. 44-45). In summary, in the literature, having technology competencies were stated a necessary condition for the use of technologies (Baylor & Ritche, 2002; Gülbahar, 2007; Hew & Brush, 2007; Pelgrum, 2001); therefore, the school principals should provide some technical and professional support facilities for the teachers, which aim to decrease the complexity of technologies (Aşkar et al., 2006).

For developing competencies, Wood and Bandura (1989) recommended the use of "guided mastery modeling" method, which includes three major elements. First, some teachers model the successful use of technologies, which aimed to provide appropriate knowledge and skills. Second, after teachers become familiar with the basic skills through modeling, they need guidance and opportunities to master them. Third, teachers should have a chance to practice their newly gathered skills.

In the present study, teachers' technology competencies directly influence teachers' attitudes and beliefs. Similarly, Gülbahar and Güven (2008) found that teachers' computer competency is a significant predictor of Turkish social studies teachers' attitudes towards the use of computers. Afshari et al. (2009) stated that teachers develop some positive attitudes about technology integration when they have sufficient knowledge about its use. Also, Albrini (2006) revealed that computer competencies were found to significantly affect teachers' attitudes towards ICT. The author emphasized that increasing teachers' ICT competencies may foster their positive attitudes toward using ICT and eventually result in teachers' use of computers in their lessons.

5.1.2.6. Teacher Attitude and Belief towards using Technology

In our model, teachers' attitude and belief towards using technology directly influence their technology integration to elementary school settings. The present finding is supported by many empirical studies which shows that attitudes towards computers in education contribute significantly to the explanation of teachers' use of computers in classrooms (Drent & Meelissen, 2007; Hermans et al. , 2008; Inan, 2007; Teo, 2010; Tondeur et al., 2007; O'Dwyer et al., 2003; Van Braak et al., 2004). In a recent study, Inan (2007) revealed that teacher beliefs have strong direct effects on technology integration. Furthermore, a model developed by Teo (2009) indicated that attitude towards computer use had the largest effect on teachers' behavioral intention to use computers. The author emphasized that when teachers believe that technology is useful and it has a potential to improve their teaching performance, they are more likely to use it in a variety of ways. The decision about the use of technology for instructional purposes highly depends on the teachers (Ertmer, 2005) and without having a positive attitude towards technology, teachers will not use technology in their lessons (Zhao &Frank, 2003& Teo, 2009). To Ertmer (2005), teachers use technology in a way that is consistent to their beliefs, so it becomes important to introduce the technology in a way that is appropriate for teachers' belief systems and valuable for their current practices. Furthermore, Rogers (1995) stated that since the old ideas are used as the main tools to assess the new ideas, new ideas should be given in a way that is compatible to the old values and ideas. In his famous book, Rogers (1995) emphasized the importance of compatibility of an innovation by expressing that an idea that is not compatible with teachers' existing beliefs will not be accepted easily. The rate of adoption of a new idea is highly affected by the old idea, therefore, in order to increase the rate of adoption, it should be introduced in a way that is consistent with (1) sociocultural values and beliefs, (2) previously introduced ideas, (3) user needs (Rogers & Shoemaker, 1971).

5.1.2.7. Lack of Time

In our model, lack of time has negative direct effects on teachers' technology competencies. Though teachers' lack of time to learn new technological skills, to prepare new instructional materials, and also to allocate time in their lessons were stated as important barriers to the adoption to new technologies (Rogers, 1999), few empirical research studies were conducted to see its effects. In one of the existing research, Totter, Stütz and Grote (2006) revealed that lack of time is an important factor influencing the vocational teachers' use of new media in classrooms due to teachers lack the time to prepare teaching materials, and to have skills about the new media. Also, Dusick and Yıldırım (2000) stated that lack of time was the most important factor that inhibits faculty members' getting technology related training. Since teachers need extra time to learn using technology, for training and exploring the technology (Vanatta & Fordham, 2004), our model, as well, indicated that teachers' lack of time had significant effects on their technology competencies.

5.2. Conclusion

This study provided descriptive information about the teacher perceptions about the factors affecting technology integration and a path model indicating the relationships among the variables affecting technology integration. Below, some conclusions were made about descriptive information and path analysis results.

First, descriptive findings show that teachers have some problems in accessing the computer classes and there are no sufficient technologies in the classrooms. Even though teachers can readily obtain technical assistance when they come across a technology related problem, the professional development activities provided for teachers were not sufficient. Though most of the school principals were supportive of teachers' technology use, there were not much incentive mechanisms to motivate teachers to use technologies. Furthermore, the findings of the present study showed that teachers help each other about technology use and become a role model by using technological devices effectively in their courses. Although teachers mostly have positive attitudes and beliefs towards the use of technologies in the lessons, they had some problems with allocating time for preparing technology supported materials and using technologies in their lessons.

Second, path analysis results revealed that the hypothesized path model was supported by our findings and indicated that technology integration is a complex process affected by many factors (Sandholtz, Ringstaff & Dwyer, 1992). Within all factors, teachers' technology competency was the most important factor with the highest direct effect on technology integration. Principal support and computer experience were also important factors for technology integration because of their direct and indirect effects. Furthermore, colleague support and teachers' attitude and belief towards using technology have important influences on technology integration to elementary school settings.

Also, the researchers explored the effects on the other independent variables. With regards to effects on teachers' technology competencies, teachers' computer use in years was the most influential factor. Also, principal support and colleague support have important effects on teachers' technology competencies. Last, the effects of teaching experience and lack of time on teachers' technology competencies showed a negative direction.

When we examine the effects on teachers' attitude and beliefs towards using technology, the most important factor was principal support. Most of its effects came from its indirect effects, since colleague support and technology competencies partially mediated the relationship between principal support and teachers' attitude and beliefs. Furthermore, colleague support and technology competencies have direct influences on teachers' attitudes and beliefs towards using technologies.

Finally, the largest effect in the model was that of principal support on colleague support. This finding was supported by Singh and Billingsley (1998) and they expressed that when the teachers perceive that the school principals strongly support teachers' work, they are more likely to work cooperatively and share a common sense of purpose with their colleagues.

5.3. Limitations of the Study

1. Validity of this study is limited to the reliability of instruments used in this study.
2. Generalizability of this study is limited to the honesty of the participants' responses to them.
3. Based on the interview results, this study explored the most common factors affecting technology integration in elementary school settings in Ankara. Therefore, this study was not intended to investigate the other factors, such as age, gender, subject characteristics, previous training, technology readiness etc., which may have potential to effect technology integration in educational settings.
4. Teachers from one district of Ankara were not included in the study due to the problems in the manageability of the data collection task.

5.4. Implications and Recommendations for Practice

The results of this study indicated that technology integration is a complex process affected by many factors (Sandholtz, Ringstaff & Dwyer, 1992) and also some complex relationships exists between these factors. Integrating technologies into educational settings does not solely depends on the presence or absence of these single factors, but rather it can be determined through a more dynamic process in which some strategies were applied simultaneously for these related factors (Afshari et al., 2009). Therefore, the technology integration model developed in this study provides a valuable tool for both policy makers and school principals to design and develop some strategies to bring success about integrating technologies in school environments.

Giving information about the factors affecting technology integration and the relationships between them, the results of the present study will help the school principals in developing a vision and plan, indicating how technology will be integrated to the lessons and how the teachers are expected to use technologies (Strudler & Wetzel,1999). According to Çağıltay et al. (2001), the success of integrating technologies to educational settings highly depends on teachers. Therefore, while developing a vision and plan, teacher collaboration should be ensured by involving them in the decision making process. A technology committee, including both teachers and administrators, should be formed in schools to develop a technology integration plan. By this way, teachers would create their own vision for technology integration, by contributing their knowledge, skills and positive attitudes (Afshari et al., 2009), which were found as important variables affecting technology integration in our model. Also, contributing to the technology planning process, teachers would be more likely to implement the decisions they accept.

In addition, using the results of this study, school principals will be aware of the different types of support they might provide to the teachers in order to accelerate technology integration process. Examining the model, most of the effects of principal support on technology integration came from its indirect effects through the mediator role of colleague support, technology competencies and teachers' attitude and beliefs towards using technologies. Therefore, in order to increase teachers' technology use in educational settings, the school principals should implement some strategies to increase collegial interaction among teachers, increase teachers' technology competencies and to promote teachers' positive attitudes towards using technologies in the classes, which possibly results in an increase in teachers' technology use for instructional purposes.

In the present model, colleague support was one of the important factors affecting technology integration, so a practical strategy to accelerate technology integration process might be to create a collegial school environment. Also, the strongest effect in the model was that of principal support on colleague support, so the role of school principals in creating a collegial school environment was emphasized in this study.

Therefore, the school principals should provide adequate time and location for teachers to communicate and share their technology related experiences and to work collaboratively. For instance, school principals might conduct weekly departmental meetings, in which teachers have a chance to share their technology related skills and experiences, to plan and develop technology supported lessons and instructional materials collaboratively. Also, the school principals might provide opportunities for teachers to observe a colleague's use of technologies in the lessons since the innovations that are observable and communicable are more easily adopted (Rogers, 1995). Ertmer (2005) emphasized the importance of vicarious experiences on teachers' beliefs that by observing some model teachers who use technologies effectively in their courses not only give information about how to accomplish the same task but also increase their confidence for performing it successfully. Wood and Bandura (1989) acknowledged that teachers can develop some competencies when they observe other teachers' successful use of technologies. Thereof, the school principals should provide teachers with enough time to observe the colleagues' ICT usage. When teachers become familiar with the basic knowledge and skills through modeling, they need guidance and opportunities to master them. To do this, Glazer et al. (2005) recommended a set of professional development activities in which teachers take on-site support and in-time training from their peers during the school day. In this study, it might be also suggested that teachers should conduct some team projects, in which they develop technology supported lessons collaboratively with their colleagues. Having guidance and instructive feedback from teachers who have more experience in the use of technologies, the less experienced teachers are more likely to gather necessary knowledge, skills and strategies to design and develop their own technology enhanced lessons. Also, placing teachers in collaborative groups would increase teachers' motivation and participation to technology integration activities. All of these supports our findings that by sharing technology related skills and experiences with the colleagues; teachers are more likely to develop some competencies and also some positive attitudes related to technology use.

In addition to face to face interaction with colleagues, Ertmer, et al., (2003) recommended that some teacher models, which use technology effectively in their lessons, should be presented via electronic means. The authors explained that “ this type of modeling can help preservice teachers develop a vision for what technology integration looks like in real classroom as well as strategies for implementing those visions” (Ertmer, et al., 2003, p.110).

In the present study, teachers’ technology competencies were found as the most important factor affecting technology integration. This finding was supported by the literature that teachers must reach and maintain a certain degree of ICT competencies in order to integrate technologies into educational settings (Baylor & Ritche, 2002; Hew & Brush, 2007; Pelgrum, 2001). Therefore, in order to accelerate technology integration process, special attention should be given to increase teachers’ technology competencies. For increasing teachers’ technology competencies, the school principals should provide appropriate professional development opportunities. As our findings indicated that colleague support was an important factor affecting technology integration, those programs should provide opportunities for teachers to share their experiences related to technology use and discuss new technologies.

On the other hand, the descriptive findings of this study indicated that teachers complained about lack of professional development activities in their schools. Although Ministry of National Education (MNE) provides some different in-service training programs for teachers in Turkey, teachers complain about the quality and effectiveness of these training programs since these programs do not consider teachers’ knowledge, skills and abilities (Aşkar et al., 2006; Yıldırım, 2007). Therefore, in order to reveal teachers’ specific needs associated with technology use, a need analysis should be conducted via surveys. Considering teachers’ specific needs, teachers should engage in quality learning experiences, such as in service trainings, workshops, on-line tutorials, instructional videos etc… Through high quality learning experiences, it is likely to improve teachers’ technology competencies and their attitude and belief towards using technology (Toci &Peck,

1998), both of which are important factors affecting technology integration in our model. Also, if teachers are to develop some positive attitudes and beliefs, the content of these programs should be designed in a way that is compatible with teachers' existing beliefs and valuable for their current practices (Ertmer, 2005; Rogers 1995).

In addition, for increasing the quality of these programs, some hands-on experiences, in which teachers would have a chance to apply what they have learned in the training sessions, should be provided. According to Bandura (1977), successful performance in the early stages of an innovation strength the level of self-efficacy, and the failures lower it. Therefore, early familiarity with the use of technologies should be provided for teachers by giving some simple tasks, in which they would be probably succeeded. Ertmer (2005) emphasized that "by helping teachers adopt new practices that are successful, the associated beliefs will also change" (p. 32). This supports the effect of technology competencies on teacher attitude and belief in our model that by helping teachers develop some technology competencies; they are more likely to develop some positive attitudes towards using technology in their lessons.

Since teachers have little time and competencies to deal with technical problems, full time technical support facilities should be provided for teachers. Therefore, each school should have a qualified technical staff, from who teachers can have just-in-time support whenever they face with a technological problem.

Though rewards and incentives were stated as important motivators for the use of technologies (Gülbahar, 2007; Yıldırım, 2007), the descriptive findings of the present study indicated that the school principals did not use much incentive mechanisms for teachers' use of technologies in their lessons. In order to promote teachers' positive attitudes towards using technologies in the classes, the school principals should support teachers' use of technologies in their lessons with the presence of role models, rewards, incentives, recognition, and encouragement. The school principals should communicate that they value teachers' effective use of technologies by promoting and announcing the best practices by the teachers who use technologies effectively in their lessons. Bandura (1977) stressed the importance of rewarded modeling that when the teachers observe some model teachers, who were praised for their action; they are more likely to exhibit the same behavior. Therefore, the school principals might promote teachers' positive attitudes towards the use of technologies in the lessons by praising the teachers, who successfully use technologies in their lessons.

According to Leonard and Leonard (2006), most of the school administrators feel unprepared to supervise teaching and learning technology in their schools. Since one of the most important factors affecting technology integration was principal support, some professional development opportunities in the supervision of technology should also be organized for principals, in which they were informed about how to support technology integration processes in the schools. Providing information about the types of support the principals might provide for teachers, the findings of this study might also help to design these training sessions. Furthermore, Leonard and Leonard (2006) indicated that most of the school principals are not familiar with the use of technologies. Therefore, some in-service training opportunities should also be provided for school principals since they should have necessary competencies to initiate and model effective technology use in their schools.

As recommended by Gülbahar (2007), "efficient and effective use of technology depends on the equity of access to resources by teachers, students and administrative staff' (p.953). Therefore, the Ministry of National Education should increase the access and availability to technological resources in the schools. Also, teachers have some problems with scheduling IT rooms. In order to solve this problem, the school administrators should set up some policies for using IT rooms. In order to facilitate „transparent' use of technological resources, Selwyn (1999) recommended locating more technologies in the classrooms so that teachers can readily use these technologies whenever they need. But, the results of the present study indicated that teachers have low ratings for the sufficiency of the technological devices in their classes. For improving teachers' technology use, Ministry of National Education developed a nationwide project which is called as FATIH project (Increasing

Opportunities and Improvement of Technology Movement) (Ministry of National Education, 2011). According to this project, 620.000 classrooms in 40.000 schools in Turkey will be equipped with notebooks, projectors and Internet connections to in three years. However, the educational policies should go beyond providing access and availability to technological resources, since it does not alone lead to high level use of technologies in the schools (Ertmer, 2005). Our model provides valuable information about the factors affecting technology integration and interrelationships between them. Therefore, it would provide a valuable tool for policy makers about how to support technology integration process and allocate money for technology initiatives.

5.5. Implications and Recommendations for Theory and Research

In addition to recommendations and implications made for practice, the results of the study have several implications for theory and research.

First, in his famous book of "Diffusion of Innovations, Rogers (1995) emphasized that innovations, which possess certain attributes, including relative advantage, compatibility, complexity, trialability and observability are more likely to be adopted easily. The present study confirmed the importance of teachers' perceived attributes about technology use in their lessons. Although this study attempted to make suggestions about how to increase teachers' perceived attributes about technological innovations depending on the literature, some qualitative studies should be conducted to examine the possible strategies in depth.

In addition, Rogers (1995) stressed the importance of communication channels because the new idea is communicated through some interpersonal channels to someone with similar characteristics. The present study also emphasized the importance of having communication channels between the school personnel. This study showed that teachers are more likely to be directly influenced by their colleagues, rather than the school principals since little communication channels possibly exist between teachers and school principals (Lee & Reigeluth, 1994). Also, some qualitative studies should be conducted to explore in depth the communication channels that exist among school personnel in depth, and to investigate the strategies for improving those communication channels.

Second, the descriptive findings of the study shed light on the elementary school teachers' perceptions about the factors influencing technology integration. This data also provides valuable information about the current status of the technology integration in elementary school settings in Ankara, Turkey. Some further research might be conducted in different cities in Turkey and also in different countries for comparing the current status of technology integration in different contexts.

Third, benefitting from both qualitative and quantitative research methods, a mixed methods approach was utilized in the present study. Since the role of qualitative methods was only to develop a background to create an instrument to be utilized in the quantitative phase, the results and discussions were based on quantitative analysis findings in the present study. In the future studies, more qualitative methods, such as interviews, observations and document analysis should be used to explain the relationships in the model further.

Fourth, in the present study, the researchers developed a survey instrument for measuring technology integration and the factors affecting it in elementary school settings. This survey instrument will provide a valuable tool for the other researchers, who want to explore the factors affecting technology integration.

Fifth, this study provided a comprehensive technology integration model, which give insights into understanding the complexity of technology integration in elementary school settings (Baylor & Ritche, 2002). To explore the applicability of the model to other educational settings, some replication studies should also be conducted with secondary and higher education teachers. Also, since the model was developed depending on the data coming from classroom teachers, some replication studies should be conducted with other teachers from different subject areas.

Sixth, the largest effect in the model was that of principal support on colleague support. Although many researchers emphasized the importance of school principals in creating a collegial school environment, little empirical research was conducted to see these effects. Therefore, some future studies should be conducted to explore the effects of principal support on colleague support.

Seventh, though the effects of colleague support and lack of time on technology integration were emphasized in the literature, little empirical research was conducted to see their effects. The present study fill in this gap by providing empirical findings about the effects of colleague support and lack of time on technology integration and the factors affecting it. In the future, some further empirical studies should be conducted about these variables to see the effects of both variables on technology integration.

Finally, this study also adds to the large body of existing empirical research on the factors affecting technology integration. Although the factors in the model explained a significant portion of variation in technology integration, there might be other factors, such age, gender, subject characteristics, previous training, technology readiness etc. Therefore, future studies should be conducted to explore the other factors affecting teachers' technology integration to elementary school settings. Also, some further research should be conducted to explore individual relationships among the factors in the model.

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APPENDIX A

INFORMED CONSENT (TURKISH)

Bu çalışma, ODTÜ Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümünde Yard.Doç.Dr. Gülfidan Can ve Doç.Dr. Soner YILDIRIM danışmanlığında araştırma görevlisi Feride KARACA tarafından doktora tezi kapsamında yürütülen bir çalışmadır. Bu çalışmanın amacı, anket ve görüşme yöntemleri aracılığı ile sizlerin teknolojinin ilköğretim okullarında öğretim amaçlı kullanımına ilişkin tutum, düşünce ve deneyimlerinizi ortaya koymaktır. Böylelikle, ilköğretimde teknoloji kullanımını etkileyen faktörler belirlenip, bu faktörler ve teknoloji entegrasyonu arasındaki ilişkileri gösteren bir model oluşturulacaktır. Yapılacak çalışma, 2010-2011 öğretim yılı süresince devam edecektir

Çalışmaya katılım tamamiyle gönüllülük temeline dayalıdır.Görüşme sorularında, sizden kimlik belirleyici hiçbir bilgi istenmemektedir. Cevaplarınız tamamiyle gizli tutulacak ve sadece benim tarafımdan değerlendirilecektir; elde edilecek bilgiler bilimsel yayımlarda ve doktora tez çalışması için kullanılacaktır.

Sorular, genel olarak kişisel rahatsızlık verecek yargıları içermemektedir.Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakabilirsiniz. Böyle bir durumda görüşmeyi uygulayan kişiye, devam etmek istemediğinizi bildirmeniz yeterli olacaktır. Görüşme sonunda, bu çalışmayla ilgili sorularınız cevaplanacaktır.Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz. Çalışma hakkında daha fazla bilgi almak için Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü araştırma görevlisi Feride KARACA (Ofis: 111; Tel: 210 7523; E-posta:falim@metu.edu.tr) ile iletişim kurabilirsiniz.

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum. (Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad	Tarih	İmza
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APPENDIX B

INTERVİEW GUIDE FOR ELEMENTARY SCHOOL TEACHERS (TURKISH)

Merhaba,

Ben Feride Karaca, ODTU Eğitim Fakültesi, Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümünde Araştırma Görevlisiyim.

Öncelikle, görüşmeyi kabul ettiğiniz için teşekkür ederim. Bu çalışmada, öğretmenlerin derslerde teknolojik araç gereç kullanımlarını etkileyen faktörleri araştırıyorum. Bu konuda sizin bilgi ve tecrübelerinizden faydalanmak istiyorum.

Kişisel bilgileriniz ve cevaplarınız kesinlikle gizli tutulacak, sadece bu araştırma için kullanılacak ve araştırma sonunda toplu halde sunulacaktır. Talep edilirse, görüşme kayıtları öğretmenlerle paylaşılacak ve onlardan geri bildirim alınacaktır. Araştırma sonuçlandığında size bilgi verilecektir. Bütün bu açıklamalardan sonra verdiğiniz bilgilerin araştırmamda kullanılmasına izin verir misiniz?

O halde ilk soruyla başlayalım.

1. Branşınızı öğrenebilir miyim?
2. Ne kadar süredir öğretmenlik yapıyorsunuz?
3. Derslerinizde teknolojik araç gereçlerden faydalanıyor musunuz?
    a. Teknolojik araç gereçleri derslerinizde hangi amaçlarla kullanıyorsunuz?
4. Teknolojik araç gereçlerin kullanımı konusunda ne tür bilgi ve becerilere sahipsiniz? Bu konuda kendinizi ne kadar yeterli buluyorsunuz?

5. İlköğretimde teknolojik araç gereç kullanımının öğrenme ve öğretme süreci üzerinde ne gibi etkileri olduğunu düşünüyorsunuz?
6. Okulunuzda yeterli miktarda teknolojik araç gereç bulunduğunu düşünüyor musunuz?
    a. Okulunuzda bulunan teknolojik arac gereçlere istediginiz zaman ulaşabiliyor musunuz?
7. Okulunuzda bulunduğu halde kullanmadığınız teknolojik araç gereçler var mı?
    a. Bu araç gereçleri hangi nedenlerle kullanmıyorsunuz?
8. Okulunuzda teknoloji kullanımı ile ilgili yeterli teknik destek sağlanıyor mu?
9. Okul yonetimi sizleri teknoloji kullanımına teşvik etmek ve desteklemek amacıyla neler yapıyor?
10. Sizce okulunuzdaki öğretmenler derslerinde yeterli duzeyde teknoloji kullanıyor mu?
    a. Okulunuzdaki öğretmenler arasında teknoloji kullanımı konusunda yardımlaşma oluyor mu?
11. Son olarak, teknolojik araç gereçlerin ilköğretim öğretmenlerince daha etkin bir şekilde kullanılabilmesi icin sizce neler yapılmalı?

APPENDIX C

CONTENT VALIDITY TESTING SHEET

Thank you for accepting to review this questionnaire for its content validity. The main purpose of this questionnaire is to find out the relationships between the factors that affect K12 teachers' technology use. The sample of the study includes classroom teachers employed in elementary schools in Ankara.

In this study, the main factors that I want to measure are:

- Technology Integration
- Principal Support
- Colleague Support
- Lack of Time
- Teacher Beliefs and Attitudes towards using technology
- Technology Competencies
- Computer use in years
- Teaching Experience

Therefore, please review the questions and check if they cover a representative sample of these main factors. If you think there should be more questions about these factors, or if you think some of the questions should be removed, please write your comments.

Thank you

Research Assistant Feride Karaca

APPENDIX D

SURVEY OF TECHNOLOGY INTEGRATION IN ELEMENTARY SCHOOLS

Dear Teachers;

The purpose of this questionnaire is to disclose your attitudes, beliefs and experiences about technology use for instructional purposes in elementary school settings. The gathered information would be only used for research purposes, and your name or your schools' name will not be mentioned directly or indirectly. We request you to answer all the questions honestly. Thanks for your contributions.

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Research Asist. Feride Karaca
Assist. Prof. Dr. Gülfidan Can
Prof. Dr. Soner Yıldırım

PART I- DEMOGRAPHIC INFORMATION

What is your gender: ☐Male ☐Female What is your age:.......

How many years have you been teaching:..............

What is your level of education: ☐Associate degree ☐Bachelor's degree ☐Master's degree ☐Doctorate degree

PART II- TEACHERS' TECHNOLOGY USE

Warning: In this questionnaire, "technology" and "technological devices" included **computers, projectors, printers, scanners, television, overhead projector, DVD/VCD/Video player and instructional software.**

1. How many years have you been using computers? ....

2. Approximately how many hours have you been using computers in a day?

☐ Never ☐ Less than 1 hour ☐ 1-3 hour ☐ More than 3 hours

3. How often do you use technologies in your lessons?

☐ Never ☐ Seldom ☐Sometimes ☐ Often ☐Always

4. How often do you use technological devices for the following purposes?

	Never	Seldom	Sometimes	Often	Always
Prepare Lesson plan	☐	☐	☐	☐	☐
Access Information Resources	☐	☐	☐	☐	☐
Develop instructional materials	☐	☐	☐	☐	☐
Develop tests and exam questions	☐	☐	☐	☐	☐
Present lesson	☐	☐	☐	☐	☐
Demonstrate sample applications	☐	☐	☐	☐	☐
Drill and practice	☐	☐	☐	☐	☐
Revise lesson	☐	☐	☐	☐	☐
Communicate with students	☐	☐	☐	☐	☐
Communicate with other teachers	☐	☐	☐	☐	☐

PART III- TEACHER PERCEPTIONS ABOUT TECHNOLOGY USE

Please, rate you perceptions about the below statements.

1	2	3	4	5
Strongly Disagree	←	—	→	**Strongly Agree**

	1	**2**	**3**	**4**	**5**
1. All technological devices in our school are kept in good working condition and updated regularly	1	2	3	4	5
2. Whenever I need, I can readily use all the technologies in our school.	1	2	3	4	5
3. In my class, there are sufficient technological devices to meet my needs	1	2	3	4	5
4. Whenever I need, I can readily use IT classes.	1	2	3	4	5
5. In our school, I don't have any difficulties in accessing instructional software and ready-made instructional materials.	1	2	3	4	5
6. I don't have much difficulty in accessing the internet in the school.	1	2	3	4	5
7. When I come across a technology related problem in our school, I can easily obtain technical assistance.	1	2	3	4	5
8. School administrators are generally supportive of teachers' technology use in the lessons.	1	2	3	4	5
9. Most teachers in our school are supportive of technology use in the lessons.	1	2	3	4	5
10. School administrators become a role model for us by using technological devices effectively.	1	2	3	4	5

1	2	3	4	5
Strongly Disagree ◄	───	───	───	► **Strongly Agree**

	1	**2**	**3**	**4**	**5**
11. Some teachers become a role model for us by using technological devices effectively in their lessons.	1	2	3	4	5
12. In our school, the teachers help each other about technology use.	1	2	3	4	5
13. We share technology based instructional media and materials with the teachers in our school.	1	2	3	4	5
14. Adequate in-service training opportunities are provided in our school.	1	2	3	4	5
15. Several facilities (i.e. trainings, workshops, sample lessons) that encourage teachers' technology use are organized in our school.	1	2	3	4	5
16. Adequate technical support is provided in our school.	1	2	3	4	5
17. The school administration rewards the teachers verbally or in a written way for using technologies effectively in their courses	1	2	3	4	5
18. The use of technology increases students' participation to the lessons.	1	2	3	4	5
19. The use of technology positively impact students' achievement in the lessons	1	2	3	4	5
20. The use of technology increases students' interest to the lesson.	1	2	3	4	5
21. The use of technology increases the permanency of the learning.	1	2	3	4	5
22. I want to have more information about technology use in lessons.	1	2	3	4	5
23. I find technology supported lessons so entertaining.	1	2	3	4	5
24. Technology use makes the lessons more student centered.	1	2	3	4	5
25. Preparation for technology supported lesson takes too much time.	1	2	3	4	5
26. Using technology in lessons takes too much time.	1	2	3	4	5
27. I can't find enough time to learn the use of technologies in the lessons.	1	2	3	4	5
28. Due to heavy load of curriculum, I can't allocate adequate time to use technologies in the lessons.	1	2	3	4	5

PART IV-AVAILABLE TECHNOLOGIES

Please, choose the available technologies in your home and classroom environment.

Technologies	Home	Class
Computer	☐	☐
Projector	☐	☐
Printer	☐	☐
Scanner	☐	☐
DVD/VCD/Video player	☐	☐
Television	☐	☐
Overhead Projector	☐	☐
Instructional Software	☐	☐

PART V- TECHNOLOGY COMPETENCIES

Please, rate your level for the following competencies.

	Not Competent	Poorly Competent	Moderately Competent	Notably Competent	Very Competent
16. Use of word processing (i.e. Word) programs	☐	☐	☐	☐	☐
17. Use of spreadsheets (i.e. Excel)	☐	☐	☐	☐	☐
18. Use of database management (i.e. Access) programs	☐	☐	☐	☐	☐
19. Use of presentation software (i.e. PowerPoint)	☐	☐	☐	☐	☐
20. Use of Internet Browsers (i.e. Internet Explorer)	☐	☐	☐	☐	☐
21. Use of Internet Search Engines (i.e. Google)	☐	☐	☐	☐	☐
22. Downloading documents and software from the Internet	☐	☐	☐	☐	☐
23. Sending and checking e-mails.	☐	☐	☐	☐	☐
24. Use of various memory devices such as CD, DVD and flash memory	☐	☐	☐	☐	☐
25. Use of printer	☐	☐	☐	☐	☐
26. Use of scanner	☐	☐	☐	☐	☐
27. Use of projection	☐	☐	☐	☐	☐
28. Use of CD, DVD and video player	☐	☐	☐	☐	☐
29. Use of television	☐	☐	☐	☐	☐
30. Use of overhead projector	☐	☐	☐	☐	☐

This is the end of the questionnaire. Thanks for your participation.

APPENDIX E

SURVEY OF TECHNOLOGY INTEGRATION IN ELEMENTARY SCHOOLS (TURKISH)

Değerli Öğretmenler;

Bu çalışmanın amacı, teknolojinin öğretim amaçlı kullanımına ilişkin tutum, düşünce ve deneyimlerinizi ortaya koymaktır. Anketten elde edilecek bilgiler, araştırma amaçlı kullanılacak olup sizin veya okulunuzun adı doğrudan ya da dolaylı olarak anılmayacaktır. Sizden, kendi düşünceleriniz doğrultusunda samimi olarak **bütün** ifadeleri cevaplamınızı rica ediyoruz. Katkılarınız için teşekkür ederiz.

Posta Adresi:
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ODTÜ – ANKARA 06531
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Araş. Gör. Feride Karaca
Yar. Doç. Dr. Gülfidan Can
Doç. Dr. Soner Yıldırım

BÖLÜM I - KİŞİSEL BİLGİLER

Cinsiyetiniz:	☐ Bay	☐Bayan	Yaşınız:.......	
Mesleki Hizmet Süreniz:...........				
Eğitim Durumunuz:	☐Ön Lisans	☐Lisans	☐ Yüksek Lisans	☐ Doktora

BÖLÜM II - TEKNOLOJİK ARAÇ GEREÇLERİN KULLANIMI

Uyarı: Bu ankettebahsedilen **"**teknoloji" ve "teknolojik araç gereçler"öğretim amacı ile kullanılan **bilgisayar, projeksiyon aleti, yazıcı, tarayıcı, televizyon, tepegöz, DVD/VCD/Video oynatıcı ve öğretim yazılımlarını** içermektedir.

1. Kaç yıldır bilgisayar kullanıyorsunuz? ....

2. Ortalama olarak günde kaç saat bilgisayar kullanıyorsunuz?

☐ Hiç ☐ 1 saatten az ☐ 1-3 saat ☐ 3 saatten fazla

3. Teknolojik araç gereçleri derslerinizde hangi sıklıkla kullanıyorsunuz?

☐ Hiç ☐ Nadiren ☐ Bazen ☐ Sık Sık ☐ Her Zaman

4. Teknolojik araç gereçleri aşağıdaki eylemleri gerçekleştirmek amacıyla hangi sıklıkla kullandığınızı belirtiniz.

	Hiç	Nadiren	Bazen	Sık Sık	Her Zaman
Ders planı hazırlarken	☐	☐	☐	☐	☐
Bilgi kaynaklarına erişim sağlarken	☐	☐	☐	☐	☐
Dersle ilgili öğretim materyali hazırlarken	☐	☐	☐	☐	☐
Test ve sınav soruları hazırlarken	☐	☐	☐	☐	☐
Ders anlatımı esnasında	☐	☐	☐	☐	☐
Konu ile ilgili örnek uygulamalar gösterirken	☐	☐	☐	☐	☐
Konu ile ilgili alıştırma yaparken	☐	☐	☐	☐	☐
Konu tekrarı yaparken	☐	☐	☐	☐	☐
Öğrencilerle iletişim kurarken	☐	☐	☐	☐	☐
Diğer öğretmenlerle iletişim kurarken	☐	☐	☐	☐	☐

BÖLÜM III - TEKNOLOJİK ARAÇ GEREÇLERİN KULLANIMINA İLİŞKİN ÖĞRETMEN GÖRÜŞLERİ

Aşağıda öğretmenlerin öğretim amaçlı teknoloji kullanımına ilişkin tutum ve düşüncelerini içeren ifadeler bulunmaktadır.Lütfen, her bir ifade için size en uygun seçeneği işaretleyiniz.

1	2	3	4	5
Hiç Katılmıyorum ◄	———	———	———	► **Tamamen Katılıyorum**

	1	2	3	4	5
1. Okuldaki teknolojik araç gereçler kullanılabilir durumda olup düzenli olarak güncellenmektedir.	1	2	3	4	5
2. Okuldaki teknolojik araç gereçleri istediğim zaman rahatlıkla kullanırım.	1	2	3	4	5
3. Sınıfımda ihtiyacımı karşılayacak düzeyde teknolojik araç gereç bulunmaktadır.	1	2	3	4	5
4. Bilişim Teknolojileri sınıfını istediğim zaman rahatlıkla kullanırım.	1	2	3	4	5
5. Derslerde kullanabileceğim öğretim yazılımları ve hazır materyallere ulaşmakta zorluk çekmem.	1	2	3	4	5
6. Okul içerisinde internete ulaşmakta zorluk çekmem.	1	2	3	4	5
7. Okulda teknoloji kullanımı ile ilgili sorun yaşadığımda kolaylıkla yardım bulabilirim.	1	2	3	4	5
8. Okul yönetimi, derslerde teknoloji kullanımını destekleyici bir tavır içerisindedir.	1	2	3	4	5
9. Okulumuzdaki öğretmenlerin çoğunluğu derslerde teknoloji kullanımını destekleyici bir tavır içerisindedir.	1	2	3	4	5

1	2	3	4	5
Hiç Katılmıyorum ⟵		⟷		⟶ **Tamamen Katılıyorum**

	1	**2**	**3**	**4**	**5**
10. Okul yöneticileri, teknolojiyi etkin bir şekilde kullanarak bizlere örnek olmaktadır.	1	2	3	4	5
11. Okulumuzdaki öğretmenlerden bazıları teknolojik araç gereçleri derslerinde etkin bir şekilde kullanarak bizlere örnek olur.	1	2	3	4	5
12. Okulumuzdaki öğretmenlerle teknoloji kullanımı konusunda yardımlaşırız.	1	2	3	4	5
13. Okulumuzdaki öğretmenler arasında teknoloji destekli öğretim materyali alış verişi olur.	1	2	3	4	5
14. Okulumuzda teknoloji kullanımı konusunda yeterli hizmet içi eğitim imkânı sağlanmaktadır.	1	2	3	4	5
15. Okulumuzda, öğretmenleri teknoloji kullanımına teşvik eden çeşitli etkinlikler (seminer, atölye çalışması, örnek ders gösterimi vb.) düzenlenmektedir.	1	2	3	4	5
16. Okulumuzda teknoloji kullanımı ile ilgili yeterli teknik destek sağlanmaktadır	1	2	3	4	5
17. Okul yönetimi, teknolojik araç gereçleri derslerinde etkin bir şekilde kullanan öğretmenleri sözlü ya da yazılı olarak ödüllendirmektedir.	1	2	3	4	5
18. Derslerde teknoloji kullanımı öğrencilerin derse katılımını arttırır.	1	2	3	4	5
19. Derslerde teknoloji kullanımı öğrencilerin ders başarısını olumlu yönde etkiler	1	2	3	4	5
20. Derslerde teknoloji kullanımı öğrencilerin derse olan ilgisini arttırır.	1	2	3	4	5
21. Derslerde teknoloji kullanımı öğrenmenin kalıcılığını arttırır.	1	2	3	4	5
22. Derslerde teknoloji kullanımı konusunda daha fazla bilgi sahibi olmayı isterim.	1	2	3	4	5
23. Teknoloji yardımıyla işlenilen dersler eğlenceli geçer.	1	2	3	4	5
24. Teknoloji kullanımı dersi öğrenci merkezli hâle getirir.	1	2	3	4	5
25. Teknoloji kullanacağım bir derse hazırlanmak çok zamanımı alır.	1	2	3	4	5
26. Derslerde teknoloji kullanmak çok zamanımı alır.	1	2	3	4	5
27. Derslerde kullanacağım teknolojilerin kullanımını öğrenmek için zaman bulamıyorum.	1	2	3	4	5
28. Öğretim programlarının yoğunluğundan dolayı derslerde teknoloji kullanmaya vakit ayıramıyorum.	1	2	3	4	5

BÖLÜM VI - MEVCUT TEKNOLOJİLER

Evinizde ve sınıfınızda aşağıdaki teknolojik araç gereçlerden hangileri bulunmaktadır, belirtiniz.

Teknolojik Araç Gereçler	Ev	Sınıf
Bilgisayar	☐	☐
Projeksiyon Cihazı	☐	☐
Yazıcı	☐	☐
Tarayıcı	☐	☐
DVD/VCD/Video oynatıcı	☐	☐
Televizyon	☐	☐
Tepegöz	☐	☐
Öğretim yazılımları	☐	☐

BÖLÜM VI - TEKNOLOJİK YETERLİLİKLER

Aşağıdaki ifadeler için yeterlilik düzeyinizi belirtiniz.

	Tamamen Yetersiz	Kısmen Yetersiz	Orta düzeyde yeterli	Kısmen Yeterli	Tamamen Yeterli
1. Kelime işlemci programı (Word vb.) kullanımı	☐	☐	☐	☐	☐
2. Hesap tablosu programı (Excel vb.) kullanımı	☐	☐	☐	☐	☐
3. Veri tabanı programı (Access vb.) kullanımı	☐	☐	☐	☐	☐
4. Sunu hazırlama programı (PowerPoint vb.) kullanımı	☐	☐	☐	☐	☐
5. Internet Göz Gezdirici (Internet explorer vb.) kullanımı	☐	☐	☐	☐	☐
6. Internet arama motorları (Google vb.) kullanımı	☐	☐	☐	☐	☐
7. İnternetten dosya ya da yazılım indirme	☐	☐	☐	☐	☐
8. E- posta gönderip alma	☐	☐	☐	☐	☐
9. CD, DVD, flash disk vb. aygıtların kullanımı	☐	☐	☐	☐	☐
10. Yazıcı kullanımı	☐	☐	☐	☐	☐
11. Tarayıcı kullanımı	☐	☐	☐	☐	☐
12. Projeksiyon cihazı kullanımı	☐	☐	☐	☐	☐
13. DVD/VCD/Video oynatıcı kullanımı	☐	☐	☐	☐	☐
14. Televizyon kullanımı	☐	☐	☐	☐	☐
15. Tepegöz kullanımı	☐	☐	☐	☐	☐

Anket bitmiştir. Zaman ayırdığınız için teşekkür ederiz.

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Karaca, Feride
Nationality: Turkish (TC)
Date and Place of Birth: 22 Temmuz 1980, Sivas
Marital Status: Married
email: alimferide@yahoo.com

EDUCATION

Degree	**Institution**	**Year of Graduation**
Ph. D.	METU – Comp. Educ. & Inst. Tech.	2004 – 2011
BS	METU – Comp. Educ. & Inst. Tech.	1998 - 2003
High School	Sivas Science High School	1993 - 1997

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2004 – Present	METU – Comp. Educ. & Inst.Tech.	Research Assistant
2003 – 2004	Cumhuriyet University - Comp. Educ. & Inst.Tech	Research Assistant

FOREIGN LANGUAGES

English (advanced level)

PUBLICATIONS AND PRESENTATIONS

Karaca, F., Yildirim, S. & Kiraz, E. (2008). Elementary School Teachers' Instructional Design Process: An Insight into Teachers' Daily Practices. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2008* (pp. 3364-3371). Chesapeake, VA: AACE.

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Karaca, F. & Baturay, M. H. (2008). Perceptions of School Staff for Technological Changes: An Analysis of the Administrative Processes. *Proceedings of IETC 2008,* Eskisehir, Türkiye.

Baturay, M. H. & Karaca, F. (2008).Perceptions of the School Staff for the Curriculum Change at a K12 School Setting. *Proceedings of IETC 2008,* Eskisehir, Türkiye.

Alim, F. (2007).Evaluation of a Blended Course from the Viewpoint of Constructivism. *Proceedings of 7th International Educational Technology Conference 2007*. Nicosia- North Cyprus

Baturay, M. H., & Alim, F. (2007). The Evaluation of the Instructional Applications at Different School Settings Prior to the Implementation of New Curriculum in Turkey., *Proceedings of 7th International Educational Technology Conference 2007* (pp. 288-293). Nicosia- North Cyprus

Yuksel, P., Alim F., Yıldırım, S. (2007). *Perceptions of Kindergarten Teachers regarding the use of Technology in early Childhood Education.* Paper presented at the Teacher Education for Responding to Student Diversity, Malta.

SPARE TIME ACTIVITIES

Reading, swimming, cinema & theater, travelling.