A META-ANALYSIS OF THE EFFECTS OF TURKEY'S TECHNOLOGY INTEGRATION INITIATIVE ON TEACHERS' ATTITUDES

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The purpose of this study was to determine the overall effectiveness of Turkey's technology integration initiative on teachers' attitudes and examine the moderating effects of related study characteristics. The 22 studies in this meta-analysis, carried out between the years 2010 and 2017, investigated the effects of Turkey's technology integration initiative on teachers' attitudes and met the inclusion criteria. This study followed a traditional meta-analysis research approach utilizing Hedge's g effect size to combine studies. The effect size was calculated using Comprehensive Meta-Analysis (CMA) software. The result (g = .31) indicates that Turkey's technology integration initiative had a moderate but significant influence on teacher attitudes. In addition to teacher attitudes, barriers that could contribute to some K–12 teachers' lack of integration training were identified. Based on the results it is recommended that future professional development and training for teachers include assessments of teacher technology usage by administrators, an increase in time for collaborative planning among teachers, and more just-in-time technology support for technology integration.

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CHAPTER 1

INTRODUCTION

The objective of this research was to quantitatively identify the magnitude of the effects of Turkey's FATIH Project, also known as the *"Movement to Increase Opportunities and Technology,"* on teachers' attitudes towards technology. The integration of computer technology into Turkey's public education system is its cornerstone. The current study is a meta-analysis of 22 studies on the FATIH Project, encompassing 20 journal articles, one Ph.D. dissertation, and one master's thesis. All studies were published between June, 2010, when the project was initiated by the then Prime Minister Recep Tayyip Erdoğan, and December, 2017 (Milli Egitim Bakanligi, 2012a).

The FATIH Project rests on the premise that access to a properly functioning education is a fundamental human right. It aims to improve the quality of education and training in public education by integrating technology that is state-of-the-art into Turkey's public education system, preschools through high schools. This is meant to ensure that students and teachers are provided equal opportunities in terms of access to learning materials and mediums for better teaching, regardless of the economic status of the district in which a particular school is located (Akcaoglu, Gumus, Bellibas, & Boyer, 2015). As part of the project, classrooms are equipped with interactive whiteboards, students receive tablets, and the use of e-books in classes is standardized. With these resources, the integrated classroom provides materials and lectures to the students as homework, and the organized class time becomes an opportunity to share opinions or questions raised about the materials (Akkus, 2013). Teachers utilize technology by recording their lectures and making them available to the students; the students utilize technology by viewing the materials and organizing their thoughts for discussion (Tucker, 2012).

FATIH Project

The Ministry of Education in Turkey has invested in several large-scale technological projects to enhance the capacity and effectiveness of Turkey's academic institutions since 2008. The FATIH Project is the Ministry's biggest project, which began in 2010 and was funded by the Turkish national budget at an estimated US$8 billion. It was expected to extend over the next ten years and provide the latest technology for educational reform by distributing 14 million tablets and 570,000 interactive whiteboards to students and teachers (Pamuk, Cakir, Ergun, Yilmaz, & Ayas, 2013).

Technology's dynamic presence in life and education is regularly increasing in Turkey. The integration of such tools into school curricula is no longer a new idea; technology has been present in pedagogical settings for decades. However, there has been a transition from merely placing computers in classrooms to integrating them into students' learning processes. Rosen and Jaruszewicz (2014) argued that "the use of digital tools and strategies" now occurs "in ways that capitalize on children's natural desire to actively, collaboratively construct knowledge [and their] levels of development across all developmental domains" (p. 164). Thus, teachers have already recognized how the new era of students receive their educational information and adjusted the curricula to be inclusive.

Several countries stress the integration of technological tools when forming academic policies (Kozma & Voogt, 2003). Consequently, their investment in modern educational technologies have increased and their classrooms are now equipped with a variety of devices including computer systems, projectors, tablets, and interactive whiteboards (Ingram, Willcutt, & Jordan, 2008). The Ministry of Education (MoE) in Turkey has engaged in several large-scale technological projects to enhance the pedagogical infrastructure of their academic institutions.

The FATIH Project is one of the MoE's most current and sizeable installations. This project is designed to improve the classroom performance of students over the next several decades by recruiting and retaining thousands of teachers to increase the amount of successful pedagogy reaching millions of students. An executive committee has already reorganized existing programs involving technology education to access new and repurposed funds (MEB, 2012a).

Integrating technology into Turkey's classrooms has been necessary in order to improve the quality of lessons in all subject areas. The 2010 budget included $3 million dollars for the FATIH Project and related training (Milli Egitim Bakanligi 2012a). Technological devices were distributed to thousands of teachers and millions of students in the public schools. As a result of this initiative, most public school teachers today own a tablet or laptop learning device and are in classrooms with an interactive whiteboard (Ciftci, Taskaya, & Alemdar, 2013). The interactive whiteboard is a tool only recently embraced by educational institutions. Becta (2004) has designed it as a type of multimedia projector that allows teachers to present educational products available through the school's computer system. Within just four years of the project's origin, Smart Class was put into practice in 40,000 schools and nearly 600,000 classrooms all over Turkey (MEB, 2012a). Smart classrooms are also equipped with both tablets and SMART Boards.

There are many resources available for teachers seeking to create technology-enhanced units or lessons (Tondeur et al., 2012). In order to maximize the effects of technology integration, however, educators must first have the knowledge and skill required to use that technology, as well as adequate resources, appropriate procedures, and supportive pedagogy in place (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur;, 2012; McGrail, 2007; Oncu, Delialioglu & Brown, 2008). As of 2012, 80% of schools in Turkey were connected to the internet (Milli Eğitim Bakanlığı, 2012a). Turkish schools receive technology funding in different ways. Some spend their budgets on computer labs, while others dedicate resources to tablets and software programs. Schools in the eastern, rural areas of Turkey sometimes struggle to match the funding for technological programs and devices enjoyed by urban school districts (Sundeen & Sundeen, 2011).

According to a FATIH research study conducted in 2013, only 54% of middle and high school teachers thought their students had significant access to digital tools at school (MEB, 2012a). In addition, it was widely believed that the government should provide more equipment, software, connections, and support in this area (Ciftci, Taskaya, & Alemdar, 2013). Teachers may be more willing to take a chance on incorporating technology into their classroom if they know they have adequate support from the administration. Chase and Laufenberg (2011) stated that backing can come in many different forms, such as instructional design, an Information Technology help desk, peer groups, training, or even just budgeting sufficiently for teachers to be able to reach out to relevant software companies when needed. Access to various technological tools may also depend on teachers' changing grade levels, schools, and/or cities, meaning that materials once made available to them may no longer be accessible in their new position.

Teachers' beliefs also sway schools' attitudes regarding the incorporation of technological tools into the curricula. There is growing evidence that, when introduced properly, technology can enhance the learning environment and significantly impact learning outcomes (Conole & Oliver, 1998; Ertmer et al., 2012). However, due to the many barriers that exist, instructors may be resistant to integration based on pre-existing negative perceptions of instructional technology. This conclusion could be the product of their own experience, or a technology-related fear due to “simply witnessing a peer receive a poor evaluation from either administration or students” (Reid, 2012, p. 400). Teachers who have experience in the classroom tend to have more faith in their time-tested instructional methods and may not be interested in wading into the digital classroom waters (Akcay et al., 2015).

The integration of technology into schools is considered essential in order for teachers to improve learning through technology. However, the difficulty in this process of integration is the strong possibility that teachers will have varying degrees of experience, familiarity, and comfort with the new and emerging technologies (Quadri & Olaojo 2013). Use of technology in the implementation of formal learning has deeply changed expectations placed on classroom teachers. Even veteran educators are expected to participate in rigorous professional development opportunities to adapt to the changing curriculum demands. Therefore, there is serious pressure on teachers to integrate technology into their classrooms. The number of educators in a country has a real potential to make this already challenging process all the more complicated. For example, according to the MoE, there are approximately one million public teachers in K-12 schools in Turkey (Milli Egitim Bakanligi, 2012a). In other words, there are one million educators in the country with different competencies in computer technologies or perspectives on the uses of technology in public education.

Many scholars believe that technology impacts both students and teachers (Bitner & Bitner, 2002; Hu, Clark & Ma, 2003) and significantly alters the way learners access information and knowledge (Siemens, 2008). According to Keengwe, Onchwari, and Wachira (2008), “learners are able to glean a deeper level of understanding through the use of various materials than they would have through lecture alone” (p. 889). Learning is an active, not passive, process, which means that the learning process and learning environments should place a particular focus on the learner and his/her needs in order to make the process more effective. There is strong evidence that, even though “technological investment in classrooms has increased exponentially in the last two decades” (Lim, Zhao, Tondeur, Chai, & Chin-Chung, 2013, p. 1), lecture is the method being used almost exclusively in many classrooms (Ball, & levy, 2008). The adoption of new instructional methods has been challenging. Loraas and Diaz (2011) noted that many teachers have concerns about learning a new technology based on the assumption that if a technology is hard to learn, the implementation of that technology will be just as difficult. This results in the failure to take advantage of new technologies, which in return means that schools’ resources are wasted. Although the adoption process proves to be slow for some teachers, a shift of focus is seen among schools towards these types of learning technologies. In the end, by providing instruction through interactive whiteboards, tablet computers and the internet, the technological devices allow teachers to advance their instructional methods beyond lecturing, which creates a new way of learning in classrooms.

Contemporary education is a rapidly evolving landscape with changing standards to achieve educational excellence. This environment brings new requirements for professional educators. Being able to integrate technology into education is one of the requirements educators face in our time. There is growing evidence that technology can enhance the learning environment and significantly impact learning outcomes, as long as it is introduced properly (MEB, 2012a).

The use of technology in formal learning environments has radically changed the role of classroom teachers. Furthermore, the demographics of the teaching field and high turnover rates for teachers reveal not only the challenges of recruiting classroom teachers with technological skills, but also the increasing importance of the orientation of existing educators to this new educational environment. There is serious pressure on teachers to integrate technology into their classroom. Even veteran educators are expected to participate in rigorous professional development to adapt to the changing curriculum demands.

The use of learning technologies appears likely to grow in the future, and researchers are now questioning where this technology will take us in the coming decades (Leer & Ivanov, 2013). Many educational institutions have shifted their focus from building classrooms to investing in technology and using the resources offered by corporations such as Microsoft and Google. The use of learning technologies, whether online or face-to-face, expands the learning experience, allows students to learn at their own pace, and encourages collaboration in the process. Technology will continue to expand, and the methods for learning will continue to evolve and become more diverse.

Information and communication technology (ICT) classrooms provide opportunities for students to show teachers possibilities for how learning might be expanded even further through technologies the teacher may not be aware of. Teaching has always been an evolving profession as the demands of the world continue to evolve. However, as Lembo (1972) stated:

> One of the teacher's most important roles in conducting a shared classroom is to help students discover how different kinds of activities, materials, and tasks can be made relevant to their concerns and goals and can move them toward the acquisition of valuable meanings and competencies. The teacher's obligations of relevance are achieved in classroom life not only when he meets the students where he is but also when he opens up reality for the student and demonstrates the applicability of different ideas and skills to his life. (p. 73)

A major predictor of success with the project has little to do with the technical skills of the individual and more to do with the teacher's level of experience (Bulger, Mayer, & Metzger, 2014). How can the goals of the FATIH Project be achieved with an individual who has had little or no academic experience, especially considering the digital immigrants who did not have access to technology while enrolled in any level of education? Many corporations and communities are recognizing that the FATIH Project involves potential challenges and are funding programs throughout Turkey to improve students' technological skills and abilities (MEB, 2012a).

The struggles felt by teachers in their efforts to include the technological tools to improve students' experiences in the classroom can be overcome by removing barriers to their participation in professional development courses focused on technological tools and curriculum integration (Holden & Rada, 2011). This may be facilitated by means of resources created by other teachers or those that are discovered through research projects or on internet sites or designed through brainstorming based on the models of the technological tools provided in the figures (Christensen, 2002). For example, after completing a novel or short story, a class of students might use a tablet to find the author's and/or publishers verified account to ask questions regarding the story. According to the Media Smarts model, this activity of posing questions to people students have never met teaches students the important skills of navigation, research and fluency, and citizenship. When this task accompanies the short story, it assigns additional meaning to it. Pratt (1980) observed, "For knowledge to be acquired, retained, and integrated, it must be meaningful. The learner must understand what is being communicated, be able to relate it to a wider network of concepts and recognize its psychological meaning or significance" (p.71).

The beliefs of teachers may also have an effect on the incorporation of educational technology into the curriculum to enhance learning. It is important for them to believe that true technology integration is not just about having teachers log into an interactive whiteboard use an tablet for reading texts, or answer questions through a web page. There is growing evidence that, when introduced properly, technology can enhance the learning environment and significantly impact learning outcomes (Abbitt, 2011; Barron, Kemker, Harmes, & Kalaydjian, 2003; Gorder, 2008). However, as discussed above, due to the many barriers that exist, an instructor may not even try due to a negative perception of instructional technologies. The levels of self-efficacy teachers' display contribute to their perceptions about technology integration in learning environments (Akinbobola & Adeleke, 2012). This perception could be derived from their own instructional experiences or simply from witnessing a peer receive a poor evaluation from either administrators or students (Reid, 2012). Teachers who have been in the classroom for some time tend to have more faith in their time-tested instructional methods and may not be interested in wading into the digital classroom waters. The struggle felt by educators in their efforts to include technological tools in order to improve learning can be overcome by removing barriers through professional development courses focused on technological tools and curriculum integration.

Researchers have revealed several factors functioning as barriers to integration of technology. Barriers are defined in the literature as "any condition that makes it difficult to make progress or to achieve an objective" (Schoepp, 2005, p. 9). Huang, Lin, and Cheng (2010) studied factors affecting teachers' adoption of teaching blogs and found that the most significant factors in teachers' decisions are education, school level, subject category and weekly computer use. In another study of teachers' decisions to implement technology, five characteristics were identified: accessibility and availability, applicability, the influence of colleagues, teachers' skills/knowledge, and students' skills/knowledge (Oncu et al., 2008). Ertmer's (2005) study of this topic was influential in this area. She categorized barriers to technology integration in education as both extrinsic and intrinsic. The barriers to effective technology integration, such as training, teachers' beliefs and attitudes, inappropriate configuration, infrastructure, technological support, and knowledge and skills, have been studied widely (e.g., Christie & Jurado, 2009; Keengwe, Onchwari, & Wachira, 2008; Komba, 2009; Kraemer, 2008; Vaughan, 2007).

Statement of the Problem

Technology integration in Turkish classrooms increases students’ achievement and helps to better prepare them for college and careers, according to Turkish MoE (MEB, 2012a). Conversely, when teachers do not integrate technology properly into the curricula or do not use its tools at all, students’ achievement can be hindered. Such correlations led the government to initiate projects and to provide funding to schools to achieve the goal of incorporating technology in their classrooms to improve students’ achievement (Abbitt, 2011; Buabeng-Andoh, 2012; Chen, 2008; Ertmer, 2006; Ertmer, Ottenbreit-Leftwich, & York, 2007; Gorder, 2008, Holden & Rada, 2011). Notwithstanding, many of the K-12 classrooms across Turkey have merely incorporated technology on a minimal level between 2002 and 2010 (Vatanartiran & Karadeniz, 2015). Therefore, the national acknowledgment of the need for technology integration in the classrooms has not found equivalent resonance in actuality. Furthermore, it became apparent that despite sufficient training and abundant resources available for teachers, they have not made as much use of technological tools in the classrooms as had been hoped.

In order to address this problem, various studies of technology integration in schools have examined the attitudes of teachers focusing on their interpretations of technology use (Abbitt, 2011; Buabeng-Andoh, 2012; Chen, 2008; Ertmer, 2006; Ertmer et al., 2007; Gorder, 2008, Holden & Rada, 2011). Studies stressed that these understandings play fundamental roles in closing the gap between the national goal of technology integration in schools and the contradictory reality (Ertmer & Ottenbreit-Leftwich, 2010; Gorder, 2008; Groff & Mouza, 2008;

Chai, Hwee Ling Koh, & Tsai, 2013). As a matter of fact, they argued that the way teachers conceived technology determined the extent of their effort in making use of it in their classes. This is especially important because if teachers lag behind in making use of technological tools in the classroom, students' learning and achievement may be slowed down. Similarly, when the teachers do not make use of technological tools at all, students miss out on important learning experiences (Ertmer et al., 2007; Gorder, 2008).

The existing literature has stressed a positive correlation between students' achievements and technology integration in the classrooms as well (MEB, 2012b; Ertmer et al., 2007; Gorder, 2008). However, these studies have not clearly delineated particular reasons that accounted for why some teachers have not incorporated technology into the classroom despite sufficient training and abundant resources (Buabeng-Andoh, 2012). Identifying such barriers that constrain teachers from integrating technology in the classrooms effectively is essential (Ertmer & Ottenbreit- Leftwich, 2010), not only to maintain consistent support for students' learning and achievement through educational technology, but also to facilitate the identification of solutions to overcome any barriers (Milli Egitim Bakanligi, 2012c; Milli Egitim Bakanligi, 2012d).

In the early phases of the FATIH Project, research primarily examined students' perspectives regarding the integration of technology into the classroom (Balcı, 2013; Dinçer, Şenkal, & Sezgin, 2013). Such a narrow perspective, however, could hinder thorough assessment and the growth of the project. Therefore, a systematic review and meta-analysis of the existing literature could inform practice and provide support for new lines of inquiry. While educational technology research in Turkey to date has reported most often on such topics as educational setups and current technology, distance education, multimedia-based research, curricular direction, pedagogical efficiency, and instructor education (Göktaş et al., 2012; Karataş & Toy, 2014; Kucuk, Aydemir, Yildirim, Arpacık, & Göktaş, 2013; Ozan & Köse, 2014; Ustundag, Gunes, & bahcivan, 2017), analyses have not focused on the FATIH Project. Therefore, a content evaluation of studies of the project is needed to enable researchers to assess the project's overall development and address surfacing needs related to research and development tasks.

Purpose of the Study

As the Turkish government explores the advantages of utilizing interactive whiteboard and Tablet technologies to facilitate learning, it is important to understand how to design instruction effectively while providing a supportive technological environment for teachers. The objective of this research is to quantitatively identify the extent of the effects of the FATIH Project on teachers' attitudes towards technology. The study provides information that may lead to conclusions about effects of technological tools to be used in educational settings have on teachers' behaviors. Meta-analysis was conducted to synthesize the literature regarding the teachers' attitudes in this area. Meta-analysis was chosen because it allows us to quantitatively summarize the relative effectiveness of studies and explain heterogeneity across studies.

The objective of this research is to quantitatively identify the extent of the effects of the FATIH Project on teachers' attitudes towards technology. For this purpose, 22 national and international studies that were published between the years of 2010 and 2017, including journal articles, proceedings, graduate level theses, reports, and dissertations, were analyzed employing a meta-analysis method. The data, as analyzed by using the Comprehensive Meta-Analysis Software, are presented in a subsequent chapter in the form of descriptive statistics and graphs. Researchers from Computer Education and Instructional Technology (CEIT) programs around the country authored most of the studies, and a great many of the studies focused on stakeholders' attitudes and evaluated the project employing quantitative methods. Few of these articles, however, were published in journals included in the Social Science Citation Index (SSCI).

This meta-analysis used a random effects model to systematically review 22 previous studies related to the problem at hand. Selected studies, published between 2010 and 2017, mainly focused on the relation between the attitudes of teachers and the level of technology integration achieved in their classrooms (Eberwein, 2012; Groff & Mouza, 2008). These studies were selected to unearth probable linkages between technology integration in the classroom and the reported barriers that hinder such integration.

Studies that examined teachers' attitudes toward technology use as the key restrictive variable affecting attainment of the desired level of technology integration in classrooms indicated that teachers had not effectively made use of technological tools in schools between 2007 and 2011 (Milli Egitim bakanligi, 2012d). They have also stressed that despite an increase in the availability of technological equipment in schools, data on teachers' actual use of these tools were far from encouraging. Teachers had the necessary training and equipment readily available, and the schools were tech-ready; nevertheless, an unidentified factor continued to hinder the actual incorporation of technology in the classrooms. In view of insights gained from these studies and by taking the effect of these barriers into consideration, the current study aimed to depict these unidentified factors deterring technology integration in the classroom (Ertmer, 2006; Loizzo & Ertmer, 2015; McLeod & Lehman, 2012; Rankin, 2014; Vatanartiran & Karadeniz, 2015).

Hence, this study had a threefold aim. The first was to obtain reliable data on technology integration in schools between 2010 and 2017. Second was to examine evidence-based research to ascertain statistical significance of findings. The third, and most important, aim was to synthesize the findings of the studies to achieve main conclusions (Bangert-Drowns & Rudner, 1991; Berman & Parker, 2002; Cohen, Kulik, & Kulik, 1982; Field & Gillett, 2010). In this framework, the goal of this study was to shed light on the constraining factors inhibiting the achievement of widespread integration of innovative technologies in schools across the country. In this way, it is hoped that avenues of research for future studies will open.

Research Questions

These three research questions guided this dissertation study:

1. What is the overall effect of the FATIH Project's technology integration initiative on teachers' attitudes?
2. Which study-related factors are statistically significant moderators of the effects of technology integration on teachers' attitudes (Training, Grade Level, Devices, Barriers, TPACK, and Outcome)?
3. Has there been change in teachers' attitudes over time?

Significance of the Study

Teachers play an essential role in integrating technology in schools. Thus, how a teacher perceives the use of technological tools relates to his or her actual use of technology in the classroom. According to Kincaid and Feldner (2002) and Ertmer and Ottenbriet-Leftwich (2010), teachers continue to feel unprepared to make use of a variety of technological instruments even after many years of their introduction in schools. Such an observation highlights the urgency of training teachers effectually so that they can implement technology effectively in the classroom. Indeed, it is necessary to identify all of the impediments hindering teachers from making use of technological tools in the classroom to identify proper strategies for providing a diversified learning environment for students. In this respect, the current study contributes to the literature that focuses on leadership and aims to provide useful information about the conditions and needs of the teachers along with strategies for the leaders (Buabeng-Andoh, 2012), so they can ease the process of technology adoption in schools by facilitating effective training as well as providing technological equipment (Gorder, 2008; Holden & Rada, 2011). This study fills a gap in the literature by analyzing the effects of the FATIH Project integration initiative on teachers' attitudes. Meta-analysis is used to synthesize studies, producing a clearer picture of the relationship between the FATIH Project and teachers' attitudes.

To my knowledge, this is the first meta-analysis relating to the FATIH Project. The literature search process was exhaustive, covering all accessible published literature concerning the FATIH Project from 2010 to 2017, which was then screened by using technology. This project makes four contributions to the field. First, this study provides information to policy makers, researchers, and classroom educators. Second, this study contributes to the knowledge base in the use of the interactive whiteboard in teacher training and online support programs for future FATIH Project research, which should support the achievement of the FATIH Project's goals. Third, this investigation indicates strengths and weaknesses of the existing FATIH training and support program components. Finally, the kinds of training that are necessary for teachers in relation to implementation of the FATIH Project are explored.

Definitions of Terms

- *Attitude:* an everyday judgment, a normative view on a specific matter (here the FATIH Project technology initiative). "It offers an evaluation rather than a descriptive problem, and implicitly or explicitly involves notions such as good/bad, right/wrong" (Voas, 2014, p. 9).

- *Effect size*: a measure that "provides a common expression of the magnitude of study outcomes for many types of outcome variables" (Hattie, 2009, p. 8). The effect size is "the standardized difference between two means that provides a measure of the strength of a treatment or independent variable" (Arthur, Bennett, & Huffcutt, 2001, p. 1).

- *External barriers:* hindrances that arise from "inadequate and/or inappropriate configuration of ICT infrastructures, including access, time, support, resources and training" (Christie & Jurado, 2009, p. 13)

- *Fail safe N*: a concept developed by Rosenthal (1979) in order to compensate for the problem of publication bias. The calculation of fail-safe N produces a result that represents the number of new, unpublished, or unretrieved non-significant studies that would most likely lower the significance of the meta-analysis (Carson, Schriesheim & Kinicki, 1990; Long, 2001).

- *Homogeneity*: the condition in which "effect sizes that are averaged in the mean are all from the same population" (Lipsey & Wilson, 2000, p. 1).

- *Internal barriers*: hindrances that are "related to teachers' personal experience and understanding, including attitudes, beliefs, practices and resistance" (Chen, Tan, & Lim, 2012, p. 1)

- *Meta-analysis*: a method of data analysis "whereby the effects in each study, where appropriate, are converted to a common measure (an effect size), such that the overall effects could be quantified, interpreted, and compared" (Hattie, 2009, p. 3).

- *SMART Board*: a combination of a whiteboard with a computer and information projector that makes it possible for operators to control applications by touching with their fingers or digital non-ink pens (AlQirim, Mesmari, Mazroeei, Khatri, & Kaabi, 2010).

Organization of the Dissertation

The report of this meta-analysis methods study is organized and presented in five chapters. Chapter 1 introduces the study by reviewing the problem statement, purpose, research questions, significance, positionality of the researcher, and definitions of key terms. Chapter 2 details the review of the literature related to teacher's beliefs and attitudes regarding of technology into their schools, extrinsic and intrinsic barriers, school level and teacher level barriers, TPACK, training, overcome extrinsic and intrinsic barriers, teachers' pedagogical principle and outlines the conceptual framework for this study. Chapter 3 outlines the methodology and research design for this study, and Chapter 4 follows with an analysis of the data and presentation of the findings. Chapter 5 includes a discussion of the findings, recommendations, and implications for further study. A list of references and appendices conclude the dissertation.

Summary

This chapter provides an overview of teachers' beliefs and attitudes in terms of integration of technology in the classroom environment. This research also seeks to address extrinsic and intrinsic barriers that are preventing teachers from integrating technology. The literature indicated that teachers incorporate technology into classroom based on three primary factors including availability, their beliefs, and their readiness. This study will provide deep understanding of teachers' attitudes on FATIH Project.

CHAPTER 2

LITERATURE REVIEW

This chapter focuses on relevant literature for this study and centers around the following key topics: barriers to technology integration, professional development, and pedagogical principal with technology integration. The integration of technology and its impact on the instructional design and learning process has attracted the interest of academics from different fields who have engaged with different aspects of the issue in journal articles, monographs, and edited books prior studies have explored the integration of technology into education (Bruce & Levin, 1997; Mohan & Brooks 2003), effects of this integration on the learning process (DuFour 2004; Ertmer 1999), and issues of implementation and adoption of technology (Ertmer 2005; Meier 2005).

This research focuses on the period 2010-2017, when the FATIH Project emerged as a new education policy in Turkey's public education system. Thus, this literature review particularly engages with academic analyses of different aspects of the FATIH Project and the question of integration of technology into education in general and other related themes. The integration of technology into education and the role of teachers in the instructional design and learning process have a long history of discussion in the field of education. Overhead projectors, radio, film, computers and the Internet have traditionally been adopted by teachers in classes; however, the constant progress in the development of technology presents both new challenges and opportunities for instructors. More recent technological innovations, such as tablet computers and interactive whiteboards, have yet to be widely adopted by teachers to become mainstream in education (Drugbo, Riedel, & Pawar, 2014). However, the increasing popularity of these new devices, tablet computers in particular, makes the question of their integration of these tools into education to facilitate more effective teaching methods all the more exciting.

The FATIH Project emerged in 2010 in Turkey as a new education policy based on the premise that access to a well-functioning education is a fundamental human right. The project aims to improve the quality of education and training in public education by integrating cutting-edge technology into Turkey's public education system from preschool through high school. It aims to ensure that students and teachers are provided equal opportunities in terms of access to learning materials and mediums for better teaching regardless of the economic level of the district in which a particular school is located (Milli Egitim Baknligi, 2012a). As part of the project, classrooms are equipped with interactive whiteboards, students are given tablets, and the use of e-books in classes is widely standardized. In this sense, the FATIH Project allows teachers to move their teaching methods beyond lecturing by providing instruction through interactive whiteboards, tablet computers, and the internet to facilitate a new way of learning in classrooms (Milli Egitim Baknaligi, 2012b).

In this literature review, I consider teachers' experiences with such technologies. The literature focuses on examining teachers' beliefs and attitudes regarding the integration of technology into their schools. Discussion of extrinsic and intrinsic barriers preventing teachers from integrating technology is also addressed.

Barriers to Technology Integration

After the initial introduction of computers in classrooms at the beginning of the 1980s, it was projected that computers would play an important role in the lives of future generations, especially in education (Yelland, 2001). Nowadays there is no doubt that innovative computer technologies provide many opportunities to use new techniques and approaches in teaching and learning (Lefebvre, Deaudelin, & Loselle, 2006). Dawes (2001) states that computer technologies allow teachers to provide students with better support during the learning process and improve two-way communication between teachers and students, even at a distance, in ways that could not be imagined before. While researchers optimistically projected that information and communications technology would change pedagogy, Dawes (2001) questioned whether such changes would be possible, anticipating that new ways of teaching would lead to new problems. Nevertheless, Information Communication Technologies (ICTs) are projected to play significant societal and educational roles in the future. Identifying and removing possible obstacles to integrating technology in schools will be an important step toward improving the quality of teaching and learning.

Balanskat, Blamire, and Kefala (2006) highlighted that one of the obstacles to the effective use of computer technologies in the curriculum is teachers' difficulties adapting to the changed system. A lot of research has examined barriers to the integration of technology in teaching and learning processes in order to find ways to overcome them as well as help teachers who have already acknowledged the benefits of technology to use it effectively (Özden, 2007; Al-Alwani, 2005). Although there are many studies of barriers to the integration of computer technologies in education, few have addressed problems which teachers face in specific subject areas, which would be especially useful in giving teachers practical advice on how to apply technology to pursue certain goals in their lessons (Becta, 2004). In the current study, a brief review of the importance of technology for effective education in general is accompanied by an analysis of the barriers to the integration of technology with education.

Researchers have identified several factors that constitute barriers to teachers' integrating technology into their teaching methods (e.g., Bingimlas, 2009; Chen, 2012; Kopcha, 2012; Schoepp, 2005). The integration of technology into education is a complicated process that involves a range of barriers which prevent achievement of goals or success in a task. This study targeted barriers to iterative white board and tablet integration in education and ways to successfully overcome them.

Classification of Barriers

Barriers to effective technology integration, such as lack of training, teachers' negative beliefs and attitudes, inappropriate configuration of infrastructure, inadequate technological support, and insufficient knowledge and skills, have been studied widely (Christie & Jurado, 2009; Keengwe, et al. , 2008; Komba, 2009; Kraemer, 2008; Vaughan, 2007). Ertmer (2005) is an often-quoted scholar for his work on the integration of technology into education. He has mainly focused on integration and evolution of technology in classrooms. These works are primarily concerned with teacher beliefs and technology integration practices.

There are several classifications of barriers to application of technology in education. Ertmer (2005), a particularly influential scholar in this area, categorized these barriers as extrinsic (external) and intrinsic (internal). Chen et al., (2012) defined those barriers as follows. Extrinsic barriers are those that arise from "inadequate and/or inappropriate configuration of ICT infrastructures, including access, time, support, resources and training" (p. 1). Intrinsic barriers are those that are "related to teachers' personal experience and understanding, including attitudes, beliefs, practices and resistance" (Chen, et al., 2012, p. 1). Critical extrinsic and intrinsic barriers to effective technology integration, such as lack of technological support, instructional support, knowledge and skills, and relevant instructional technology, have been studied widely (Christie & Jurado, 2009; Keengwe et al., 2008; Komba, 2009; Kraemer, 2008; Vaughan, 2007). Becta (2004) proposed dividing barriers according to origin, such as in teacher-level and school-level barriers. While teacher-level barriers involve such difficulties as lack of time, resistance to change, and lack of confidence, school-level barriers are concerned with such problems as lack of training in technology and inappropriate resources. Balanskat et al. (2006) created another classification by dividing barriers into micro and macro groups. Teachers' negative attitudes toward technology integration are micro level barriers, while those connected with the institutional environment are macro level barriers.

Ertmer et al. (2012) attempted to determine whether barriers to teachers' technology integration were largely internal or external based on findings in prior studies addressing this issue. Ertmer conducted interviews with 12 teachers whose technology practices had been recognized by a number of national and international institutions. The participants' interviews and analysis of their classroom websites revealed that they experienced more external than internal barriers, such as need for better training, technology support and leadership programs. Many teachers face the barrier of inadequate technological skill and knowledge to use technological tools effectively. Thus, the main external barrier is training or professional development to prepare teachers to use technology in the classroom. Teachers may be more willing to take a chance on incorporating technology into their classrooms if they feel well prepared. Training could come from many different sources, such as instructional designers, information technology help desks, peer support groups, and even contract negotiations with software companies that ensure funding for adequate support so that teachers can get help from suppliers if needed.

Huang, Lai, and Cheng (2010) studied factors affecting teachers' adoption of teaching blogs and found that the most significant factors affecting teachers' decisions are education, school level, subject category, and weekly computer use. Oncu et al. (2008) proposed five factors that influence teachers' decisions to implement technology: colleagues, teachers' skills/knowledge, students' skills/knowledge, accessibility of support, and applicability to their needs. Several issues in which extrinsic and intrinsic barriers are intertwined are discussed in the following section (Table 1).

Table 1

Barriers to Teachers' Attitudes to Integrated Technology

Barriers	Article	For teachers
Lack of Access	Ay, 2016; Han, 2016; Anaturk, 2014 Sozcu, 2014	Taking advantage of resources at schools
Resistance to Change	Aktas, 2014 Goktas, 2013 Sozen, 2017	Being open minded towards new ways of teaching
Lack of Training	Akcay, 2015 Aksu, 2014 Akyus,2014 Balta,2015 Han, 2016 Karal, 2013 Korkmaz, 2013 Sozen, 2017 Temelli, 2014 Yildiz, 2013 Yuksel, 2012	Preparing themselves (pre-service) by self-training Taking up opportunities for training offered at schools Knowing how to access to resources
Lack of technical support	Balta, 2015 Dasdemir,2012 Izci, 2016 Karal, 2013	Relying on themselves to be able to solve problems in their use of ICT Accessing available support
Lack of teacher competence	Aydin,2016 Dasdemir, 2012 Turel, 2012	Experiencing fear of failure

(table continues)

Barriers	Article	For teachers
TPACK	Akcay, 2015 Aksu, 2014 Kiranli, 2013 Korkmaz, 2013 Tekerek,2012 Temelli, 2014 Yuksel,2012 Turel, 2012	Training in new pedagogical approaches

Teacher-Level or Internal Barriers

Resistance to change and lack of confidence are considered to be the most common barriers to the integration of technology into education at the teacher level. The introduction of new technologies in schools requires fundamental changes in the teaching and learning processes and the classroom setting (Watson, 1999), towards which teachers have different attitudes. Several studies have documented resistance to change as the primary obstacle for technology use in schools. For example, Aktas (2014) claimed that teachers' resistance to change could be connected with the necessity to learn new teaching strategies. Sozcu (2014) found that the main cause of teachers' resistance to the integration of technology at school was their uncertainty as to whether they could get support or guidance in the process. According to Empirica (2006), teachers can be resistant to the use of technology in their classrooms because they don't believe it will improve their teaching or students' learning processes.

In fact, resistance to change can indicate external problems in the educational facility rather than simple ignorance or unwillingness on the part of teachers to apply the technologies. Earle (2002) explained that resistance to change could point to such problems as lack of technical support, no time for learning new strategies or planning to use them, or no opportunity to gain expertise (Gomes, 2005; Schoepp, 2005). However, Han's (2016) findings emphasized internal barriers to changes as teachers did not think there was great necessity to change their methods and strategies of teaching. Cox, Preston and Cox's (1999) also found that lack of education could also result in teachers' resistance to changes, which may be why communities with lower educational levels reject the introduction of technology in schools more often rather than communities with higher levels of education. For example, teachers' resistance to change is much lower in Europe, where only about 20% of the teachers studied considered the use of technology as ineffective, than in developing countries (Korte & Hüsing, 2007). Becta (2004) agreed that understanding the importance of using of technology in teaching and learning has a great impact on teachers' attitudes toward its integration in their classrooms. Thus, it is important to determine teachers' beliefs about change in order to determine ways to increase their understanding of how technology integration will benefit their teaching and their students' learning.

Dawes (2001) and Becta (2004) found that teachers' lack of confidence is considered as one of the most frequently met barriers to use of technology in education. Beggs (2000) found that teachers lacked confidence because they were afraid to fail in using of new methods of teaching supported by technological devices. Balanskat et al. (2006) highlighted that the main cause of teachers' lack of confidence was their limited knowledge of computer technologies, which agreed with Becta's (2004) claim that teachers who had low computer knowledge and skills felt anxious about using technology with children whose superior computer skills could enable them to notice gaps in their teachers' knowledge. Conversely, Cox et al., (1999) found that teachers who had sufficient experience in the use of technological devices were aware of the usefulness of technology in their teaching processes and personal work and appreciated the benefits which technology could give them in the future. Aydin et al. (2016) stated that while lack of proper training is an important external barrier to teachers' adaptation of technology in classrooms, this phenomenon is also intertwined with the internal barriers mentioned above, particularly with teachers' lack of confidence.

Among various reasons for teachers' lack of confidence in adopting new technologies, one is that students often perceive their teachers' limited knowledge, which makes teachers less secure and fear failure (Beggs, 2000). Becta (2004) stated that “many teachers who do not consider themselves to be well skilled in using technological tools feel anxious about using it in front of a class of children who perhaps know more than they do" (p. 7). Thus, for teachers with lack of confidence, technological tools may appear as an impediment to their competence.

This issue becomes more problematic and challenging, given that, as Mok (2014) explained, one downside of a technological classroom environment is that teachers have to monitor and supervise students in order for peer-to-peer problem solving to be effective. Teachers s are tasked with managing the classroom to ensure that students are on task while using the technology, which becomes difficult in a setting that encourages individual exploration and problem-solving. A fair criticism of technological learning environments is the loss of the absolute control that a teacher has traditionally had over learning opportunities for their students. Teachers who have control issues often believe they are the only link between information and knowledge for students (George-Palilonis & Filak, 2009). However, Dasdemir, Cengiz, Uzoglu , and Bzdogan (2012) claimed it was time for teachers to empower learners so “they can construct their own knowledge, meanings, and solutions” (p. 47). In addition, teachers must understand that students share in the responsibility for making meaning out of new content.

Abstaining from using new technologies; fear of change or fear of not knowing how to use technology manifest as negative perceptions and complaints about not having enough time, increased workload, lack of support for the change, and not knowing if the delivery is effective

(Tshabalala, Ndeya-Ndereya, & van der Merwe, 2014). This leads some teachers to displace their fear of using new technology and act incompatibly with students' needs. It is important for teachers to understand that technology is a tool for their engagement with students. This does not, however, mean that learning all takes place via the technology itself; rather, it is important to understand that technology only provides a stimulation for the learner to think about the lesson in a new way. Bingilmas (2009) asserted that "teachers resistance to change concerning the use of new strategies to change to technology integration in teaching" (p. 238). While technological tools have the potential to increase engagement in classrooms, they also run the risk of becoming a source of distraction for students. Students may use their tablet computers to check social media or text a friend, which can disconnect them from the lesson, which is another reason for teachers' resistance to adopting technology in their classrooms.

School-Level or External Barriers

Lack of effective training, lack of technical support, and lack of accessibility are key school-level barriers preventing teachers from using technology effectively (Akcay et al. 2015; Aksu, 2014: Akyuz et al., 2014; Lewis, 2003; Becta; 2004). Both Pelgrum (2001) and Beggs (2000) reported that teachers often have no opportunities to acquire their technology skills in a classroom environment. Akcay et al. (2015) found that effective integration of new technology into the teaching and learning process could not be achieved because of the lack of provision for in-service training programs for teachers. Becta (2004) noticed that poor training of teachers' computer skills can be connected to issues with time of training, skills taught in training, use of technology in training, and pedagogical training. Gomes (2005) found that teachers who had training in technology complained of a gap in digital literacy, as well as poor pedagogical and didactic training, and ineffective training in the proper use of technologies and use of technology in lessons. Korkmaz et al. (2013) reported poor training in technology use and delivery style prevented teachers from adopting new methods of teaching with technology.

The effective integration of technology into education first and foremost lies with the effective training of teachers to integrate technology in a classroom environment (Bingimlas, 2009; Ertmer et al., 2012; Ruggiero & Mong, 2015). Effective training includes helping them conceptualize technology as an integral part of modern education, which enhances learning, provides needed resources to struggling students, and allows teachers to create more immersive classroom experiences. Training should give teachers adequate technological skills to integrate technological tools into their classroom and sustainable ways to meet modern standards of education. It is therefore not surprising that lack of sufficient training appears as the most frequently mentioned barrier in studies on the effective integration of technology into classrooms (Beggs, 2000; Schoepp, 2005).

Akcay (2015) also confirmed that lack of effective training negatively affected teachers' confidence in using new computer technologies. While lack of proper training is a major external barrier, it is also closely related to internal barriers. Motivating teachers to receive training and use the tools has never been more important as all learners, including teachers, must be willing participants in the learning process. If one were to ask an untrained teacher to use an interactive whiteboard to teach a class, the teacher would be woefully lost. In the same manner, all teachers who are not literate in the use of technology tools and software would also be lost. The best way to motivate teachers to use technological tools is to make sure that they are confident with the tools they are expected to use. This confidence can be obtained through training. There is a strong connection between this extrinsic barrier and teachers' perceptions of using technological tools in the classroom.

In order to make training in use of technology more effective, Becta (2004) and Cox et al. (1999) proposed focusing on pedagogical aspects rather than basic technology skills. Computer training for teachers should go beyond giving them technical information on the operation of devices and help them understand how to use technology to enhance their lessons (Cox et al.'s, 1999). Becta's and Cox et al.'s findings were supported by the results of the research conducted by Balanskat et al. (2006), which showed that training provided by schools had not met teachers' needs. While teachers required more pedagogical practice using technology, the training only addressed their general technology skills. As a result, teachers lacked confidence in the integration of technology in education and failed to prepare effective tasks using technology. Schoepp (2005) insisted on the necessity to train special pedagogical technology skills and helping teachers use them in classroom. Newhouse (2002) indicated that appropriate pedagogy, along with general technology skills and knowledge, should be a part of teachers' professional development as both are needed for success in modern classrooms.

Sicilia (2006) reported that training in technology without addressing integration of technologies into specific subjects could be useless for teachers' professional development. Other problems concerning the training of teachers include poor differentiation of teachers' needs and lack of updating sessions (Balanskat et al. 2006). Albirini (2006) observed that training which provided opportunities to practice a technology before its integration into, teaching and learning better ensures future successful use of technology. Becta (2004) found that teachers who could not improve skills and knowledge in basic technology were not successful in providing children with proper access to technological resources. Consequently, effective training in technology should combine the development of basic technological devices skills and knowledge with training of pedagogical skills.

Lack of technical support also diminishes teachers’ chances to overcome the barriers to the integration of technology with education (Lewis, 2003). Sicilia’s study showed that technical problems could be the major barriers for teachers as they led to the “smooth delivery”(p. 43) of the lesson and affect the flow of classroom activities. According to Sicilia (2006), the technical barriers could include such as low internet connection, malfunctioning computers, unreadable printing, much time for opening of websites, and teachers’ work on computers proceeding slowly. The study conducted by Pelgrum (2001) among with both primary and secondary teachers showed that both groups of participants suffered from poor technical support. Balta and Duran (2015) explained that lack of technical support at school may be connected to irregular maintenance and increasing risks of technical breakdowns. Becta (2004) noticed that technical faults could have a negative impact on the use of technology in classroom as teachers have experienced frustration with technical problems during lessons, so they are afraid that new attempts would involve failure. Izci and Eroglu (2016) argued that including effective technology support and regular maintenance in contracts with suppliers would supplant teachers’ negative technology experiences with successful experiences if teachers did not have to waste lesson time dealing with software and hardware problems.

Balta and Duran (2015) reported that teachers in Turkey were ready to introduce technological tools into their lessons if they would be provided with strong technical support. The research literature on the use of technologies showed that lack of technical support was another main barrier for teachers’ integration of computer technologies in teaching (Dasdemir, 2012; Karal et al., 2013; Gomes, 2005; Toprakci, 2006). Sicilia (2006) claimed that problems with smooth delivery of lessons caused by technical breakdowns affect teachers’ decisions to integrate technology into the teaching and learning process. However, no level of technical support and access can prevent such issues as low internet connection, teachers will continue experiencing lack of technical support as a barrier to use of technology in classes. Korte and Hüsing (2007) found that in the United Kingdom, the Czech Republic, the Netherlands, Latvia, and Malta, schools had recognized the necessity of technical support for teachers using technology in the classroom and responded accordingly. In conclusion, lack of technical support prevents teachers from managing time and the natural flow of the lessons effectively, so they should be provided adequate technical support in order to use technology in teaching and learning effectively.

Lack of accessibility to resources may be another barrier that prevents teachers from introducing new technologies into their classes. Han and Okatan (2016) refered to difficulties teachers experienced when they had to book computers in advance but forgot because of a myriad of other tasks they must fulfill. In addition, teachers complained that they could not book the computers for long enough periods of time for big projects with their students. Sicilia (2006) reported that teachers complained about waiting a long time for access to a computer or sharing a computer with other teachers. Sozcu (2014) noticed that lack of accessibility can reflect poor organization of resources, poor quality of software, and lack of personal access for school teachers.

Comparison of accessibility of technology across all countries where research was conducted showed that the problem of lack of accessibility was similar. Ay (2016) found that in Europe lack of access was the largest barrier to the use of technological devices in teaching. Empirica (2006) found that lack of computers and adequate programs were the main barriers for use of technological devices in European schools. Korte and Hüsing's (2007) study showing that one third of European schools did not have internet access supported Empirica's (2006) finding that technology access was not adequate. In a study of teachers' opinions about barriers to introduction of computer technologies in 26 countries, Pelgrum (2001) found that four of the ten barriers most often mentioned referred to inadequate accessibility of technological devices at school including lack of computers, lack of peripherals, no or poor Internet access, and lack of copies of software (Pelgrum, 2001). Toprakci's (2006) study participants complained of insufficient numbers of computers, obsolesced or slow technology systems, and lack of educational software in Turkish schools. In comparison, Aydin, Gurol , & Vanderlinde (2016) noticed that there was no access to Internet during the day at school, while lack of hardware prevented schools from integrating technology (Table 2).

Table 2

Addressing the Barriers from the Articles Used in the Meta-Analysis

Subject	Count
Using the SMART Boards	Four times mention
Interactive White Boards`	Three times mention
Using the tablet technology	Four times mention
Inadequate provision of in service training	Eight times mention
Unequipped with necessarily skills	Three times mention
Lack of the teacher's technological information	Five times mention
High Level Leadership and Coordination	Two times mention

Gomes (2005) indicated several barriers to improvement of access to technology at schools, including inappropriate infrastructure and lack of reliable material resources. However, the development of good infrastructure will not guarantee that the technology will be integrated with education successfully, because schools may experience poor access to technological resources, low quality hardware, and unsuitable educational software (Balanskat et al., 2006).

Newhouse (2002) stated that poor quality hardware and software were main causes affecting the integration of the technology. Cox et al. (1999) also found that teachers could not use technology in teaching because of poor technology resources and no time to review software. The limitations of hardware and software resources access discourages teachers from introducing technology in the classroom (Osborne & Hennessy, 2003). In combination these studies identified common barriers to technology use in the classroom as lack of high quality software, lack of computers, lack of time, technical problems, resistance to change, teachers' negative attitudes towards computers, teachers' lack of computer skills and confidence, insufficient funding, and poor administrative support.

Overall, the same barrier that keeps teachers from integrating technology into their classrooms is their ability to use the technology, or readiness (Inan & Lowther 2009, p. 145). In order to maximize the benefits of technology integration, teachers need to have the knowledge and skills to use the technology, as well as appropriate pedagogy in place (Ertmer et al., 2012; McGrail, 2007; Oncu et al., 2008). Teachers' struggles to adopt technology into the classroom, as discussed above, are due to different external and internal barriers that can be overcome through various means. To address lack of knowledge and skills, professional development is seen as an effective method for enhancing teachers' familiarity and comfort with technology that can eventually lead to improved technological knowledge and skills (Jimoyiannis, 2010). Similarly, Ertmer et al., (2007) argued that teachers need professional development in order to facilitate new technological tools.

What is Professional Development?

Ideally, professional development involves sustained or long-term educational opportunities for teachers to interact with learning technology, build skills and confidence, practice implementing technology enhanced curriculum, and participate in collaborative learning activities (Akcay, Arslan, & Guven, 2015; Aksu, 2014; Gerard, Varma, Corliss, & Linn, 2011; King, 2002; Kiranli & Yildirim, 2013; Kopcha, 2012; Korkmaz, Akturk ,& Karimi, 2013; Matherson, Wilson, & Wright, 2014; Meier, 2005; Tekerek, Ercan, Udum, & Saman, 2012; Turel & Johnson 2012; Yuksel, 2012). Historically, teachers have mostly relied upon professional development to learn new methods (Gregory, 2009). Jimoyiannis (2010) argued that authentic learning experiences are critical for successful professional development. Professional development can occur in formal or informal settings, from administration in-service days to an instructor learning something new from a book. There are particular challenges in emerging technologies that make it difficult to describe what a particular technology entails in terms of new teaching methods for someone who is unfamiliar with the basic tenets of technology. Therefore, it is imperative that ample explanation and support are provided to instructors in their training for a new technology. The effectiveness of the professional development training can directly influence teachers' incorporation of ICT's into their classrooms.

Wang, Hsu, Reeves, and Coster (2014) conducted a two-year study of the relationship between professional development and teachers' integration of technology into the classroom, the teachers received 240 hours of professional development sessions related "to improving their skills in using Information and Communication Technologies as cognitive tools through the new literacy framework, and enhancing their strategies for supporting students' content learning" (p. 107). This study concluded that the teachers successfully adopted technological tools due to the professional development courses in which they developed their skills. Similar studies can be conducted and modeled for other learning environments to successfully engage teachers with professional development activities and encourage the proper integration of learning technologies to increase digital literacy.

Similarly, Kopcha (2012) reported results of a two-year situated professional development program on the integration of technology into classrooms that focused on scaffolding professional learning activities and building teachers' knowledge and skills for these new technologies over an extended period of time. This kind of in-service could also be facilitated by resources other teachers find or create, through research projects, Internet sites, or brainstorming. For example, after reading a novel or short story, the class could use tablets to find the author's homepage and/or publisher to ask questions about the story. Such a lesson would teach the students the important skills of navigation, research, and fluency by requiring them to pose questions to people they have never met. A learner should be able to relate a particular knowledge to a wider network of concepts and understand its psychological significance in order to acquire and internalize knowledge (Pratt, 1980).

It is important that professional development activities are relevant and meaningful to the participants. Customizing professional development activities through voluntary participation and focusing on transforming problems through critical evaluation, problem-solving, and content-specific solutions will promote meaningful growth and development in the implementation and use of education technology (Townsley, 2012). Meier (2005) found that situated professional development was successful when it addressed the specific needs of participants and employed the use of content-specific mentors or leaders to help troubleshoot significant issues.

Teachers’ Pedagogical Principles and Technology Integration

When integrating technologies into the learning environment, it is crucial that the tools facilitate sound pedagogy, and contribute positively to the design of an effective learning environment (Mishra & Koehler, 2006). Bruce and Levin (1997) presented a particularly useful taxonomy of learning technologies based on the constructivist pedagogy first proposed by John Dewey more than 70 years ago. This classification system divides learning technologies into those that serve as media for inquiry, communication, construction, or expression. In fact, the idea of using technology to facilitate these four educational goals comports with recent directives from the Partnership for 21st Century Learning, which calls for students to leverage today’s learning technologies to master the four C’s: critical thinking, communication, creativity, and collaboration.

In addition to ensuring that learning technologies support sound pedagogy, it is also important to consider the effect that the integration of technology has on the learning environment itself. Effective technological learning environments are centered on learners, knowledge, and assessment, and promote a sense of community (National Research Council, 2000). Educators should seek to ensure that learning technologies integrated into classrooms in no way interfere with these positive environmental attributes. Instead, learning technologies can, ideally, play a role in fostering them. Effective technology integration should support both sound pedagogy and a healthy learning environment.

Summary

Knowing where to begin can be overwhelming for a teacher who is just beginning to conceptualize the framework for technological tools in the classroom. This chapter provide an overview of internal and external barriers, professional development, and pedagogical principal with technology integration. The idea in this study provides that lack of knowledge and skill remains a primary reason why teachers do not use technology in the classroom (Hew & Brush, 2007). Teachers incorporate more technology into the classroom based on three primary factors: availability, their beliefs, and their readiness.

CHAPTER 3

METHOD

The first chapter provided a brief overview of meta-analysis and why this method is well suited for this study of educational technology. This chapter focuses on the construct of meta-analysis as well as how this method was used to address the research questions for this study, including identification of prior studies and data analyzing procedures.

Overview of Meta-Analysis

The term meta-*analysis*, which means "the analysis of analyses" (Glass, 1976, p. 6), may be used interchangeably with *systematic review, research review*, or *research synthesis*. Meta-analysis, a quantitative method for assessing the current state of research in a field, is widely used principally in the social sciences, including medical interventions, sociology, psychology, and education. The history of meta-analysis begins in 1940, when psychology researchers in the US focused on how to integrate the results produced by their research within a particular area of their field. After this point, other American researchers began to use methods for quantitative synthesis of the results of related but not identical studies.

The roots of meta-analysis as a recognized quantitative method for combining results produced by different studies on a similar topic go back to the 1960s and the studies of Gene Glass and later of other researchers: Larry Hedges, Harris Cooper, John Hunter, Jacob Cohen, Thomas Chalmers, Robert, Douglas, and Bonett. Glass (1976), who is considered the father of modern meta-analysis, described it as "the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings" (p. 10) at the conference of the American Educational Research Association (AERA). Since then, literally hundreds of reviews have been conducted using meta-analytic methodology, and dozens of papers have been presented as researchers in other fields adopted this method, starting with medical researchers, who, as a notable example, applied it to studies on certain heart diseases and verified the effectiveness of the use of aspirin as a preventive measure. As researchers became increasingly aware of the benefits of the approach, its use proliferated across fields, and by the middle of the 1990s, diverse approaches under the name of meta-analysis had become confusing, so Chalmers and Altman (1990) clarified that the practice of meta-analysis was one tool for "the application of strategies that limit bias in the assembly, critical appraisal, and synthesis of all relevant studies on a specific topic. Meta-analysis may be, but is not necessarily, used as part of this process" (p. 3).

As Conn (2014) observed, "meta-analysis methods allow us to systematically review literature by standardizing and statistically combining the findings of similar evaluations, thus increasing statistical power and allowing us to estimate an average effect size" (p. 3). The purpose of meta-analysis is to draw a general conclusion or to synthesize the results from different studies (Borenstein, Hedges, Higgins, & Rothstein, 2011). In its current meaning, meta-analysis is a method that Conn (2014) defined as "a way of statistically aggregating study results that is transparent, replicable, and allows for study-to-study comparability through the standardization of findings" (p. 12). Because this method allows us to statistically synthesize outcomes of similar research studies and aggregate the results of small studies, the findings raise the power of the aggregated outcomes of research and enable us to empirically approximate total effect size, as well as to more effectively assess the effect size variations among studies. This pooling of individual studies supports "generalization" (Orwin, Cooper & Hedges, 1994), the goal of meta-analysis, as a way of transcending the limitations of single studies.

Meta-analytic outcomes, therefore, make possible statistically more powerful effects sizes than those estimates “provided by individual studies considered in isolation” (Borenstein, Hedges, Higgins, & Rothstein, 2011, p. 9). Taveggia (1974) asserted that

> The findings of any single study are meaningless in and of themselves. They may have occurred simply by chance. Therefore, we need to synthesize the results from individual studies to explore generalizations regarding their effectiveness. Furthermore, without such evidence, we do not know the magnitude or pattern of the effects of these interventions on fluency, or for whom they are most effective. It is also unclear which intervention approach is most or least effective in promoting fluency. (p. 9)

Additionally, via its organized techniques and structured approach, meta-analysis allows us to see patterns that we would most likely not perceive with other synthesis techniques. Through its lens it may become clear how much we know about the area, whether there is significant controversy, and where there are gaps in the research.

Since its 1991 introduction in the field of ecology and its evolution as a tool for systematic literature review in the social and medical sciences, meta-analysis has become increasingly popular, and each year the number of studies using this method continues to grow. Despite much criticism by scholars in its early days due to issues stemming from inappropriate procedures, it is now a recognized method with wide application in the social and medical sciences (Cooper, Kuhn, & Hardy, 2010).

A meta-analysis has its own value and does not “enhance the value of the studies included” (Lau, Sigelman, Heldman, & Babbitt 1999, p. 21). As a statistical method for integrating the results of multiple similar independent studies (Huque, 1988), well-structured meta-analysis can claim rigor as a way to more objectively evaluate and synthesize evidence than traditional, and especially qualitative studies, by providing an accurate estimate of treatment effects that may explain the heterogeneity of results among different studies (Egger, Smith, Schneider, & Minder, 1997). However, a poorly structured meta-analysis may create a bias owing to exclusion of relevant studies. Biased and misleading analyses may be averted by adopting a few principles, which are discussed in the following paragraphs. As a type of observational study of evidence, meta-analysis involves the same steps as any other statistical method: identifying the problem to be addressed, collection and analysis of the data, and reporting of the results.

Lipsey and Wilson (2000) pointed out that since the focus is on analyzing effect size, meta-analysis makes it possible for decisions to be made depending on the type and "magnitude of an effect separate from its statistical significance" (p. 15). For evaluating effectiveness, it is important to consider effect sizes and differences among them, which may be small Cohen. Hattie (2009) proposed that "when judging educational outcomes $d = 0.2$ would be considered a small effect, $d = 0.4$ might be considered moderate, and $d = 0.6$ would be considered large" (p. 9). An effect size of *0.4*, according to Hattie, should be considered the "hinge point" for assessing the value of an educational innovation, which might represent a "real-world change [that] could be visualized in students" (p. 9). Hattie (2009) further argued that that any effect size above *0.4* would be considered as having the greatest statistical impact or as occurring in the "zone of desired effects" (p. 9). In this study, effect sizes were calculated and analyzed based on Hattie's proposed categorization of-effect size.

In the present study, the term *meta-analysis* denotes a set of statistical procedures that are used to quantitatively aggregate the outcomes of several key studies to arrive at a set of general results or a summary of these research studies (Arthur, Bennett, & Huffcutt, 2001). According to Arthur, there are 11 steps in the meta-analysis procedure (cited in Crawford, 2011):

1. Topic selection—defining the research domain
2. Specifying the inclusion criteria
3. Searching for and locating relevant studies

4. Selecting the final set of studies
5. Extracting data and coding study characteristics
6. Deciding to keep separate or to aggregate multiple data points (correlations or effect sizes) from the same sample
7. Testing for and detecting outliers
8. Analyzing —calculating mean correlations and variability, and correcting for artifacts
9. Deciding to search for moderators
10. Selecting and testing for potential moderators
11. Interpreting results and making conclusions. (p. 26)

This meta-analysis examines the overall impact of the FATIH Project's provision of tablet and SMART Boards as technological tools in Turkish classrooms have on teachers' attitudes. Several studies have looked at the impact of the FATIH Project on teachers' attitudes. This study narrowed the analysis to studies that were reported from 2010 to 2017. Meta-analysis of relevant research is useful for the FATIH Project at this point as the outcomes can assess present overall effects of the initiative to integrate technology into the public school system examine teacher attitudes and inform further research.

Study Characteristics

The characteristics of the studies included are presented in Table 3, Table 4, and Table 5. Many studies about the FATIH project were published in 2010; however, they were qualitative and students' opinions of the project. A majority of the studies in this meta-analysis were published in 2014. As shown in Table 3, most of the studies (about 27.2 %) in the current study were published in the years 2014 and 2013 is following it with 22.7% (in Table 3), while 18.8% and 9.1% were published in the year 2012 and 2015. The second least productive year was 2015. The most productive years are 2013 - 2014 and 2011 was least active year because many researchers used qualitative research and literature review.

Table 3

Frequency of Publications across Years

Year	Number	Percentage
2010	0	0%
2011	0	0%
2012	4	18.8%
2013	5	22.7%
2014	6	27.2%
2015	2	9.1%
2016	4	18.8%
2017	1	4.5%
Total	22	100%

The majorities of the studies were published in Turkish (55.31%), while the remainder were published in and English (46.68%), as shown in Table 4. However, most of the studies were written in the U.S. Many studies used teacher perspectives, opinions, and views about the FATIH Project. Between 2010 and 2017, there was only one study examining teachers' opinions about the project.

Table 4

Frequency of Languages in which Articles were Written

Language	Number	Percentage
Turkish	11	55.31%
English	10	46.68%

The data were analyzed using Comprehensive Meta-Analysis software. Statistics calculated with this software required only sample size, and effect direction (Borenstein et al., 2011) of all of the data gathered in the application. Effect size was calculated from the data provided in Table 6 for each article.

Table 5

Database Search Process Arranged Chronologically

Database	Keywords	Results
Google Scholar	FATIH Project	117 Results, 7 Unique
ERIC	Teachers ‘Perspective, opinion and view	43 Results, 2 Unique
SSCI JOURNAL	Fatih Project And Teacher's Perspective	60 Results, 6 Unique
Dissertations & Theses: ProQuest	Fatih Project And Teacher's Perspective	7 Results, 1 Unique
UNT Website	Teachers' Perspective, opinion and view	12 Results, 1 Unique
ULAKBIM	Teachers' Perspective, opinion and view	33 Results, 4 Unique
JSTOR	Teachers' Perspective, opinion and view	4 Results, 1 Unique

Procedure

This meta-analysis synthesizes the findings of studies relevant to the FATIH Project published between 2010 and 2017, study approaches used, research subjects, and the researchers' disciplines. A systematic literature search was conducted using different databases including ERIC, Google Scholar, and SSCI Journals. When I had gathered articles from these sources, I read through them, particularly for synthesizing concepts across the studies. For example, one of the synthesizing concepts I used to group the articles was the terminology on which the researchers focused. Then using key words and phrases such as "FATIH Project," "movement for improving," "boosting possibilities through technology," "SMART Board technology," "whiteboard," and "Tablet," I searched for an extended range of studies, using such sources as the Council of Higher Education's National Thesis Center, school indexing solutions, EBSCO, Scientific research Direct, the JSTOR, University of North Texas Willis Library, EBSCO, ERIC, UNT library webpages, Google Scholar, and ULAKBIM (see in Table 5). Also I performed a series of Internet searches that delimited results to the internet sites with Edu expansion to get college journals. After I had grouped the articles by venue of publication, I began looking at specific methods and consistencies among the articles. The common study characteristics and issues I found include using SMART Boards, using interactive whiteboards, using tablet technology, having inadequate provision of in-service training, being unequipped with necessarily skills, and leaking high level leadership and coordination. This thorough search of journals, dissertations, conferences, theses, and reports for the terms yielded approximately 163 articles as seen in Figure 1.

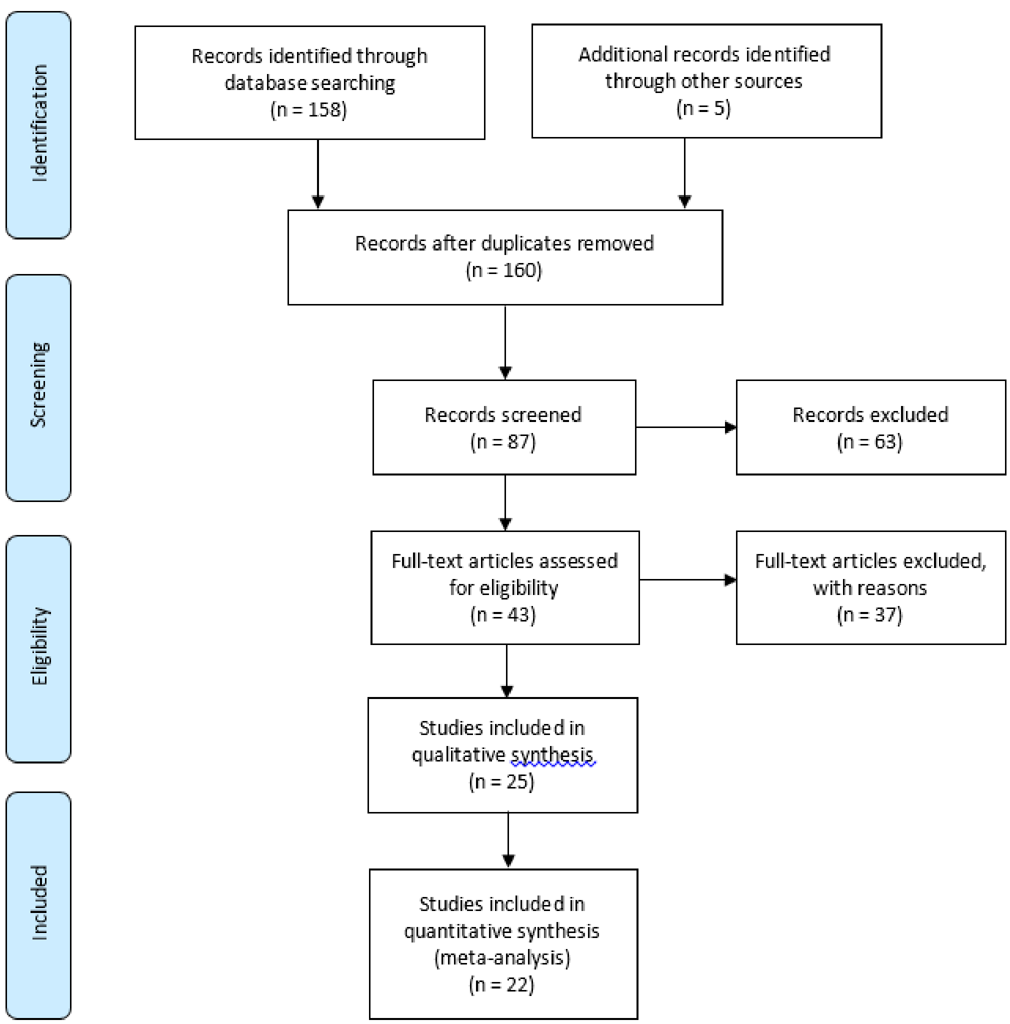

Figure 1. PRISMA flow diagram of inclusion and exclusion of studies.

Twenty-two of the 163 articles were selected based on the terms “FATIH Project” and “FATIH Projesi” in the articles as seen Table 5. Thirteen of the 22 articles were selected based on the terms “SMART Boards” and “interactive whiteboard” in the articles. Nine of the 22 articles were selected based on the term “Teachers’ perspective, view, opinion, ideas about FATIH Project.” The selection of the articles was also impacted by their publication date. The articles selected were published from the years 2010 to 2017. Embarking on an analysis of the articles required a blueprint or framework necessary to establish consistency. Of these, 22 studies (with 41 effect size) were included in this meta-analysis (in Table 6). Below are the inclusion criteria:

- The studies used quantitative research methods
- The studies were published between 2010 and 2017.
- Grey literature (dissertations and theses) was included
- The studies involved teachers’ perspectives on, opinions of, and views of the FATIH Project
- Quantitative data (standard deviation, p values, means etc.)
- Studies must be conducted in Turkey.

Table 6

Details of Included Articles for This Meta-Analysis

Study	Grade Level	Year	Subject	Outcomes	Training	TPACK	Barriers	Device
Akcay et al.	High School	2015	All	Negative	Training	TPACK	External	IWB
Aksu	Middle School	2014	All	Positive	Training	None	External	Tablet
Aktas et al.	Middle School	2014	All	Negative	Training	TPACK	Internal	Both
Akyuz	Middle School	2014	Science	Negative	Training	TPACK	Internal	IWB

(table continues)

Study	Grade Level	Year	Subject	Outcomes	Training	TPACK	Barriers	Device
Anaturk	High School	2014	Science	Negative	Training	TPACK	Internal	IWB
Ay et al.	K-12	2016	All	Negative	Not Training	TPACK	External	Tablet
Aydin et al.	K-12	2016	All	Negative	Training	TPACK	External	IWB
Balta et al.	K-12	2015	All	Positive	Not Training	None	Internal	IWB
Dasdemir	Middle School	2012	Science	Positive	Not Training	None	Internal	Tablet
Goktas et al.	Element ary	2013	All	Negative	Not training	None	External	Both
Han et al.	High School	2016	All	Negative	Not Training	None	External	IWB
Izci	K-12	2016	All	Negative	Training	None	External	Both
Karal	K-12	2013	All	Negative	Not	TPACK	Internal	Both
Kiranli	High School	2016	All	Negative	Not	TPACK	Both	Tablet
Korkmaz	Element ary	2013	All	Negative	Not training	None	Internal	Both
Sozcu	Middle School	2014	All	Negative	Not Training	TPACK	Both	Both
Sozen	High School	2017	All	Positive	Training	TPACK	Both	Both
Tekerek et al.	High School	2012	Science	Positive	Not Training	None	External	Tablet
Temelli et al.	Middle School	2014	All	Positive	Not training	None	Internal	IWB
Turel et al.	K-12	2012	All	Positive	Training	TPACK	External	IWB
Yildiz et al.	Middle	2013	All	Negative	Training	TPACK	External	Both
Yuksel and Alemdar	K-12	2012	All	Negative	Training	TPACK	External	Both

Analysis

In meta-analysis, two models are commonly used for effect size: fixed effects and random effect analysis (Cooper, 2010). The fixed effects analysis supposes that every study has only one true effect, while random effects analysis gives researchers an opportunity to assume that each study estimates a different effect, and meta-analysis should include a distribution of multiple true effects. In this study, the random effects models and meta-regression were applied to take into account the great heterogeneity of the studies in the significance of effect sizes. In this random effects analysis, the true effect sizes varied across the different studies, so in order to estimate an average effect, it was necessary to evaluate the degree of heterogeneity. It would be difficult to compare the variances of distribution of true effect sizes, so the common measure of variance (I^2) was used. The separated study-specific effect sizes were weighted by inverse variance to evaluate the combined effect size.

The software Comprehensive Meta-Analysis (CMA) was used to calculate fixed and random effects. The moderator analysis was proposed for the meta-analysis, as the effect sizes could not come from the same population, which is necessary for random-effects analysis (Cooper, 2010). The fixed-effects calculations were used for the homogeneity statistic Q, because random-effects calculations were made between sample variances leading to the distortion of Q. After conducting a homogeneity testing, random-effects procedures were applied to estimate weighted mean effect sizes, and an analysis was proposed to determine any variances which could be found in the target effect sizes.

The random effects produced different implications for the aggregation of effect sizes and the modeling of the variability among the pooled effects. A random-effects approach allowed generalizing to estimate a broader universe of studies than allowed by a fixed-effects approach. In random-effects models, the application of the effect sizes with hierarchical linear modeling approach to meta-analysis has been proposed (Bryk & Raudenbush, 1992). In both fixed effect and random effects models, the value of an average effect was a variability index distributed as a chi-square. The chi-square distribution had *k*-1 degrees of freedom, where *k* is equal to the number of data sets. A significant homogeneity statistic will show that the effect sizes and the weighted-average effect size will not match with each other, so a study with a smaller sample has greater impact on the project than a study with a large number of participants. Similarly, the estimation of *Q* allows detection of unaccounted for variance in a regression equation, while Q_E (error) helps clarify the chi-square distribution with *k*-1 degrees of freedom, where *k* represents a certain number of predictors (Hedges & Vevea, 1998). In case *Q* is significant, the model will have serious unaccounted variance. Both types of models will have similar tests of homogeneity. Each analysis helps explain the tendencies in the issues being investigated. Thus, meta-analysis is a statistical procedure which combines the data from different studies and identifies the common effect of the studies (Cooper, 2010). A subgroup analysis was necessary to study the relationship between dependent and independent variables, that is, between barriers to the technology use in classroom and other variables (teachers' experience, education, area of teaching and other factors). The random effects model helped account for the heterogeneity of the samples.

Publication Bias

Publication bias analysis was used to examine whether some studies had been neglected by the search systems, (Becker, Rothstein, Sutton, & Borenstein, 2005). Publication bias analysis allows inclusion of all studies having a significant impact on the findings of the research. It consists of four complementary statistical procedures including visual examination of a funnel plot, classic fail-safe analysis, a fail-safe procedure, and a trim and fill procedure. Visual examination of a funnel plot enables researchers to study whether the distribution of weighted effect sizes exhibits symmetry. In addition, it also provides an opportunity to determine the positions of potentially missing studies. Classic fail-safe analysis, proposed by Rosenthal (1979), allows estimation of the number of null-effect studies and analysis of the probability of the average effect for α equal to *.5*. Orwin's (1983) fail-safe procedure determines how many null-effect studies are required to bring average effect size to the trivial value equal to *.10*. A trim and fill procedure helps estimate the number of missing effect sizes needed to gain symmetry between effect sizes above and below the mean (Duval & Tweedie, 2004). A trim and fill procedure allows for study of the publication bias by removing small sample sizes that result in funnel plot asymmetry.

Outliers can change the average weighted effect size significantly. In addition, outliers also impact surrounding variability. The distortion is significant for the fixed effects model due to the necessity of conducting the weighting procedure mentioned above (Viechtbauer & Cheung, 2010). The random-effects model is more reliable as it is free from the distortion. It is also necessary to pay attention to studies with large sample sizes and check whether they have significant influence on the meta-analysis findings.

This meta-analysis included 41 effect sizes from 22 selected studies. Funnel plots were used to identifying publication bias (Bartolucci & Hillegass, 2010; Egger et al. 1997). Larger sample sizes are represented in the upper section of the funnel plot, and smaller sample sizes in the lower section (Rothstein, 2008). The funnel plot for the research question (k =22) is presented in Figure 2. It depicts a fairly balanced distribution of effect sizes both inside and outside of the standard errors of the funnel. In this study, most of the effect sizes showed symmetry in a funnel plot.

As can be seen in Figure 2, the 22 studies included in this meta-analysis are scattered symmetrically on both sides of the effect size vertical axis in the upper and middle parts and are located very close to the optimized effect size (Borenstein et al., 2011). Duval and Tweedie's Trim and Fill Procedure found that in the random-effects models seven studies were inputted to the negative side of the distribution to achieve symmetry. Overall, these results suggest that there is no evidence of publication bias in this particular dataset.

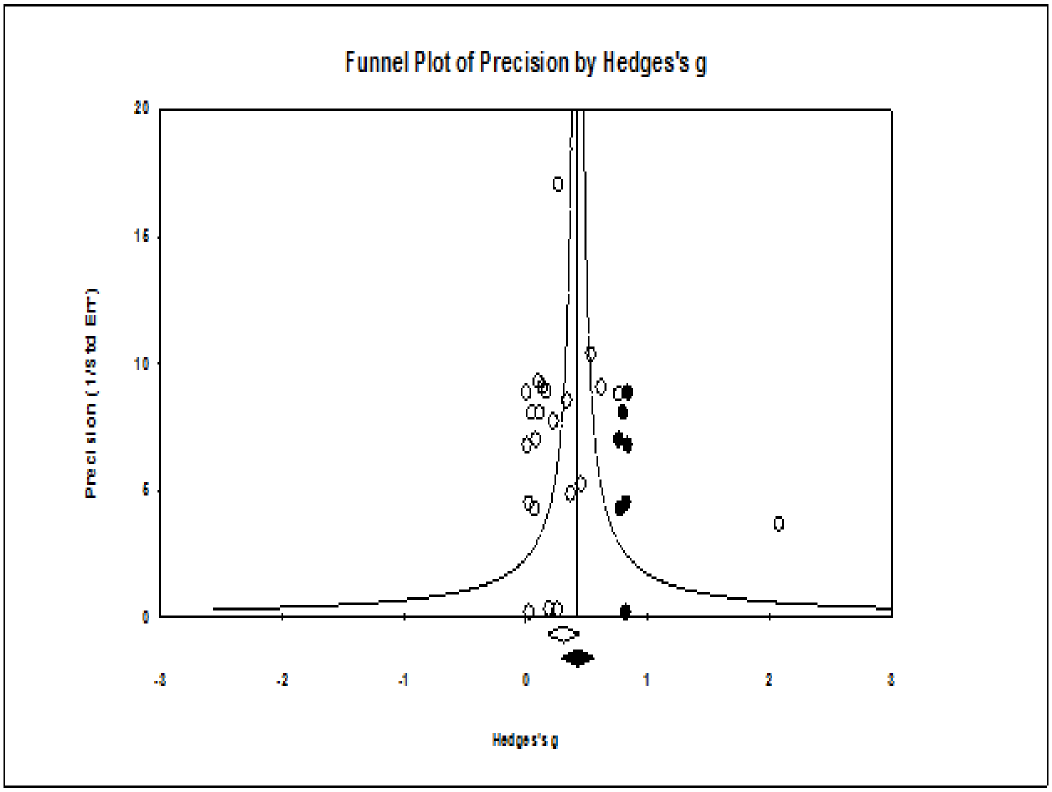

Figure 2. Funnel plot for studies.

Summary

This study examines the overall effects of the FATIH Project's provision of tablets and IWB in classrooms have on teachers' attitudes. The study only synthesizes findings from researches that examined FATIH project between 2010 and also 2017. These studies have been classified and analyzed according to journal types, count of articles in SSCI journals, study approaches, research subjects, and researchers' disciplines. Research studies on FATIH project have been gathered extensive databases such as EBSCO, ERIC, JSTOR and ULAKBIM. After eliminating studies that did not focus on FATIH project, meta-analysis approach applied to 20 journal write-ups, one thesis, and one dissertation, released before December 2017. The study reveals significan relationship between teachers' attitudes and technology in classroom environment. Next chapter will address essential findings from this study.\

CHAPTER 4

RESULTS

Descriptive statistics showed that half of the 22 studies were reported in Turkish and half in English. With regard to devices studied, eight studies reported on uses of the interactive Whiteboard and five on uses of the tablet, in nine studies, researchers reported the device type as both tablets and IWB (interactive whiteboard) technology. More than half of the identified studies were in all school subjects, whereas the others focused specifically on mathematics and science. Most interventions occurred at the middle school and high school levels while a few were conducted at the elementary level. Researchers most commonly used a quasi-experimental study design. Half of the studies emphasized external barriers such as training, and the rest focused on internal barriers such as teachers' attitudes toward and confidence using technology. Most of the studies focused on Technological Pedagogical and Content Knowledge. (TPACK) and called for teacher educators to implement needed training for teachers and prospective teachers.

Overall Results

This section presents descriptive statistics followed by publication bias among the selected studies, optimized findings for effect sizes with a forest plot, optimized findings based on a random effects model and the results of homogeneity testing, and optimized findings based on a random effects model and the results of subgroup analysis.

As shown previously in Table 6, the 22 studies on the effectiveness of Turkey's Technology integration initiative included in the meta-analysis. An examination of studies that investigated teachers' attitudes toward the FATIH Project by year, indicates that 2014 stands out as the year with the highest number of studies, constituting 27.2% of the total. The highest percentage (36%) of all studies that investigated the FATIH Project focused on all K-12 levels, while those focusing on either middle school or high school each comprised about 32% of the studies as shown in Table 7. It was also found that most studies (64%) focused on all subjects and 36% on science. Of particular significance, Table 7 shows that most (59%) of the studies reported negative perceptions of the FATIH Project.

Table 7

Findings of Effect Size Analysis for the Effects of Turkey's Technology Integration

Moderator		*k*	Q_B	Effect Size	95% Confidence Interval
Grade Level	K-12	8	13.701*	0.50	[0.20,0.80]
	MiddleSch	7		0.28	[0.04,0.52]
	High Sch.	7		0.16	[0.07,0.26]
Perception Outcomes	Negative	13	13.735*	0.20	[0.13,0.27]
	Positive	9		0.41	[0.32,0.49]
Subject	All	14	0.034	0.29	[0.23,0.35]
	Science	8		0.28	[0.16,0.39]
Training	Training (TPACK)	9	1.150	0.31	[0.24,0.39]
	Not Training	13		0.30	[0.12,0.52]
Barriers	Internal	8	19.829*	0.22	[0.14,0.31]
	External	11		0.41	[0.33,0.49]
	Both	3		0.09	[0.05,0.22]
TPACK	TPACK	14	10.410*	0.34	[0.28,0.41]
	None	8		0.15	[0.05,0.25]
Devices	IWB	9	5.547*	0.27	[0.20,0.34]
	Tablet	8		0.40	[0.29,0.52]
	Both	5		0.21	[0.09,0.33]

Note: * $p \leq .05$

A total of 41 effect sizes were calculated from the 22 studies, of which 20 were research articles, one a thesis, and one a dissertation. A total of 5,266 participants were accounted for in the studies included in the meta-analysis. According to the random effects model, the homogenous level of the studies included in the research is $Q = 104.831$ and $p = 0.001$. Because the P value is smaller than the *.05* significance level, it could be claimed that there are statistically significant differences among variables. Therefore, since the effect size of the study is considered as heterogonous, the analysis was carried out randomly according to the Random Effects Model (REM), as a result of which the average effect size was found to be *.307* with a standard error of *.068.* With a reliability level of 95%, the lowest effect size is *.009,* and the highest is *.500*.

The positive result of the average effect size supports the conclusion that teachers have shown negative attitudes toward using the FATIH Project's technological devices. However, in this regard, publication bias needs to be taken into consideration. In order to bring down the effect size *.307*, which was obtained using Orwin's meta-analysis method, to 0, it is proposed that 5,631 studies whose effect size is 0 are required. The large size of this number shows that publication bias is low. The analysis of subgroups shows that there are significant differences in Grade Level ($Q_B=13.701$, $p \leq .05$), perception outcomes ($Q_B=13.735$, $p \leq .05$), barriers ($Q_B=19.829$, $p \leq .05$), TPACK ($Q_B=10.410$, $p \leq .05$) and devices ($Q_B=5.547$, $p \leq .05$). However, there are no significant difference in subject ($Q_B=0.034$, $p \geq .05$) and training ($Q_B= 1.150$, $p \geq .05$) in the analysis of subgroups.

Figure 3 presents effect sizes regarding the effects of Turkey's technology integration initiative on teachers' attitudes, with the standard error for effect sizes higher than the low effect size value and lower and upper limits based on a 95% confidence interval. According to Figure

3, the standardized mean differences (d) among the 22 studies based on teachers' attitudes toward Turkey's technology integration initiative fall between .09 - .55 in favor of the FATIH Project. The statistical significance difference was found to be ($p \leq .05$) in all 22 studies. The confidence interval for two studies was found to be between .20 and .98. Figure 3 shows that the majority of the results in studies included data about Barriers, TPACK, Training, Outcomes and were not in favor of FATIH Project.

Study name	Outcome	Statistics for each study						
		Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Akcay et al., 2015	Blank	0.762	0.114	0.013	0.539	0.984	6.709	0.000
Aksu (2014)	Blank	0.047	0.124	0.015	-0.195	0.289	0.380	0.704
Aktas et al., 2014	1.000	0.264	0.059	0.003	0.150	0.379	4.515	0.000
Akyuz et al. 2014	1.000	0.369	0.204	0.042	-0.031	0.770	1.808	0.071
Anaturk (2014)	Blank	0.071	0.233	0.054	-0.386	0.528	0.304	0.761
Ay et al., 2016	1.000	0.337	0.117	0.014	0.108	0.566	2.881	0.004
Aydin et al., 2016	1.000	0.260	2.951	8.710	-5.524	6.044	0.088	0.930
Balta et al., 2015	1.000	0.189	2.834	8.030	-5.365	5.743	0.067	0.947
Dasdemir, et al., 2012	1.000	0.226	0.129	0.017	-0.027	0.479	1.748	0.080
Goktas et al., 2013	Blank	0.534	0.096	0.009	0.345	0.723	5.546	0.000
Han et al., 2016	Blank	2.081	0.269	0.073	1.553	2.609	7.727	0.000
Izci , 2016	1.000	0.010	0.147	0.022	-0.278	0.297	0.065	0.948
Karal et al. 2013	1.000	0.026	4.580	20.980	-8.951	9.003	0.006	0.995
Kiranli et al., 2016	1.000	0.080	0.143	0.020	-0.199	0.360	0.563	0.574
Korkmaz, 2013	1.000	0.139	0.110	0.012	-0.077	0.354	1.260	0.208
Sozcu 2014	1.000	0.004	0.113	0.013	-0.217	0.225	0.038	0.970
Sozen et al., 2017	Blank	0.171	0.112	0.013	-0.048	0.391	1.528	0.126
Tekerek et all, 2012	1.000	0.452	0.190	0.036	0.080	0.825	2.380	0.017
Temelli et al. , 2014	1.000	0.113	0.124	0.015	-0.130	0.356	0.914	0.361
Turel et al. , 2012	Blank	0.102	0.108	0.012	-0.109	0.313	0.950	0.342
Yildiz et al. 2013	Blank	0.025	0.221	0.049	-0.409	0.459	0.114	0.909
Yuksel and Alemdar (2012)	Blank	0.620	0.110	0.012	0.404	0.836	5.631	0.000
		0.284	0.027	0.001	0.231	0.338	10.452	0.000

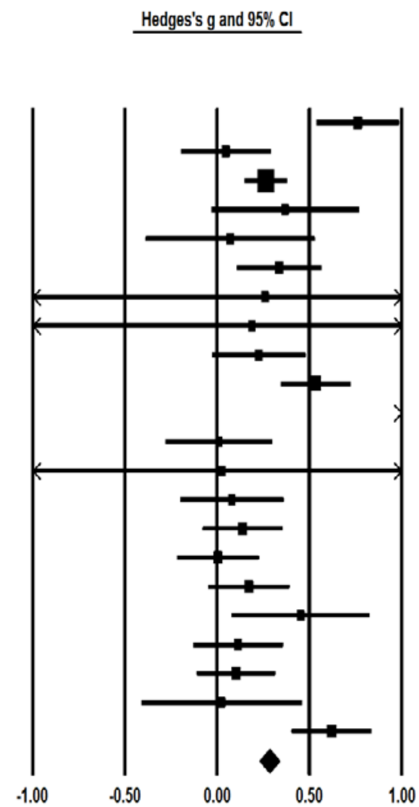

Figure 3. Effect sizes forest plot.

A heterogeneity test (e.g., Cochran's Q statistics) determines differences in individual study effects to test the significance of d. A significant Q test suggests that the outcomes are heterogeneous. To support the heterogeneity test results, the I^2 statistic, which represents the percentage of variance across studies, was calculated. The heterogeneity test yielded a statistically significant result, *Q (41)* = (*104.891*, p < 0.001). Also, the I^2 value was calculated as *79.968*. The value of the Q was statistically significant because the effect sizes were not homogeneous.

Table 8 shows that, based on a random effects model, data in the 22 studies that were included in meta-analysis had a *.068* standard error, the upper and lower limits for a 95% confidence interval were *.231* and 0.338 respectively, and effect size value was d=0.307. Although the effect size value wasn't higher than *.80*, but it still was calculated to have a high level effect based on Cohen's classification (Cohen, 1992). It was observed that the effects of the FATIH Project on teachers' attitudes were higher than those of the FATIH Project technology initiative. The result of a z-test for statistical significance, *Z=4.503*, indicated that the obtained result was statistically significance with p=0.001.

Table 8

Summary Statistics for Mean Effect Size, Heterogeneity Analysis, and Publication Bias

Model	K	ES	CI	SE	Z-value	P-value	Q-value	I-Squared
Random	22	0.307	0.231-0.338	0.068	4.503	0.001	104.831	79.968

Research Question 1

What is the overall effect of the FATIH Project's technology integration initiative on teachers' attitudes?

Mean effect sizes were calculated for the categorical moderators and found to be statistically significant. The effect of technology integration on teachers' attitudes shows information on each sample, effect size, and lower and upper limits of the 95% confidence interval. Based on the tests for homogeneity, a heterogeneity test (i.e., Cochran's *Q* statistics) was conducted to determine whether the studies in the population all have the same effect.. A significant Q test suggests that the outcomes are heterogeneous. To support the heterogeneity test results, I statistics, which represent the percentage of the heterogeneity and in which higher values of Iº represent higher levels of heterogeneity, were calculated. The heterogeneity test yielded a significant result, *Q (41) = (104.891*, $p < 0.01$). Also, the I^2 value was calculated and found to be *79.968*. Because the value of Q was statistically significant, this study showed heterogeneity.

The results regarding effect size and Q value also show that, based on a random effects model, analysis of the data in the 22 studies that were included in the meta-analysis yielded a *.068* standard error, upper and lower limits for the 95% confidence interval of *.231* and *.338* respectively, and an effect size with the value of *d=.307.* Although the effect size value wasn't higher than *.80*, but it was considered a high level effect based on Cohen's classification (Cohen, 1992). It was observed that effects of the FATIH Project on teachers' attitudes were higher than those of the FATIH Project technology initiative. The results indicated a statistically significant relationship between teachers' attitudes and Fatih Project, *k (21) = .307, p=.001, CI= .231, .338*. Even if results suggest significant relationship between teacher attitudes and technology in classroom environment, it also reveals that technology in classroom negatively impact teacher attitudes in classroom due to insufficient or lack of training or TPACK. These results illustrated that effects of technology in classroom environment on teacher is negative. However, it suggests that the more teacher believe that technology impact on classroom negatively. The project has had negative impact on teacher's attitudes. A z-test yielded *Z=4.503*, which was statistically significant with $p=0.001$. Table 7 provides the results of the effect sizes.

To assess the stability of the summary effect size, the classic fail-safe *N* was calculated. According to Rosenthal (1979), the Fail Safe *N* estimates the number of studies required to yield a non-statistically significant mean effect size at the $p<0.05$ level. Persaud (1996) states that this statistic "indicates the stability of meta-analytic results when additional findings are included, no matter the source" (p. 125). For the present study the value of the Fail Safe *N* was 108, which suggests that it would be necessary to retrieve an additional 108 studies to observe a statistically non-significant mean effect size at the $p \leq 0.05$ level. The visual results of a trim-and-fill procedure to examine the representation of effect sizes in the sample. The results of the trim-and-fill resulted in the imputation of 12 additional studies and the mean effect size was adjusted accordingly. After the trim-and-fill procedure was completed, the overall mean estimated odds ratio was 000, p <.005. This value was statistically significant and large based on effect size benchmarks.

Research Question 2

Which study-related factors are statistically significant moderators of the effects of technology integration on teachers' attitudes?

The random-effects model was run to determine the mean effect sizes for each level of the different moderators, including perception outcomes, subject, training, barriers, grade level, TPACK, and devices. Figure 4 provides the model parameters with the moderators included. When the 95% confidence interval does not include zero, the effect of the moderator is significantly different. The Q_B values were included for the homogeneity analysis of the effect sizes for each moderator. A statistically significant Q_B value indicates that the moderator influences variations in effect sizes. I focused on seven moderators: perception outcomes, subject, training, barriers, grade level, TPACK, and devices as indicated in Figure 4. Results of the subgroup analysis suggested that grade level, perception outcomes, barriers, TPACK, and devices were significant predictors of the effect size. With regard the analysis of subject and training, 22 effects were disaggregated effects of technology integration on teachers' attitudes.

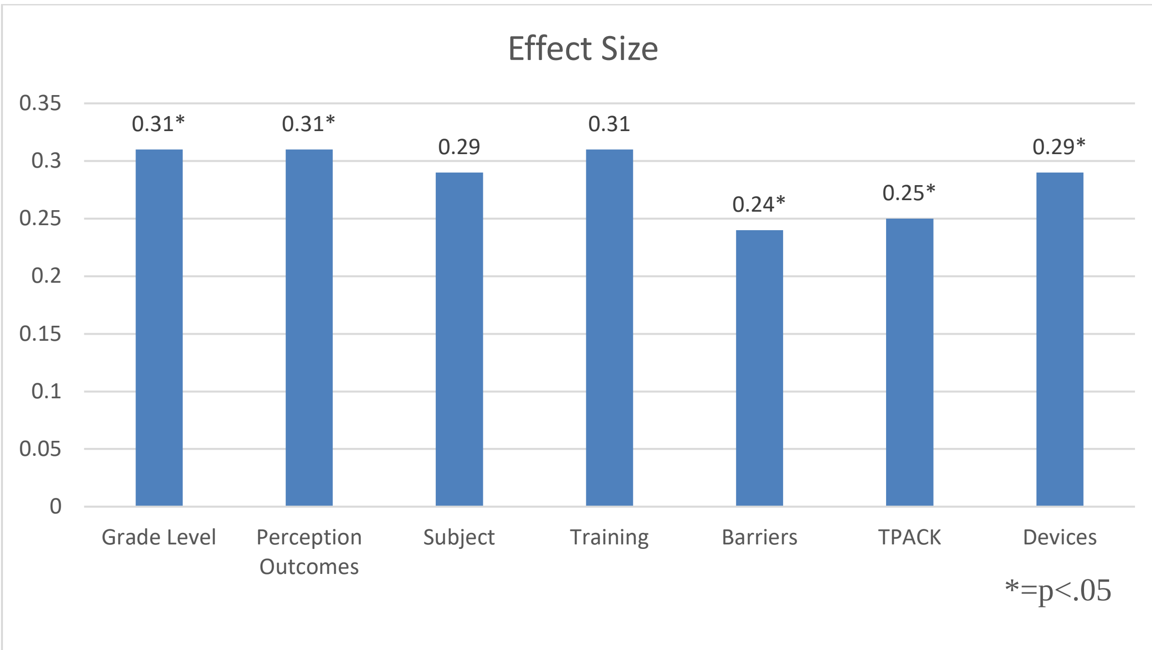

Figure 4. Meta-analysis results for average weighted effect.

Grade Level

To determine the weighted mean effect size between seven moderators and technology integration on teachers' attitudes, researcher employed same meta-analytic procedure previously described. Each moderator was analyzed for the subset of studies the effect sizes for grade level (K-12, middle school, and high school) were all statistically significantly greater than zero. The result of the test for heterogeneity of moderator was therefore significant, grade level $QB = 13.701$, $p < .05$. Also, the overall effect size was *.313*, with a confidence interval of [*.07, .80*], which indicated a moderately significant effect in the model. The average effect between Grade level and technology integration initiative on teachers' attitudes was statistically significant. K-

12 has highest effect size in grade lever with 0.50 and lowest effect size was 0.16 in grade level. Among grade levels, the K-12 level had more effect on teachers' attitudes than middle school and high school. The results indicated that the grade level with the greatest effect was the K-12 level. The level with the lowest effect size was the high school level. The middle school also had a small effect size. An explanation for the lower effect sizes for middle school and high school is that the project first started at the elementary school level.

Perception Outcomes

The average effect between perception outcomes and technology integration initiative on teachers' attitudes was statistically significant, mean effect size 0.31, p= .001, CI= .13, .39, k=21. The Q statistic test was statistically significant, *Q B= 13.735, p= .001.* Among perception outcomes, positive outcome had more effect than negative outcomes.

Subject

The average effect between subject and technology integration initiative on teachers' attitudes was not statistically significant. The results indicated that there was not a statistically significant between subject and technology integration initiative on teachers' attitudes , *k(21)= .29, p=.704, ,CI= .231,.338*. In this case, the Q statistic was not significant, $Q_{B\,.}$034, indicating the effect sizes were homogeneous.

Training

The average effect between training and technology integration initiative on teachers' attitudes was not statistically significant. The results indicated that there was not a statistically significant between training and technology integration initiative on teachers' attitudes, *k (21)=*

.31, p>.05, ,CI= .16,.39. In this case, the Q statistic was not significant, $Q_{B\ 1.150}$, indicating the effect sizes were homogeneous.

Barriers

There was a significant for barriers. The test for non-homogeneity for barriers (Q_B= *19.829, p<.05)* showed that there was a significant relationship among the mean effect sizes of the barriers. The results indicated that the barriers with the greatest effect was external barriers. The level with the lowest effect size was the both barriers. The internal barrier also had a small effect size. Among the barriers, external barriers had more effect than internal barriers.

TPACK

The average effect between TPACK and technology integration initiative on teachers' attitudes was a statistically significant. The results indicated that there was a statistically significant between TPACK and technology integration initiative on teachers' attitudes, *k (21)= .25, p<.05, ,CI= .05,.41*. In this case, the Q statistic was significant, Q_B 10.410, indicating the effect sizes were heterogeneous.

Devices

There was a significant for devices. The average effect between devices and technology integration initiative on teachers' attitudes was a statistically significant. The emean effect size was *.29*. The test for non-homogeneity for barriers (Q_B= *5.547, p<.05)* showed that there was a significant relationship among the mean effect sizes of the devices. The results indicated that the devices with the greatest effect was tablet. Among the devices, tablet had more effect than IWB.

Effect size was based on the Q_B statistic, grade level, perception outcomes, barriers, TPACK, and devices were statistically significant moderators. However, subject and training of moderator were not statistically significant. Among devices, Tablet had more effect on teachers' attitudes than IWB. Also, determining significant differences among effect sizes of subject areas was not part of the study. There was no difference between science and other subjects. Two subjects had similar effect sizes. The Q_B value was .034, P> .05. The project revealed negative and large effect sizes regarding teacher attitudes. The device with the greatest effect was Tablet, with the largest effect size at the elementary school level. The present meta-analysis showed significant differences in the effects of different barriers.

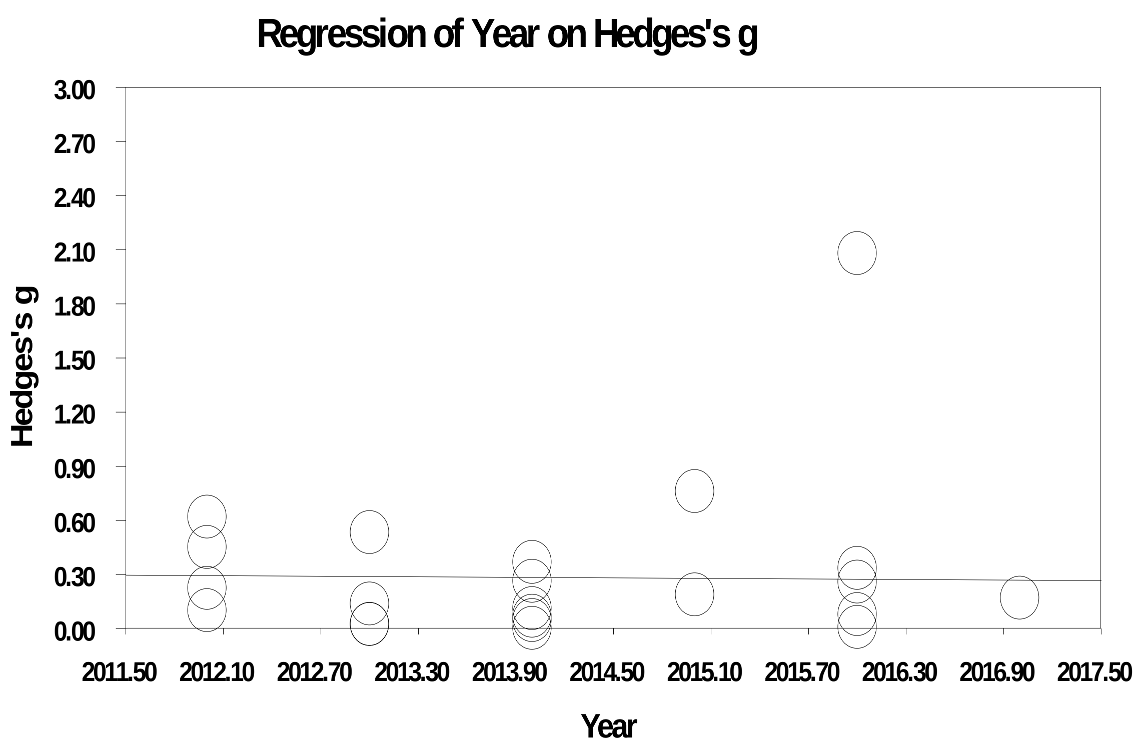

Figure 5. Regression of year on Hedge's g.

Research Question 3

Has there been change in teachers' attitudes over time?

This study shows that there was no change over time in teachers' attitudes toward Turkey's technology integration initiative project. One goal of the program was to provide teachers with professional development opportunities that would enrich the quality of their classroom instruction. However, the project hadn't provided training programs for teachers.

The result of the data analysis suggest that most teachers had negative attitudes toward the project, which could be interpreted as discouraging. The reason for teachers' negative attitudes, as explained in several papers (Akcay et al., 2015 ; Aksu, 2014: Akyuz, Pektas, Kurnaz & Memis,2014; Anaturk, 2014; Balta and Duran, 2015; Han, 2016; Karal et al., 2013; Korkmaz et al., 2013; Sozen, 2017; Temelli, 2014; Yildiz, 2013; Yuksel, 2012), was external barriers such as unmet needs for training and technical information. Absence of effective training was one of the main causes of teachers' negative attitudes toward the project. Teachers' attitudes toward technology integration in schools over time was investigated with the construction of a Hedge g regression of year graph, which compared teacher attitudes over time between 2010-2017, during which there were no significant changes in teachers' attitudes. As shown in Figure 5, the results for 2017 were very similar to those for 2010.

Limitations

This study, designed as a meta-analysis, entailed two limitations. The first limitation is that, because the studies selected to be reviewed were published between 2010 and 2017 with the 2014 as the year of highest publication, further advances in technology integration that ensued since that period and had not yet been reported were excluded. Moreover, the range of years selected for this meta-analysis could have directed the main focus of the study onto the barriers teachers encountered at certain stages of technology integration in schools.

The second limitation is related to the criteria set for the perceived effectiveness of technology integration across the reviewed studies. The studies reviewed mostly considered students' learning as the measure of the effectiveness of technology integration in the classrooms (Moersche, 1998). For instance, according to Ertmer (2005), the effectiveness of technology integration could only be measured by the levels of students' achievements and progress. However, all in all, student learning is difficult to measure. The actual effect of technology on students' learning capacities could be overly subjective in this study because it does not include the achievements of the students as reflected on test scores (Moersch, 1998).

Summary

In this study meta-analysis conducted utilizing random effect model to determine the effect of technology in classroom environment on teachers' attitude. With analysis of 22 studies, this research finds that the effect size of Turkey's technology integration initiative in teachers' attitudes is moderate. The next chapter will provide discussion on findings recommendation for field and practice, and the overall conclusion

CHAPTER 5

DISCUSSION

The purpose of this research was to analyze teachers' attitudes toward technology integration in Turkey based on relevant research literature. The meta-analysis of the 22 selected studies revealed that technology integration impacted teachers' attitudes, focusing mainly on the relation between the attitudes of teachers and the level of technology integration achieved in their classrooms. The articles were selected to produce findings that might reveal probable linkages between technology integration in the classroom and the reported barriers that hinder such integration.

Hence, this study had a threefold aim. First, it was designed to obtain reliable data on technology integration in schools between 2010 and 2017. The second, by using evidence-based research reported in the selected studies, it aimed to discern effects that were statistically significant. Finally, this study sought to synthesize the findings of all the reviewed studies to reach main conclusions. In this framework, the overall purpose of this study was to shed light on the constraining factors inhibiting the achievement of widespread acceptance of the integration of innovative technologies in schools across Turkey. It was also hoped that the meta-analysis would open new avenues for future studies. In the first below sections that follow, the research questions guiding this study are addressed, the chapter continues with a discussion of findings.

Research Question 1: Overall Effect

What is the overall effect of the FATIH Project's technology integration initiative on teachers' attitudes?

The overall effect of the FATIH Project on teachers' attitudes was positive, however, teachers' attitudes were negative overall. Despite, the negative attitudes of teachers towards the project, there were notable positive classroom effects. Sahin, Akturk, and Celik (2013) described a FATIH Project experience designed for school teachers involving tablets, interactive whiteboard, content-specific instruction, and practical applications. Participants were involved primarily in technological learning modules but also attended face-to-face instructional sessions at the beginning and near the middle of the course. The goal of the program was to provide teachers with professional development opportunities that would enrich the quality of their classroom instruction, specifically in math and science. These researchers suggested that being provided this instruction and allowed the opportunity to develop units for their own courses of instruction increased teachers' interest in these classes and enrollment in further school-based programs as well as their awareness of the role of technology in their careers. The researchers also reported that inspiring and motivating learners early in the program was essential to its success. This case demonstrates the importance of effective pedagogy in designing collaborative inquiry-based professional development for in-service teachers. When appropriate pedagogy is in place, technology enhanced instruction can be successful. This knowledge enables teachers to make decisions about the effective and appropriate use of technology.Tpack and Trainingallow teachers the opportunity to interact over longer periods of time, build confidence, practice implementing technology enhanced curriculum, and participate in collaborative learning activities. The purpose of this study was to demonstrate the effects of Turkey's technology integration initiative on teachers' attitudes.

Research Question 2: Significant Moderators

Which study-related factors are statistically significant moderators of the effects of technology integration on teachers' attitudes?

Grade level, participant outcome, barriers, TPACK and devices were all statistically significant moderators of the effects of technology integration on teachers' attitudes.

Grade Level

The effects of the project varied across grade level. The largest effect sizes were observed in the K-12 category, followed by middle school, and then high school. Grade level teachers have different student expectations that must be considered, when interpreting the results of this study.

Perception Outcomes

The largest effect sizes were observed for negative teacher perceptions of the Fatih project. This is consistent with the overall negative teacher attitudes observed in the study.

Barriers

Internal and external barriers were statistically significant moderators of teachers' attitudes. These results are consistent with previous research on technology integration. External barriers had a substantially larger mean effect size compared to internal barriers.

On the one hand, lack of pedagogical and general technology skills training hindered teachers' successful use of the available educational technologies in their classrooms. Poor accessibility of ICT resources may have negatively impacted the effectiveness of teachers' training and reduced their opportunities to develop technological and pedagogical skills. Moreover, the availability of technological resources at school will not benefit the introduction of technology in education if teachers do not have access to technology resources at home. One problem is that teachers need to engage in self-training in the use of technological resources in order to manage time and mediate learning and teaching successfully during lessons. In addition, providing technical assistance for teachers using technology while they are teaching will make it easier for them to operate the technological tools and reduce their resistance to change.

Providing ready technical support at school will help teachers avoid delays during lessons and learn how to work with the up-to-date equipment quickly. Technical support together with access to technology resources will help ensure effective technology integration in education. In addition, in order to use technology in teaching effectively, teachers need training to improve their competencies. However, lack of time, poor or no training, and lack of technical support present serious obstacles to the development and improvement of teachers' competencies. Effective training is essential for teachers to overcome barriers to introducing technology into their lessons and using technological devices effectively.

Training can help integrate technologies into the teaching process effectively, overcome resistance to change, and increase the self-confidence of teachers. Besides the school training of proper professional and computer skills, teachers should also be able to improve their competence with self-training by accomplishing tasks proposed in guides, CDs, and DVDs. Teachers with poor technological knowledge and skills should be provided with more time and additional help in order to overcome barriers to the use of technology in their lessons. Having professional technical support always available will help ensure that teachers can integrate technology effectively in their classrooms and overcome teacher-level barriers as proper support increases their confidence.

TPACK

Although training was not a statistically significant moderator, the related utilization of

TPACK was a statistically significant moderator. The TPACK framework is consistently used to guide professional development and teacher training, thus this is a notable result.

Researchers have directly or indirectly addressed the issue of TPACK or technological, pedagogical and content knowledge (Korkmaz et al., 2013; Kiranli and Yildirim , 2013; Temelli, 2014). There is no doubt that teachers must not only carefully select content and determine how it will be presented, but also pay careful attention to the selection of technology resources. The consensus is that TPACK is required for effective implementation and integration of technology (Ferdig, 2006; Keengwe et al., 2008; McGrail, 2007; Mishra & Koehler, 2006). Without the careful selection of technologies in conjunction with a consideration of how those technologies might help students achieve the desired learning outcomes, technology becomes a source of meaningless tasks. Selwyn (2007) encouraged a more expansive and empowered use of technology to avoid the souring of administrators', instructors', and students' attitudes toward technology-enhanced instruction. What has become very clear in this investigation is the need for educators to carefully choose their own tools, technologies, and pedagogies if they are to successfully incorporate technology-based information and skills into their repertoire of traditional pedagogical and content knowledge (Verkroost, Meijerink, Lintsen, & Veen, 2008; Vaughan, 2007).

Devices

Technology integration was a foundational element of the FATIH Project. Thus, it is understandable that devices were a statistically significant moderator of study results. Particularly, tablets, which had the largest observed effect sizes.

Research Question 3: Change in Teachers' Attitudes

Has there been change in teachers' attitudes over time?

Gerard et al. (2011) referred to case studies involving the innovative use of technology that illuminate many effective possibilities for designing technology-integrated learning experiences. Jimoyiannis (2010), for example, found that technology-enhanced learning becomes successful when it is undertaken as a collaborative enterprise with a focus on relevant experiences for teachers, including inquiry-based learning and problem-based learning activities. One effective way to create a collaborative environment for learning new technologies is to form learning communities consisting of practitioners dedicated to cooperation and ongoing evaluation of the successes and failures of planned learning experiences (DuFour, 2004). Such communities can be small groups organized by grade level or content area facilitated by technology leaders, which contribute to the creation of shared learning spaces and encourage partnerships, collaboration, and the co-development of instructional materials (DuFour, 2004; Kopcha, 2012; Townsley, 2012).

In order to effect change in school culture, it is necessary to look beyond prescribed remedies and find meaningful solutions that work within shifting contexts. Making changes to teaching and learning practices across an entire school necessitates not only altering behaviors, but in many cases shifting teachers' core beliefs regarding students and learning; this undertaking requires time, support, and collaboration (Loucks-Horsley, & Matsumoto , 1999). Johnson and Marx (2009) suggest a model for transformative professional development for teachers, emphasizing the importance of building connections and fortifying educators' relationships with their students, as well as with colleagues and administrators. They consider these relationships critical to the success of their professional development model. Their finding is also supported by Loucks-Horsley et al.'s (1999) research, which concludes that professional development should consist of multiple opportunities for teachers to collaborate, positive examples of technology applications, and practice in the implementation of strategies, and time for reflection.

Conclusion

Designed as a meta-analysis, this study reviewed 22 previous studies published between 2010 and 2017 to obtain insights into the perceptions of teachers regarding technology integration in their classrooms and to evaluate constraining variables that hinder such integration. Even though the scholars of previous and related research stressed teachers' perceptions as the main factor that hinders technology integration in the classrooms, the researcher found it necessary to take other inhibitors into account as well. In other words, the current study reviewed the related literature that mainly focused on the relation between the perceptions of teachers and their effective technology integration in the classrooms. However, the authors of the literature also paid attention to other barriers that might impact the effective integration of technology in schools. Therefore, I endeavored to define an effect size index to identify other barriers that impede technology integration in the classrooms.

With respect to the effect size index this study measured, the perceptions of teachers were observed to have some positive effects on technology integration in their classrooms. In large measure, the level at which technology was incorporated in the classroom was strongly associated with how the teacher perceived technology. It followed from this observation that teachers' perceptions were crucial for the effective use of technological tools in the classrooms.

In alignment with the previous researchers' findings, it is fair to claim that improving teachers' perceptions is essential to the successful integration of technology in classrooms.

The reviewed studies measuring the effectiveness of technology integration in classrooms with respect to students' learning achievement made it clear that few teachers in K-12 schools incorporated technology in their curricula. Consequently, such a lack of technology integration in the classrooms has decreased students' achievement. Teachers' levels of self-efficacy shaped their perceptions of technology integration in the classrooms. Indeed, this meta-analysis also revealed that teachers are more inclined to introduce technology during instruction when they have an appropriate level of preparation and proper knowledge of the technological tools at hand.

What is equally important is that the reviewed studies depicted various other obstacles that needed to be tackled in order to increase technology integration in the classrooms. Among these hindrances are the lack of teacher's technological know-how, inadequate administrative support, and limited access to technology, the absence of planning for technology integration, and lack of explicit technology-oriented professional development opportunities for teachers. The absence of support in all these areas discourages the use of technology by teachers and negatively influences how teachers perceive technology integration in schools (Starr, 2009). Moreover, the specific culture and the unique atmosphere of each particular school also appeared among the determining factors for the level of technology integration in schools. Overall, all of the above-mentioned variables, along with particular leadership approaches and practices surfaced as either promoting or reducing the barriers to use of technology use faced by teachers.

In this meta-analysis, we investigated the effects of technology integration on teachers' attitudes in grades K-12 teachers. Regarding the first question in the study, the results are significant. According to data obtained from the 22 international studies regarding the effects of

Turkey’s technology integration initiative on teacher attitudes, effect size was calculated to be *d=.307* based on a random effects model. This result points to negative and lower level effects regarding teacher’s attitudes on the FATIH Project. According to this result, it can be argued that FATIH Project has not been well implemented. The results make clear that without making learning and teaching processes more productive and efficient, the project will not rise to its potential to play an important role in developing productivity in teaching. This study may be replicated in the future by including attitude, motivation and permanency in addition to academic achievement.

Integration of technology with education means using technology to enhance lessons. Technology should not replace the teacher but rather extend what teachers can do, and it is beneficial if teachers have a history of familiarity with the technology being used. It is clear the role of technology in education is changing. Right now, teachers need to create meaningful and inspiring lessons to stimulate their students’ thinking. For instance, when the interactive whiteboard was first introduced, it qualified as a new technology of instruction. Its new abilities to integrate digitally with computers and its versatile functionality provided something a traditional white or black board could not, but only if the teacher knew how to use it. A tool can be provided, but how that tool is used is determined by the instructor. Through usage and experience, efficiencies can be developed, and while the tool does not change, how it may be used does.

Technology integration is a complex task for teachers, especially with regard to such factors as time and money. There are several aspects that researchers have illuminated as barriers to technology integration. Huang, Lai, and Chen (2010) in a study that specifically addressed factors affecting teachers’ adoption of teaching blogs found the most significant influences to be education, school level, subject category, and weekly computer use. Oncu et al.’s (2008), study of teachers’ decisions to implement technology found five characteristics to be influential: accessibility and availability of technology, applicability, the influence of colleagues, teachers' skills and knowledge, and students' abilities and know-how. McGrail (2007) stated that when the appropriate pedagogy is in place, technology-enhanced instruction is successful; however, the researcher cautioned that without appropriate pedagogy, the technology would be more cumbersome than helpful.

When introducing technology-enhanced teaching and learning strategies, careful thought should be devoted to the selection of appropriate technologies. Given the need for teachers to adapt and change to accommodate the use of new and different technologies, much attention has been paid to the efficacy of specific tools and the pedagogical decisions made by teachers when incorporating them. In particular, Mishra and Koehler (2006) expand on their notion of pedagogical content knowledge to include a third dimension: technology. Technological knowledge and skills work in conjunction with content knowledge to effectively integrate technology into a learning environment. This knowledge enables teachers to make sound decisions regarding the effective and appropriate uses of technology in their classrooms. Emphasis is placed on the alignment the learning goals with the technology used (Conole & Oliver, 1998; Ferdig, 2006). Thus, the focus is on the intersection of three types of information: 1) content knowledge: an understanding of the particular subject matter to be taught or learned, 2) pedagogical knowledge: the how and whys of particular instructional strategies, and 3) technological knowledge: knowing how to use new and traditional classroom technologies (Mishra & Koehler, 2006).

Summary

Researchers are discovering that when teachers embrace newer technologies and use them appropriately, students are more engaged and may experience significant gains in achievement (Johnson et al., 2009). However, a major roadblock to successful technology integration is the need for human capital investments that allow experienced and effective teachers to remain in the classroom. Professional development activities to ease the transition into a technology rich environment need to be carefully designed based on the specific needs of a particular group of teachers. The design of post-secondary education and teacher preparation programs should incorporate instruction and scaffolding for the adoption and implementation of technologically enriched instructional materials.

A further complication causing difficulty in the effective integration of technology into the classroom is that teachers find it hard to appreciate the possibilities at the beginning. One has to understand content, teaching, and technology on nearly equal terms, and lack of such understanding has an awkward way of illuminating the holes in a teacher's expertise. That does not mean that teachers who question education technology do so simply because they are not good at it, but rarely does one hear people complain about things they do well. Technology does not simply make teaching better or worse, simple or more complex. Rather, it seems to change the experience entirely, the frameworks, the models, the training, the instructional design, curriculum, lesson designs’ assessment, learning feedback, classroom management, school design -- all of these. Lastly, every teacher needs to fully understand what s/he is for and against regarding education and technology. If we can summarize our thinking into pros and cons, we can better evaluate things.

In the final assessment, technological tools, including devices, software, programs, and supplements must be wisely implemented into an educational system that is prepared to properly support the momentous changes involved in order to affect discernible improvements. Integrating technology in the classroom can be quite difficult if the teacher does not understand what incorporating technology means. For the teacher, it is important to stay up to date on current events in the field of technology because it changes often and drastically, for which administrative training and support are necessary.

Recommendations

In light of the national call to maintain students' learning experiences at a consistently sophisticated level via educational technology, it is imperative to further motivate and support teachers in order for them to use technology in the classrooms effectively. As the research shows, the leadership of regional administrations and the national governments can and must do more to overcome constraining impediments documented in the related literature and to promote technology integration in schools across the country. Indeed, leaders can be of help in facilitating training and providing technological equipment, as well as other resources, to smooth the processes of technology adoption, integration, and effective implementation in classrooms. In the final analysis, we find that in order to endorse well-founded solutions, it is necessary to thoroughly examine how teachers perceive their roles and tasks in technology integration in the classrooms.

APPENDIX

INCLUDED STUDIES REGARDING THE FATIH PROJECT

Study	Title	Methods	*N*	Subjects
Aktas et al., 2014 (Journal)	Ogretmenlerin FATIH Projesine Yonelik Gorusleri: Farkindalik, Ongoru ve bekleyis	Quantitative independent t-test, ANOVA	1201	Teachers in 16 cities
Aksu, 2014 (Journal)	An Evaluation into The Views of Candidate Mathematics Teachers Over “Tablet Computers” To Be Applied in Secondary Schools	Quantitative Single-factor Anova and Chi-square	130	Math Teachers
Akyüz et al., 2015 (Journal)	With the implementation of FATİH Project, Ministry of Education aims to improve the competence of use of technological tools, such as smart boards, through in-service training	Quantitative Experimental design (Post-test-Pre-test)	52	In-service teacher
Akyüz et al., 2014 (Journal)	Akıllı tahta kullanımlı mikro öğretim uygulamalarının fen bilgisi öğretmen adaylarının tbap’larına ve akıllı tahta kullanıma yönelik algılarına etkisi	Pretest and post-test	48	Science teachers
Anatürk, 2014 (Dissertation)	High school science teachers’ beliefs and attitudes towards the use of interactive whiteboards in education	mixed-methods question	36	17 pilot cities all around Turkey. Science teachers
Ari, Eren, Cam,Akifova,and Tahirova, 2014	Ortaokul Beşinci Sınıf Derslerine Yönelik E-değerlendirme Materyallerinin Geliştirilmesi*	Survey	20	Teachers and Students

Study	Title	Methods	*N*	Subjects
Aydin & Gürol, 2016 (Journal)	Evaluating ICT Integration in Turkish K-12 Schools through Teachers' Views	mixed methods	102	Teacher from 5 schools
Bağcı, 2013 (Dissertation)	FATIH projesi çerçevesinde ortaöğretim öğrencilerinin etkileşimli tahtaya yönelik görüşlerinin incelenmesi	Quantative Survey descriptive model	80	the perspectives of school teachers and students
Balcı et al., 2013 (Journal)	Türkçe dersinde "tablet pc pilot uygulaması"yla öğretim gören öğrencilerin tutumlarını belirlemeye yönelik ölçek çalışması	Quantitative Survey 5-point Likert-type	114	Fifth grade students
Balta and Duran, 2015	Attitudes of Students and Teachers towards the Use of Interactive Whiteboards in Elementary and Secondary School Classrooms	Survey	23	255 students and 23 teachers from three private schools.
Banoğlu, Madenoğl, Uysal, 2014	FATİH Projesine Yönelik Öğretmen Görüşlerinin İncelenmesi (Eskişehir İli Örneği)*	Descriptive Statistic	17	Teacher in Pilot School
Bilici, 2011	Öğretmenlerin bilişim teknolojileri cihazlarının eğitsel bağlamda kullanımına ve eğitimde fatih projesine yönelik görüşleri: Sincan il genel meclisi	Survey	39	39 teachers and 3 administrators who work in Sincan
Bozdogan, 2012 (Dissertation)	Tablet Bilgisayarin fen ve Teknloji Derslerinde kullanilmasiyla ilgili Fen ve teknoloji ogretmenlerinin Goruslerinin icncelenmesi	Anova	120	Science and Technology teachers

Study	Title	Methods	*N*	Subjects
Çatma, 2016	How Special are Teachers of Specialized Schools? Assessing Self-Confidence Levels in the Technology Domain	independent t-test	40	teachers
Dasdemr, Cengiz, Uzoglu, and Bozdogan, 2012	Tablet Bilgisayarlarin Fen Ve Teknoloji Derslerinde Kullanilmasiyla İlgili Fen Ve Teknoloji Öğretmenlerinin Görüşlerinin İncelenmesi	ANOVA and Chi-Square test	120	science and technology teachers
Dundar & Akçayır, 2014 (Journal)	Implementing tablet PCs in schools: Students' attitudes and opinions	Mixed methods	10	Secondary teachers
Duran, M (2016)	Students' Opinions on the Use of Tablet Computers in Education	Questionnaires	84	Teacher
Emiroglu, 2016	Eğitimde Teknoloji Kullanımına Özel Okul Öğretmenlerinin Yaklaşımı	Survey	256	Teachers
Eryılmaz ve Salman, 2014 (Journal)	An Inquisition upon Expectations of Intervening Teachers and Students within the Context of Fatih Project and Perceptions to Usage of Information Technology	Quantitative Survey	50	180 students' and 50 teachers
Genc, and Genc, 2013	Öğretmenlerin Mesleki Gelişmeleri Takip Etme Durumları : Fatih Projesi Örneği*	Survey	184	High School Teachers
Gokmen, and Akgun, 2016, (Article)	Opinions of Teacher Candidates about FATIH	t testi ve ANOVA	505	Pre-service teacher

Study	Title	Methods	*N*	Subjects
	Project: Awareness, Foresight and Expectations			
Gunbay and Yoruk, 2014	Yonetici ve Ogeretmenlerin Egitimde Fatih Projesinin Uygulanma Duzeyine Iliskin Gorusleri Antalya	survey	321	Teacher and Principals
Izci and Eroglu, 2016	Evaluation of in-service training program named Technology Usage Course in Education1	Mixed Method	54	49 teachers and 5 formator teachers
Karakaya, 2013 (Dissertation)	FATİH projesi kapsamından pilot okul olarak belirlenen ortaöğretim kurumlarında çalışan kimya öğretmenlerinin teknolojik pedagojik alan bilgisi ye	Mixed Method observing interview focused group interview	42	2nd grade
Karali Aktaş Turgut Gökoğlu, Aksoy, Çakir, 2013	FATİH Projesine Yönelik Görüşleri Değerlendirme Ölçeği: Güvenirlik ve Geçerlilik Çalışması	Mixed method	305	Pre-service teacher
Kilic and Johnson, 2012	Teachers' Belief and Use of Interactive Whiteboards for Teaching and Learning	The questionnaire	174	1 teacher-participants,
Kiranli and Yildirim, 2013	Technology usage competencies of teachers: prior to Fatih project	Descriptive survey model	224	High School teachers
Kocak, 2013	FATİH projesi kapsamındaki lcd panel etkileşimli tahta uygulamalarına yönelik öğretmen tutumları - Erzincan ili örneği	Independent Samples t-testi ve One-Way ANOVA	154	Teachers

Study	Title	Methods	*N*	Subjects
Kocaoglu, 2013 (Thesi)s	Lise Öğretmenlerinin Fatih Projesi Teknolojilerini Kullanmaya Yönelik Öz-Yeterlik Inançlari: Kayseri Ili Örneği	Survey (ANOVA)	278	Kayseri Melikgazi district of Fatih Project
Korkmaz, Akturk and Karimi, 2013	Fatih projesi sürecinde sınıf öğretmeni adaylarının bilgisayara yönelik tutumlarının incelenmesi: Kilis 7 Aralık Üniversitesi Örneği	Descriptive Statistic	165	Elementary School Teaching adhering to volunteer principle.
Kurnaz, Bayraktar, and Degirmenci, 2013	Fizik, kimya ve biyoloji öğretmenlerinin fatih projesi kapsaminda hazirlanacak zkitaplara ilişkin beklentileri	Descriptive Statistic	48	Graduate student and teachers
Küçükaydın, Bozdoğan & Öztürk, 2014	To understand eService teachers' conceptions of technology integration	Quantitative study Survey	15	elementary science methods students'
Ocak, Gökçearslan, 2014 (Journal)	Investigating Turkish pre-service teachers' perceptions of blogs: Implications	questionnaire	174	CT on pre-service Teachers
Ozdemir, 2014 (Dissertation0	Fen Bilimleri Öğretmenlerinin Tablet Bilgisayarlarin Derslerde Kullanimina Ilişkin Görüşlerinin Farkli Değişkenler Açisindan Incelenmesi	Survey	133	Science teachers
Ozkan and Deniz, 2014	Orta Öğretimde Görev Yapan Öğretmenlerin FATİH Projesi'ne İlişkin Görüşleri	Survey	15	Technology teachers

Study	Title	Methods	*N*	Subjects
Saltan and Arslan, 2013 (Journal0	Teachers' Perception of Interactive White Boards: A Case Study	Survey	34	Teachers
Salman, 2013 (Journal0	FATİH projesi kapsamında yer alan öğretmen ve öğrencilerin projeden beklentileri Ve bilişim teknolojileri kullanımı.	Multiple regression Anova	91	second graders (7 or 8 years old)
Sayir, 2014 (Dissertation0	Students' And Teachers' Attitudes Towards Interactive Whiteboards Used In English Courses Via Fatih Project And The Effects Of Iwbs On Speaking Skill	questionnaires	19 teachers	183 students and 19 teachers participated in the study
Sozcu and Karats, 2014	Teacher' awareness and expectations related to the Fatih Project; a situation analysis	descriptive	319	Teachers' view
Tekerek, Ercan, Udum and Saman, 2012	Bilişim Teknolojileri öğretmen adaylarının bilgisayar öz-yeterlikleri	Survey	200	Pre-service teachers
Temelli and Genç, 2014 (Journal0	Akıllı Tahtaya Yönelik Öğretmen Tutumları (Çanakkale İli Örneği)	Survey	130	volunteer teachers who work in Çanakkale
Uluyol, 2013 (Journal0	Urban teachers' perspectives on barriers that hinder technology integration in their mathematics classrooms.	Mixed method Interview survey	20	15 females and 5 male mathematic teachers
Uzoglu and Bozdogan, 2012	An examination of preservice science teachers' views related to use of tablet PCs in	Survey	420	preservice science teachers

Study	Title	Methods	*N*	Subjects
	science and technology course in terms of different variables			
Koksal, Yaman, Saka, 2016 (Journal)	Analysis of Turkish Prospective Science Teachers' Perceptions on Technology in Education	four-way ANOVA, t-tests	264	Turkish pre-service science teacher
Pamuk, Ulken and dilek,(2012)	Türkçe öğretmeni adaylarinin digital pedagojik yeterlilikleri	Anova	170	teachers
Yildiz, Santepeci and Seferoglu, 2013	FATİH Projesi kapsamında düzenlenen hizmet- içi eğitim etkinliklerinin öğretmenlerin mesleki gelişimine katkılarının ISTE Öğretmen Standartları Açısından İncelenmesi	Mixed	40	40 teachers from 8 schools where in-service training
Yüksel ve Alemdar, 2012 (Journal)	Teachers' ICT integration states on the eve of Fatih project	analysis of data; descriptive statistics, t-tests and Anova tests	172	The work group included 172 teachers who works in MNE schools

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** *Double asterisk indicated an article used in meta-analysis.*

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