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Prospective Mathematics Teachers' Views on the FATIH Project: The Big Educational Technology Movement in Turkey

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Abstract

The purpose of the present study was to evaluate the FATIH Project from the perspective of future mathematics teachers. Contributions to the education system derived from the project, and related problems that emerged from the implementation process, were investigated based on the prospective teachers' observations. Qualitative research methods were used in the study, and the participants were 50 prospective mathematics teachers, who were senior students from a state university in Turkey. They were selected by means of purposeful sampling among students who were completing their teaching education in the high schools where the project was being implemented. The data was collected by means of focus group interviews, observations and a questionnaire prepared by the researchers. The data was analyzed by a way of descriptive analysis. Results revealed that the participants viewed the project as an important educational reform movement. However, the participants also indicated that it did not seem possible for the project to achieve its goals.

Key words: FATIH project, Interactive board, Tablet PC, Technology integration, Mathematics education.

Introduction

In this age, new technological developments take place every day, and reflections of these developments are witnessed in many subject areas. Technology, particularly those information technologies with, global influence, cannot be considered in isolation from education, one such subject area (Friedman, 2005). Thus, it is necessary to take this factor into consideration in order to determine the goals of education. Within this context, it is intended both in Turkey and other countries that students should be prepared for a technologically dominated social and educational life (Eren Şişman & İzmirli Şahin, 2012). This goal can be achieved, to some extent, by increasing the students' familiarity with technology and, more importantly, by ensuring technology is used in an effective and beneficial way.

Jones and Mclean (2012) stated that the effective use of technology is an important component of contemporary education, and that technology is a factor that facilitates learning. They also indicated that the integration of technology in educational activities is required in all units of education such as mathematics, science, and foreign language. Some students certainly have concerns around mathematics as a difficult and complicated subject (Lim & Emest, 1999). To address these concerns, it is essential for students to develop an appreciation of mathematics and assure them that they can be successful in this field. As such, students' interests can be driven towards mathematics by making it more enjoyable with the means of new technologies (Memişoğlu, 2005).

In the constructivist mathematics curriculum, which has been in place in Turkish schools for about ten years, there is an emphasis on the necessity for students to develop positive attitudes towards mathematics and encourage them to believe that they can be successful (Ministry of National Education [MoNE], 2011). In this regard, Ertem (1999) stated that the effective use of technology (e.g., computers, interactive boards, tablet PCs, and internet) should be compulsory in order for students to become successful in mathematics. Equipping educational institutions with technological tools will allow teachers to utilize new and effective learning opportunities. Therefore, technological novelties in educational institutions will be promoted using an increase

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in the students' levels of learning (Goos & Bennison, 2007). In this process, various technologies such as interactive boards and tablet PCs can be utilized.

The purpose of this study was to identify pre-service mathematics teachers' views on the FATIH Project. Regarding the aforementioned issues relating to integrating technology in mathematics teaching and the FATIH Project, the prospective mathematics teachers' views of the FATIH Project, with respect to their experience and impressions gathered in schools, were regarded as meaningful. More specifically, the current study investigated the following research question:

- What are the prospective mathematics teachers' views on the implementation of the FATIH Project in Turkish high schools?

Literature Review

The effective use of technology is now widely acknowledged as an important component of contemporary education and is increasingly regarded as a means for enhancing learning. In this sense, it is possible to see various examples of projects throughout the world which have been implemented, or are being implemented, for the purpose of extending the integration of technology in education, particularly the use of interactive boards. The United Kingdom, the United States, Singapore, South Korea, New Zealand, Portugal, Kazakhstan, Russia, Peru, Uruguay, and Italy are some of the countries in which such projects are being carried out (Lee & Winzenried, 2009). In addition, Australia, the United States and the United Kingdom have invested a substantial amount in equipping classrooms with interactive boards (Hall & Higgins, 2005; Wood & Ashfield, 2008). The Fatih Project, which aims to enable teachers and students to use information and communication technologies in an effective way (MoNE, 2012), has been carried out in Turkey since 2012. Within the scope of the project, the aim is for all K-12 schools to be equipped with interactive boards.

The interactive board, which is one of the components of the FATIH Project, can be defined as "a whiteboard displaying the image from the computer monitor, with the surface operating as a giant touch screen" (Preston & Mowbray, 2008). In recent years, it has become one of the most common technological tools used in classrooms. This technology has a significant role not only in the different fields of education such as mathematics but also in students gaining skills in pattern formation and the development of problem-solving abilities and spatial thinking (Hwang, Chen, & Hsu, 2006). Promoting cooperative learning and interactive instruction is another prominent advantage of interactive boards (Brigham, 2013). Hence, the interactive board presents many benefits for an educator, in adopting a constructivist approach (Bell, 2002).

Similarly, in Turkey, the new constructivist curriculum was introduced in 2005; and hence, the importance of technology in education has increased in recent years. These developments have brought about the FATIH Project, which stands for "Movement of Enhancing Opportunities and Improving Technology", with the aim of enabling the integration of technology in education. This project also aims to improve the use of technology in schools, provide equal educational opportunities in different regions, and reinforce learning with the help of technology in educational activities. The targets of the project are as follows:

- to complete the project within five years
- to equip all 570,000 classes throughout the country; from pre-school to 12th grade, with liquid-crystal display (LCD) interactive boards
- to provide every student (5th–12th grades) and teacher with a tablet PC
- to provide schools with internet infrastructure (MoNE, 2012)

In this regard, 84,921 classrooms were equipped with interactive boards and the project began in pilot schools in Turkey in 2012. Accordingly, 14% of the target to equip all the classes with interactive boards has been realized. In addition, an agreement to purchase 347,367 interactive boards was signed and 675,000 tablet PCs had been distributed to students and teachers by the end of 2014. Providing schools with such technology is now seen as crucial, given that interactive board technology can no longer be regarded as a new technology, but rather a technology which brings about new learning opportunities (Campbell & Martin, 2010). More specifically, interactive boards provide students and teachers with a number of useful functions such as saving notes for future, participating in educational multimedia activities, watching simulations and viewing graphics (Preston & Mowbray, 2008).

In this regard, teachers have emphasized that subject matter can be taught more effectively with the help of interactive boards (Pamuk, Çakır, Ergun, Yılmaz, & Ayas, 2013). Interactive boards contribute to classroom

efficiency by saving time (Çoklar & Tercan, 2014; Kurt, Kuzu, Dursun, Güllüpınar, & Gültekin, 2013), motivating learners (Beeland, 2002; Smith, Higgins, Wall, & Miller, 2005), improving student literacy and positively influencing achievements in math and science (Lewin, Somekh, & Steadman, 2008).

As such, students and teachers have positive opinions about the use of interactive boards for instructional purposes (Çoklar & Tercan, 2014; Pamuk et al., 2013). Given that students have different learning styles, it is easier to achieve a multiple learning environment (Beeland, 2002; Hall & Higgins, 2005; Kent, 2004). Teachers can find various information sources in lessons by having internet connectivity (Starkings & Krause, 2008). Abstract topics can become more readily concrete by the use of classroom technology, and student comprehension of such topics can be achieved more easily (Levy, 2002; Preston & Mowbray, 2008).

However, despite the positive reviews, some teachers and students have fairly negative viewpoints due to some problems experienced with the technology (Levy, 2002; Şad, 2012; Türel, 2012). It appears that teachers' inabilities to deal with technical problems led to developing negative attitudes. Wasting time and related classroom management problems were among the reasons cited for these negative attitudes (Ateş, 2010; Hall & Higgins, 2005).

Moreover, in some instances, the traditional blackboard was found to be more effective by teachers, and an interactive board was thought to actually hinder active learning. Teacher-centered instruction was another concern highlighted by the use of interactive board technology (Türel, 2012). Through continuous presentation of subject matter by teachers, students can become highly passive learners. In terms of time, this technology can lead to wasting time as teachers attempt to manage the computer and interactive board. Student attention can wane at this point, making classroom management more difficult (Polat & Özcan, 2014). Problems relating to the use of interactive boards may lead to a decrease in motivation. However the problems in question mostly arise from lack of information about how to use interactive boards, which highlights the need for in-service training for teachers (Türel, 2012).

Apart from interactive boards, another component of the FATIH Project is tablet PCs. MoNE aims to distribute tablets to all teachers and students from 5th to 12th grade. The practical characteristics of tablet PCs are that they are easy to carry, make the homework process easier, and are entertaining (Romney, 2011). Given that students have difficulties carrying their books and notebooks, tablet PCs provide greater convenience (Çiftçi, Taşkaya, & Alemdar, 2013).

For teachers, making lessons more enjoyable is one of their concerns. Lessons can become more enjoyable through the visuals that tablet PCs can provide, and abstract concepts can be better understood by students in mathematics courses (Aksu, 2014). Tablet PCs can increase student participation and interaction and they can add variety to lessons as well (Çağlar, 2012). Tablet PCs also help teachers to maintain eye contact with the class since they do not need to face at board (Ambikairajah, Epps, Sheng, & Celler, 2007). On the other hand, some disadvantages of tablet PCs in the teaching and learning process are: (a) loss of concentration (Dündar & Akçayır, 2014), and (b) a decrease in communication and social interaction in the classroom (Aksu, 2014). Furthermore, students could use tablet PCs for purposes irrelevant to school work, as well as send messages to each other, which is counter-productive to learning (Dündar & Akçayır, 2014).

Considering the aforementioned components of the FATIH Project, the implementation of the project is strongly reliant on the provision of sufficient training, both for pre-service and in-service teachers (Çiftçi et al., 2013). Teacher motivation and self-confidence are regarded as crucial factors in the effective implementation and maintenance of technology in education (Niederhauser & Perkmen, 2010). Their competence in using technological devices plays an active role in the success of the project (Adıgüzel, Gürbulak, & Sarıçayır, 2011; Pamuk et al., 2013). Thus, if teachers lack self-confidence and use technology ineffectively, it becomes difficult for technology-assisted education to reach the desired objectives. In this regard, while most teachers have met the National Educational Technology Standards for Teachers, their skill level in the use of interactive board technology is low (Kıranlı & Yıldırım, 2013). Therefore, it becomes more and more necessary to provide teachers with adequate in-service training so as to ensure they grasp how to use the devices within the scope of the project. There have been a number of studies concerning the Fatih Project but it has been noted that the studies approaching the effects of the Fatih Project on mathematics education are not sufficient. Considering the effects of the technology on mathematics education, there exists a need to examine the following: "a) how the Fatih project will contribute to mathematics courses, b) what the advantages and disadvantages of the project are, in terms of students and mathematics teachers, c) the mathematics teachers' level of technological capability with regards to implementing the project, d) whether the in-service training provided to mathematics teachers is sufficient in terms of quality, e) the problems experienced by teachers in the implementation process, and f) the

observations and thoughts of teachers and students in terms of whether there is consistency between the goals and the implementation of the project." In this study, we attempted to demystify these particular factors and evaluate the FATIH Project in terms of mathematics education.

Method

Qualitative methods were considered to be the most appropriate for this study, in order to gather prospective teachers' views on the FATIH Project. According to Merriam (2009), basic qualitative research is one of the most commonly used types, as it deals with how individuals construct their world, interpret their lives, and give meaning to their experiences. In this sense, the main goal of a basic qualitative research is to reveal and interpret the meanings that individuals prescribe to their experiences and lives (Merriam, 2009). In this regard, prospective teachers' experiences, in relation to the implementation of the project, were the focus of the study.

Participants

In this study, 50 prospective teachers (18 male and 32 female), who were senior-level students studying mathematics teaching at a state university in Ankara, were recruited as participants. Codes P1, P2, …, P49, P50 were used to refer to the participants. The purposeful sampling method was used to determine the participants. Purposeful sampling aims to select information-rich cases; the review of which offers insight into the questions under study (Patton, 2002). The participants selected were those who completed the school experience course in the fall semester of the 2013–2014 educational year and the practice teaching course in the spring semester of the same educational year. The participants made observations in the schools in which the FATIH project was already implemented. Regarding the academic standing of the participants, 64% of the participants' total Grade Point Average (GPA) was between 2.00 and 2.99, 28% was between 3.00 and 3.49, and 8% was between 3.50 and 4.00. In the university in which the study was carried out, the 4.00 point grading system is adopted to evaluate student success rates. A detailed description of this grading system is presented below, in Table 1.

Table 1. Description of 4.00 point grading system

Grade range	Description
0.00–1.99	Unsatisfactory
2.00–2.99	Satisfactory
3.00–3.49	Honor
3.50–4.00	High Honor

Instruments and Data Collection Procedure

In the 2013–2014 educational year, the participants carried out semi-structured observations, with the researchers' support, in five high schools in Ankara where the FATIH Project had already been implemented. Ten participants conducted related observations in each high school. The observations were carried out for four hours a week in the fall semester. In the spring semester, the participants also taught some mathematics topics, whereby they performed observations, as far as the school administrators would allow, and they reported their findings to the researchers. By carrying out observations, the participants took an active role in the data collection process. Observation is one of the key data collection instruments in qualitative inquiry (Creswell, 2012).

The participants shared their experiences of the observation sessions with the researchers, in weekly reports. At the end of the year, a questionnaire comprising 15 open-ended questions was prepared, in order to determine the views of the participants. The aim of the first part of the questionnaire was to determine the participants' demographic information (i.e., gender, the type of school they attended, etc.). The second part included some questions designed to determine the participants' views in relation to the project. The questions were examined by two experts who have completed related studies in this field. While one of the experts recommended adding a question to the questionnaire, the other suggested combining two of the questions. In line with the experts' advice, the questionnaire was reorganized. Sample questions from the questionnaire are outlined below:

- How much do you know about the use of technological tools such as interactive boards, tablet PCs, etc.? Have you received any training on the use of these tools?

- Please explain whether the teachers in the schools where you carried out observations received training in relation to the implementation of the FATIH Project?
- What impact do you think the FATIH Project has had on the Turkish education system? What were the improvements that you observed?
- Which mathematics topics could be taught better with the aid of the technological tools provided by the FATIH Project? Why do you think so?

The participants were asked to answer the questions based on their experiences and observations. Afterwards, the participants that implemented the observations in the same schools were grouped and focus group interviews were carried out in five groups. In the focus group interviews, participants expressed their opinions and queried each other; thus, researchers were able to gather more extensive information when compared to the individual interviews (Morgan, 1996). The focus group interviews were conducted at round tables in the mathematics laboratory of the university. The participants were familiar with the place as they used it for their studies. Thus, the researchers were able to follow the interviews and take note of important points. In these interviews, the answers that the participants provided in the questionnaire were confirmed and their views regarding the FATIH Project were heard. All the focus group interviews were recorded with the participants' consent and transcribed that same evening. The researchers then reviewed the interviews alongside the field notes. Once the data collection process was complete, the data was then analyzed.

Data Analysis

In qualitative research, the process of data analysis, from the beginning of the data collection process to the end (Glesne & Peshkin, 1992), is quite complicated, requiring both description and interpretation (Merriam, 2009). The data obtained from the focus group interviews, the questionnaire and the field notes, in relation to the observations, constituted the data for this study. Descriptive analysis was employed to analyze the qualitative data. The basic objective of descriptive analysis is to present the results as organized and interpreted. In descriptive analysis, the data is organized based on the themes that emerge from the research questions (Yıldırım & Şimsek, 2008). The completed questionnaire forms were primarily reviewed and analyzed. The qualitative data from the focus group interviews was analyzed and compared with the data collected from the questionnaire forms, the results of which were then synthesized. A further list of codes was prepared, to organize the codes formed by the two researchers. Together, the researchers determined under which category each of the codes would be placed. The data relating to implementation of the FATIH Project was analyzed by the following six categories:

- The training provided to prospective teachers for the FATIH Project
- The success of the FATIH Project in terms of achievement of goals
- The problems arising from implementation of the FATIH Project
- The advantages and disadvantages of the FATIH Project in terms of students and teachers
- The mathematics topics upon which the use of technology is effective
- The prospective teachers' suggestions for improvement of the project.

A section of the list of codes and themes formed is presented in Table 2.

Table 2. A sample list of codes and themes regarding the advantages and disadvantages of the FATIH Project

Theme/category	Code
Advantages (in terms of teachers)	*Being economical–saving time–solving many problems–motivation–using the internet –reaching information fast –drawing graphs and figures–concretization–visualization–permanence–using mathematics and geometry software that is supported–interaction*
Disadvantages (in terms of teachers)	*Laziness–difficulty in classroom management–the problems with the use of interactive boards–the problems with the use of tablet PCs–not being open to innovations–technical problems–having no software support for the software to be used–radiation*

Trustworthiness of the Study

Among the most often used procedures for increasing trustworthiness in qualitative inquiry are triangulation, rich description, and member checking (Merriam, 2009). According to Seah (2008) one way of ensuring validity and reliability in qualitative research is data triangulation. Triangulation is the application and combination of several research methodologies from the study of the same phenomenon (Denzin, 1988). To collect data, the participants observed mathematics teachers, completed the questionnaire regarding their observations and experiences and focus group interviews were conducted. Thus, triangulation was achieved. Furthermore, the qualitative data was coded by an expert in the field. The researchers' analysis was compared to the results of the analysis carried out by the expert and congruence between the two analyses was examined. At this stage, the method proposed by Miles and Huberman (1994) was used and the reliability rate was calculated as 93%, through a "Reliability = Number of agreements / Total number of agreements and disagreements" formula. This analysis revealed that the coding used to analyze the data was reliable (Neuendorf, 2002; Yıldırım & Şimşek, 2008). For the purpose of increasing validity and reliability of the results, the participants and procedure were described in detail and direct quotations were used to support the results of the study. Moreover, the results of the study were reported and shared with the participants after completion of the data analysis procedure. The participants then checked the reports and confirmed the results. In this way, member check was carried out.

Results

The participants' views are presented in this section. These views concern: (1) the training provided to prospective teachers for the FATIH Project, (2) the success of the FATIH Project in terms of achieving the goals, (3) the problems stemming from the implementation of the FATIH Project, (4) the advantages and disadvantages of the FATIH Project in terms of students and teachers, (5) the mathematics topics upon which use of technology is effective, and (6) the prospective teachers' suggestions for improvement of the project.

First of all, the participants' awareness regarding the use of the technology was determined. The results showed that 68% of the participants regularly followed technological improvements. More specifically, the number of male pre-service teachers was higher than the number of female pre-service teachers, but all reported that they followed technological improvements relating to education. The results in relation to the number of participants who regularly followed technological improvements are presented in Table 3. These results indicate that most of the students followed the improvements and used technology in this process, which was regarded as significant in terms of having innovative teachers.

Table 3. Following the technological improvements

Male (n = 18)		Female (n = 32)		Total (n = 50)	
f	%	f	%	f	%
15	83	19	59	34	68

The training provided to prospective teachers for the FATIH Project

In the present study, the participants were asked about whether they had received any training in relation to the use of the interactive board and tablet PC, and whether they were informed about the project. The results showed that 54% of the participants had received some training and 46% had received no training. The training the participants had received was limited to only 1 to 2 hours and as such, the participants reflected that the training provided was insufficient. P26 shared his thoughts as follows:

"In my opinion, the training that we have received at school is not enough. I only observed how to use the interactive board, but I did not find any opportunity to use it."

In this regard, P14, P29, and P31 proposed the following suggestions:

"It would be better to open an elective course in which this training is provided. In this way, sufficient time can be available in order to instruct on how to use interactive board technology and other technologies, with some hands-on experiences."

Furthermore, the participants' level of using such technologies as the interactive board and tablet PC was questioned. The results demonstrated that 32% of the participants could not use the interactive board and that

they did not have sufficient information in regards to it. 30% of the participants indicated that they could use the interactive board at a minimum level, but that they could not do everything they wanted to do on it. 10% of the participants believed that they could use the interactive board adequately although they had not tried it. Others stated that they had not found the opportunity to practice using interactive boards. It was therefore found that the majority of the participants thought that they were not competent enough to use interactive boards as they had not received any quality training. They stated that they wanted to make improvements on the matter.

The success of the FATIH Project in terms of achievement of goals

Within the context of the study, the participants' views concerning the success of the FATIH Project were obtained. Once analysis of the views was completed, it was found that the implementation of the project was not successful under the current situation, but that some conditions were fulfilled, yielding favorable results. In other words, the success of the project was dependent on the following conditions being satisfied, as outlined by the participants:

P3: *"Pioneer countries should be modeled in terms of integration of technology and experts' opinions should be taken into consideration."*

P12: *"Implementations should not be sudden or unexpected."*

P16: *"Students should be encouraged to investigate."*

P21: *"Teachers should fulfill their responsibilities. Teachers need to receive the required training as soon as possible."*

P24: *"It is not beneficial to implement the project without completing the required training."*

P48: *"Students should be informed about how to use tablet PCs properly. Implementation of the project should be under controlled circumstances and followed through. Equality in education needs to be ensured."*

Moreover, the results revealed that a certain amount of time was needed, in order for the project to be successful. In support of this result, P6 said:

"It is not realistic to expect the project to be successful in such a short time."

The results also indicated that the budget of the project could have been used for more efficient projects. P7 expressed the following opinion:

"It is possible that more effective projects could be carried out, using the budget for this project."

The problems in implementation of the FATIH Project

The participants' views, with respect to the problems implementing the FATIH Project, were obtained. While 92% of the participants stated that there were serious problems regarding the implementation of the project, the idea that there could be successful implementation of the Project all over the country was supported by a small percent of the participants (6%). One of the participants did not present his opinion on this issue. Based on the participants' views, the reasons why the Project could not be implemented successfully are presented in Table 4.

Table 4. The reasons for problems in implementation of the project across the country

	Reasons	f	%
1.	Physical infrastructure and economic restrictions	24	48
2.	No implementation of the project even in pilot schools	18	36
3.	Teacher factors	18	36
4.	Regional factors	13	26
5.	Student factors	11	22
6.	Other factors	7	14

Specifically, the participants reported that even compulsory education does not ensure equality of opportunities. There are some regions that do not have internet connectivity, there are multi-grade classes in different regions of the country, there are classes in which there is no teacher, and there are many schools with no infrastructure or necessary equipment, all of which are regarded as problems of the education system. Taking these reasons into consideration, it was underlined that implementation of the project equally and successfully across the country was over-ambitious, and that meeting the basic needs of education should be considered the higher priority.

P43: *"Considering that the students in Turkey do not have equal opportunities in receiving even primary education, implementing the project in all regions of the country in a fair manner is like a dream."*

According to the results of the study, the project has not been implemented even in the pilot schools. P32 stated the following:

"*Teachers do not implement the project. Some of them use interactive boards like a projection, open a pdf file and tell students to write it down. Interactive boards are only used for slides, presentations and solving problems. Teachers write the questions on interactive boards instead of black boards. Therefore, they were not used in terms of serving the purpose of the project."*

The teacher factor was determined to be significant, in terms of whether or not the project was able to be implemented successfully throughout the country (36%). The participants' observations showed that the training teachers had received was not carried out simultaneously, there were some problems with the actual training, the teachers who received training were still not successful in using the technology, and that some teachers were not open to technological innovations and continued their normal routines. Alongside an extensive teacher shortage in the country, is the factor of substitute and graduating teachers from the faculties of science and letters also not having the required level of skill to use the technology within the scope of the project.

It was therefore indicated from the study that it was not possible for the project to be implemented successfully and fairly across the country. In this sense, the statements provided by P4 and P18 respectively are remarkable.

P4: "*The factors that teachers are not educated well enough, the graduates of science and letter faculties become teachers and that there is a teacher shortage in the country are obstacles to the project being implemented equally across the country."*

P18*: "Teachers' interests in technology are not equally at the same level in that there are teachers who do not like technology. These teachers hinder the equal implementation of the project. These teachers should be provided the necessary training."*

Furthermore, the student factor was also indicated as a hindrance to achieving the goals of the project (22%). It was pointed out that the level of technology use among students differed, in that some of the students had substantial experience with technology use whilst others were not even familiar with computers. Use of technology by students deviating from its purposes was also regarded as another obstacle to successful implementation. Therefore, students' profiles are one of the indicators for determining the success of implementing the project around the country.

Moreover, the problem of terrorism, social change and political injustice were also claimed to be among the obstacles to achieving the goals of the project (14%).

P12: *"The terror problem should end and the students should become equal economically."*

The advantages and disadvantages of the FATIH Project in terms of students and teachers

Opinions regarding the advantages and disadvantages of the project were obtained for the purpose of the study, from both the teachers' and students' viewpoints.

While a good percentage of the participants (72%) stated that the project would have some positive impact on the education system, others (26%) proposed the requirement for certain conditions in order for these positive impacts to emerge. The conditions are as follows: "Having devoted teachers, teachers open to technological

improvements, teachers and prospective teachers equipped with quality training, schools with quality infrastructure." P21 also stated that:

"*...if the use of educational technologies is not known, there will be some trouble. Putting* interactive *boards in classrooms, without providing necessary training, is as absurd as supplying villages that have no electricity with washing machines and dishwashers*."

What's more, some participants (38%) believed that the project would have some negative impacts on the education system, and that these negative impacts would arise mostly as a result of inadequate training for teachers, economic problems, and deficiencies in the infrastructure.

P30: *"Lack of infrastructure in schools affects the implementation of the project and the education system negatively."*

P50: *"Unless sufficient in-service training is provided, it does not seem possible that the project will have positive impacts on the education system."*

In terms of the advantages that the project provided for teachers, more effective use of time, solving more problems, saving time (34% for each topic), concretization of abstract concepts, teaching more easily and effectively through the use of technological equipment, and practicing various dynamic software (28% for each topic) were regarded as some of the advantages. Moreover, it was stated that teachers could avoid monotony, access information more readily and make effective use of the internet and digital materials. Classes would be less tiresome for teachers, and lessons could be more enjoyable (30%). Teachers could also benefit from visual tools (8%), improve their teaching skills using innovations (6%), communicate with students better and use the same content in every class.

P24: *"A learning environment in which visuals are used more means an effective use of time is ensured by means of the project."*

P38: *"Teachers can teach abstract topics more easily through the technological tools."*

A substantial contributing factor was that teachers would encounter some problems (76%). More than half of the participants (54%) thought that the problems facing teachers would be regarding the use of technology. More specifically, many teachers were unable to use interactive boards or software programs relating to instruction. Some of the teachers were not open to technology use whilst others did not know how to use computers. As such, the results revealed that encountering technical problems around calibration of interactive boards, and fixing the settings on the boards and tablet PCs were regarded as disadvantages of the project.

P31: *"Teachers can encounter some technical problems while using the interactive boards and tablet PCs. This may cause loss of time allowed for instruction."*

What's more, teachers could potentially experience difficulties in overcoming these problems. It was stated that the teachers who had problems with the technology could find themselves in the difficult situation of being in front of the students and could feel embarrassed, leading to difficulties controlling the class. Monitoring the class could also get difficult because of the teacher being distracted (12%). Other disadvantages were the difficulty of applying the technology to some mathematics topics (4%), teachers getting used to a lazier approach and reduced productivity (2%) were regarded as other disadvantages for teachers.

P44: *"Teachers get used to laziness as they do not write what they will teach on the board."*

P45: *"The technologies may limit teachers' productivity, which is regarded as one of the disadvantages of the project."*

The project also has advantages and disadvantages for students; 24% of the participants outlined advantages of the project in terms of students. The results of the study demonstrated that the project was advantageous in that students would not have to carry their books, pencils, and notebooks around as much, they would not have to take as many notes, they would be more motivated, and that their sense of curiosity would be stirred. P4 expressed the following:

"Students would get rid of carrying their course books and notebooks with them, thanks to the tablet PCs."

Furthermore, more enjoyable lessons for students (10%), enabling permanent learning (40%), structuring what was learnt, accessing information, and understanding the subject matter more easily, increased technology usage (40%), more active participation in lessons (6%), concretization of abstract topics, and time saving (4%) were stated to be other advantages of the project for the students. Likewise, students could potentially develop more positive attitudes towards lessons. P25 and P32 provided the following statements:

P25: *"Lessons become more enjoyable compared to previous lessons."*

P32: *"As students engage in using technological tools a lot, they will develop positive attitudes towards the lessons."*

However, almost half of the participants (48%) considered that the project would also have some disadvantages in terms of students. These included students becoming distracted and students spending time on undesirable activities (32%). Opening irrelevant sites on the internet, playing games whilst pretending to do the lesson by looking at the tablet PCs could be considered as undesirable.

P3: *"Students may focus on irrelevant things, such as playing games, rather than listening to their teachers."*

Similarly, difficulties using technology, unattractiveness of technology (4%), decreased time spent writing and undisciplined behaviors among students were cited as other disadvantages of the project, in terms of students. Some problems in relation to health may also emerge due to a risk of radiation exposure.

P29: *"In my opinion, students can learn some of the topics more easily, but exposure to that much radiation can lead to health problems in future."*

P34: *"Students may display undisciplined behavior and monitoring the class becomes difficult for teachers."*

The mathematics topics on which technology use is effective

As the fifth theme, participants' views in relation to which mathematics topics can be taught more easily by means of the FATIH Project were received. The results are presented in Table 5.

Table 5. The topics on which FATIH Project is more effective

Topics	f	%	Topics	f	%
1. Geometry topics	38	76	12. Trigonometry	1	2
2. Solids	8	16	13. Circle, circular region	1	2
3. Integral	7	14	14. Fractions	1	2
4. Derivative	6	12	15. Volume	1	2
5. Limit	3	6	16. Circumference	1	2
6. Area	3	6	17. Binomial expansion	1	2
7. Numbers	2	4	18. Pythagorean relation	1	2
8. Sets	2	4	19. Vectors	1	2
9. Functions	2	4	20. Permutation, combination and probability	1	2
10. Mapping	2	4	21. Parabola	2	4
11. Problem solving	1	2	22. Patterns and fractals	1	2

In terms of mathematics topics in which the FATIH Project is most effective, more than half of the participants (76%) indicated the teaching of geometry topics. In other words, it would be efficient in teaching almost all geometry topics. The topics of solids (16%), integrals (14%), derivatives (12%), limit and area (6%), and sets, function, mapping, and parabola (4% for each topic) were expressed to be effectively taught through the tools provided by the project. Moreover, it was stated that the topics of problem solving strategies, patterns, trigonometry, circle, circular region, fractions, volume, circumference, binomial expansion, Pythagorean relation, vectors, permutation, combination, and probability (2% for each topic) could be taught effectively by means of the technology. P2 and P14 gave examples as follows:

P2: *"The topics of functions, integrals, sets, trigonometry and derivatives can be taught more effectively and easily using the technological tools provided by the project."*

P14: *"In fact, the technologies can be used effectively in teaching geometry topics, like volume."*

The participants supported the contribution of the project to teaching mathematical concepts that can be better concretized through visual representations, especially in the teaching of geometry topics.

P13: *"As the technologies increase visualization, it will be easier to teach geometry topics in an effective way."*

The prospective teachers' suggestions for project improvement

Lastly, the participants' suggestions concerning the progress of the project were obtained. A significant number of the participants (32%) suggested that teachers should improve their skills, and that the level of technology use should be increased. They underlined that accomplishment of the project's goals would be in jeopardy if teachers could not use the technological devices. P41 indicated as follows:

"If the teachers cannot be trained well in relation to effective use of technology, some problems can arise in the project achieving its goals. I mean, attainment of the goals of the project depends on the teachers."

The participants also pointed out that the necessary training should be provided at college-level, with hands-on practice opportunities. School infrastructure should be satisfactory for supporting the technology, and that the implementation of the project should be enabled equally in every school. Additional suggestions by the participants are:

P23: *"More software support of interactive boards should be ensured, in order for the project to be successful."*

P26: *"Educational software should be provided economically."*

P31: *"Within the scope of implementing the project, inspections should be carried out regularly to determine any problems."*

P49: *"Testing and evaluation systems should be reformed based on the constructivist approach."*

The participants also made mention of certain complaints they had, with respect to implementation of the project. They indicated that the tablet PCs were slow and that the students seated in the back row could not see the interactive board because it was too small. On the basis of their observations, teachers had some problems in relation to technology use and implementation of interactive boards. All in all, most of the participants stated that the project is a necessary one, but that the training teachers were provided with, to implement the project, was not adequate.

Discussion and Conclusion

In the present study, most of the prospective teachers emphasized that they observed technological and pedagogical improvements, and that they used the technology effectively in this process. This is commendable, in terms of having teachers who are open to innovation. However, it was determined that the female participants did not follow technological improvements as much as the male participants. In this respect, teacher educators can play an important role in increasing awareness in female participants with regard to following technological enhancements and improving their use of technology.

The prospective teachers were willing to be better informed about the FATIH Project; they complained that there was not enough information available on the MoNE website. When the MoNE website was examined, it was seen that a short text relating to the goals and justifications of the project was available, but the information did not satisfy those specifically interested in the FATIH Project (MoNE, 2012). Insufficient information dissemination regarding the project was also criticized in a report published by Education Reform Initiative (ERI, 2013). It is significant in terms of attaining the goals of the project that stakeholders are fully informed about the project, specifically those most affected by it. Similarly, Karataş and Sözcü (2013) found that the chief barrier to the success of the project was insufficient information and the experience that teachers and school administrators had.

Some studies (Gürol, Donmuş, & Arslan, 2012; Somyürek, Atasoy, & Özdemir, 2009; Türel, 2012) support the issue of sufficient training for teachers and it was underlined in this project that teachers would benefit from the provision of adequate training. What's more, the need to provide, not only teachers, but also pre-service teachers with adequate training was found in the present study. Çiftçi et al. (2013) underlined that the inadequate training teachers received, concerning implementation of the project, could well be regarded as a disadvantage.

Almost all of the prospective teachers in the current study believed that the project would contribute to the education system positively if the related goals were able to be attained. It was also found that satisfactory outcomes would arise provided that teachers and students fulfilled their responsibilities and received required training, implementation of the project was monitored, experts' opinions were taken into consideration, and adequate time was allowed to realize the goals of the project.

However, the prospective teachers considered that the project was not implemented successfully even in the pilot schools situated in the capital of Turkey. Moreover, the prospective teachers expressed that they had not observed any teachers who used the related technologies in line with its purpose in the pilot schools. Considering the project was not implemented appropriately, even in the capital of Turkey, presents the question of how it can be implemented in underdeveloped regions, rural areas and outer suburbs. Türel (2012) reported that the project was not implemented successfully, even in the pilot schools. These results confirm the claim raised by Güven (2012), who emphasized that it was most probable the project in Turkey would not arrive at a successful conclusion based on the results of different projects carried out in various other countries.

In terms of the advantages of the FATIH project, the prospective teachers did believe that teachers could teach subject matter more easily and effectively through use of the technological tools. In parallel with the issue of effective teaching, Pamuk et al. (2013) emphasized the use of interactive boards. The participants believed that students became much more motivated with the use of technology in the classroom. Interactive boards have been found to help motivate learners in other studies also (Beeland, 2002; Smith et al., 2005). The participants also emphasized that teachers can access information more easily. Starking and Krause (2008) underlined the importance of accessing more information in order to have effective classes. Moreover, an increase in participation levels in the lessons was determined as an advantage by the prospective teachers. This result was supported by some other studies (Çağlar, 2012; Smith et al., 2005). Additionally, better concretization of abstract topics, especially in mathematics lessons, and generally more enjoyable lessons were regarded as other advantages of the project. The study by Türel (2012) has presented similar results.

The prospective teachers considered that it would be easier to teach, and for students to learn, geometry and mathematics topics in which visualization is an important component, and that the project would help students and teachers to save time. Studies by Kurt et al. (2013) and Çoklar and Tercan (2014) support the issue of saving time, however, dealing with switching on computers and the interactive board could lead to time being wasted (Türel, 2012). This leads to the disadvantages of the project. The prospective teachers stated that the teachers had encountered some technical problems and that some teachers did not know how to use computers. The studies (Çiftçi et al., 2013; Gürol et al., 2012; Yılmaz, 2007) supported this result by pointing out the problems encountered. The participants also underlined that students became distracted and did not always use the tablet PCs for instructional purposes. In line with this result, Kurt et al. (2013) pointed out that there are problems relating to distractibility, and irresponsible and irrelevant use of technologies in classrooms. In this study, one of the crucial points continually highlighted by the participants was the importance of teachers having sufficient technical competency and motivation with respect to the project. According to Türel (2012), teachers do not possess technical skills and pedagogical knowledge required, and there exists a lack of materials concerning how to use interactive boards effectively.

Furthermore, almost all the prospective teachers reported that it would not be possible to implement the FATIH Project in the same way in all schools throughout the country, due to socio-economic reasons and teacher and student profiles. This is consistent with the results of technology-based education programs which have been implemented in Texas, USA. According to these results, inequality in the use of technology is generally ongoing in schools where socio-economic status is low (TCER, 2008). Hence, in order to ensure better equality in terms of opportunities in education, the goal should be to reduce or even eliminate the differences among the various schools in regions of the country.

All in all, it should be noted that the prospective teachers will be the new implementers of the project, and their ideas and experience will shape their own attitudes and behaviors in the education process. It is known that teachers' and prospective teachers' performances are constituents of the education system and as such, simply equipping classes with various technologies is not enough. It will be more effective to invest in teachers and the

institutions that engage in teacher education. The present study will contribute to the administrators and implementers of projects similar to the FATIH Project in other countries, in terms of the project's impact on educational environments, problems and suggestions emerging from this process, and the effectiveness of the project on different mathematics and geometry topics, such as solids, mapping, integrals, derivatives, limits, functions, numbers, area and parabola etc.

In light of the results of this study, future studies could investigate why mathematics teachers in schools where the FATIH Project is implemented are not fully utilizing the technological tools and how the problems encountered are affecting mathematics teaching. Further investigation could also be conducted on what kind of training is necessary for teachers in relation to implementation of the FATIH Project, and what can be done to ensure that prospective teachers are able to use such technologies as tablet PCs and interactive boards in an effective way. Additionally, ways of eliminating obstacles to achieving the goals of the FATIH Project could be another topic to examine.

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