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USER PERCEPTIONS OF TECHNOLOGY INTEGRATION IN SCHOOLS: EVIDENCE FROM TURKEY'S FATIH PROJECT

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ABSTRACT

This study aims to provide insights into and evidence on technology integration in Turkish schools, particularly in high schools, through analyzing the effectiveness of the FATIH Project. The primary purpose attempts to determine whether teachers would accept this new technology and the barriers preventing its use. The frequently used technology acceptance model is used as a theoretical framework to highlight the integration process and behavioral aspects of acceptance. The results of the unstructured interviews are presented using tag cloud methodology. The findings reveal that perceived usefulness and perceived ease of use are two key factors affecting the use of technology in the classrooms. The proposed model can be applied to both secondary and higher education institutions; however, the methodology could be improved by including more participants in the focus groups.

Contribution/Originality: The primary contribution of this study is finding that perceived usefulness and ease of use are the main factors affecting the use of technology in the Turkish classroom. The analysis supports previous research on the FATIH Project and adds a new perspective from the viewpoint of technology acceptance .

1. INTRODUCTION

Turkey has been one of the recognized candidate countries for the European Union since 1987. There are some EU acquis that Turkish education authorities ought to embrace, and there have been a number of innovation projects in the Turkish National Education System relevant to the accession negotiations between the EU and Turkey. One project creating radical change in education is the FATIH Project (the Movement to Enhance Opportunities and Improve Technology), which is provided with a large budget and encompasses comprehensive content. This study aims to analyze the five components of the FATIH Project from the viewpoint of teachers, revealed through focus group interviews. Participants comprised 50 teachers from different fields in two selected state schools: one elementary and one vocational high school) in Izmir. These teachers were asked about EBA (Educational Informatics Network), the educational e-content portal created under the FATIH Project, and the Project's five components, including their effective use.

2. RESEARCH QUESTIONS

This study aims to answer the following questions:

Primary question: Is the acceptance of technology under the FATIH Project negatively affected by its incompatibility with the prevalent network systems?

Sub-questions. What are the teachers' perceptions of the usefulness and ease of use of the Project's technology? How can their perceptions be improved to ensure the most effective use of the technology?

3. THE FATIH PROJECT

The FATIH Project, which was started in 2010, aims to provide equal opportunities in education and the use of ICT tools through practical lessons that engage more of the senses; specifically, the end goal is to enhance innovation in schools. Investment has been made to provide PCs and other hardware, and broadband internet in all preschools, and primary and secondary schools. Providing free tablets to all students requires immense funding, and is a bold initiative. Although the Project is innovative, idealistic, as well as technologically advanced, its implementation has been impracticable and unsatisfactory. The Project consists of five main components: the provision of hardware, software, and network infrastructure; the provision and management of educational e-content; the effective use of ICT in the curriculum; the provision of in-service teacher training; and the provision of conscious, safe, manageable, and measurable ICT use.

3.1. Provision of Project Hardware, Software, and Network Infrastructure

The objectives of the first component of the Project are summarized in Table 1:

Table-1. Infrastructure under the FATIH Project.

For each school	For each classroom	For each teacher	For each student
A multifunctional printer	An interactive board	Tablet	Tablet
Network infrastructure	Wired/wireless internet connection	EBA Portal	EBA Portal
High-speed internet access	Classroom management	EBA Market	EBA Market
		E-mail account	E-mail account
		Content creation studio	Digital identity
		Cloud account	Cloud account
		A learning management system (LMS)	Individual learning materials
		Sharing course notes	Sharing homework

Source: Adapted from the FATIH Project, developed by authors (http://fatihprojesi.meb.gov.tr).

The infrastructure services of the FATIH Project started in 2011 as pilot trial, but later became prevalent. The infrastructure involved:

- Building a system control room in each school.
- Installing a secure gateway device in each school.
- Providing an uninterruptible power source for network services.
- Enabling access to offline content from classrooms.
- Providing structured cabling in schools.
- Providing 1 data and 2 electrical sockets in each classroom.
- Linking schools via fiber optic cables.

The operating systems and software on the interactive boards comprised Windows, Pardus, StarBoard, and LibreOffice, while the Android operating system was installed on both teachers' and students' tablets. Thus, the large-scale investment by the Turkish Ministry of National Education in technology-based education is evident. The focus group interviews focused mainly on the actual use of this equipment: the majority of teachers found that they were able to experience and better understand the modern, technological teaching environment through access to digital broadband and interactive boards. The interactive boards are the most frequently used ICT tool by teachers for: problem-solving in a range of lessons; listening activities in foreign language classes; for PowerPoint

presentations to facilitate students' comprehension of a subject; for watching simulated scientific experiments. Teachers in both Izmir schools believed that visualizing the subject facilitates the learning process: an elementary school English teacher said, "My students enjoy listening to English songs and videos in which they can take part. It makes it easier for them to learn the language"; a geography teacher said she found loading her teaching materials onto a flash drive to load on the interactive board more convenient than carrying books and maps to the classroom; history teachers at the vocational high school said, "Students love watching films, so we watch historical films on certain subjects together"; while a math teacher said that although he displayed the questions on the interactive board, due to finding it difficult to write on it, he preferred to work out the answers on a traditional blackboard. In short, interactive boards are being used as computers with big screens, in many respects similar to standard projectors, which reduces interaction. However, interactive boards are designed to be used simultaneously with students' tablets: teachers can open a page on their tablets and display it on the interactive board, and manage which pages are open on the students' tablets. This feature could be of great benefit for both teachers and students; however, during the interviews, the participants declared they rarely used the tablets in their classrooms because it would take up too much time, which reveals teachers' lack of technology literacy. Furthermore, participants stated that the wired/wireless internet connections in schools are not at the required level, resulting in login failures, while the security restrictions created problems.

3.2. Provision and Management of Educational E-Content

The content platform for the FATIH Project in education, the Educational Informatics Network (EBA), is a social–educational online platform managed by the General Directorate of Innovation and Educational Technologies (YEGITEK).

The main objectives of EBA are to: offer diverse, enhanced educational content; generalize the informatics culture to education; meet educational needs with content; enable users to share information through a social network structure, creating an expanding archive of source materials and enabling the continual restructure and reproduction of information for courses; and support teachers in educating students with different learning styles (verbal, aural, visual, mathematical, social, solitary, and aural) by using technology as a tool to find common ground. Thus, EBA could be invaluable to teachers in Turkey; however, focus group participants criticized one particular shortcoming: the lack of appropriate content for each school grade. One teacher said, "Our curriculum is known to the Ministry of Education. Why is the e-content not relevant to it?" and another said, "I try to find videos and presentations by searching under multiple keywords, but the few results means I give up."

Moreover, teachers at the vocational high school highlighted another problem with the materials related to both vocational and general high school subjects: most of the materials and presentations are at the primary and elementary school level. In the main, teachers create and share their materials on EBA voluntarily, but they experience two difficulties: their lack of technological skills and the time-consuming procedures of preparing and uploading content. Teachers tend toward either a traditional approach of adopting low-level innovations in their classrooms or technologically advanced and student-centered teaching practices (Ryan and Bagley, 2015). Unfortunately, the abovementioned challenges prevent the effective use of the FATIH Project's most important components.

EBA not only provides educational materials for lessons but also records students' progress and participation in lessons. Nonetheless, the teachers reported that they only used EBA to search for teaching materials, such as PowerPoint presentations and videos, for displaying on the interactive boards, refraining from simultaneous use with their students' tablets due to "students' increasing interest in their tablets rather than the lesson," leading to difficulty in class management. Furthermore, teachers at both schools reported that the operating systems of the interactive boards and student tablets were sometimes incompatible, hindering integration.

3.3. Effective Use of ICT in the Curriculum

ICT helps students learn better, more efficiently, and enables access to more up-to-date information. It provides flexible and accessible learning opportunities for all, inside and outside the classroom: open educational resources enable learning to happen anytime, anywhere. The Turkish Ministry of National Education's FATIH Project is the most significant attempt to disseminate ICT as an innovation for schools. Although EBA is able to provide materials to students and teachers for more interactive and technological education, the initiatives cannot fulfill its purpose unless all the components are embedded in teaching practice. One physics teacher said, "The curriculum should be changed. If the ICT tools are to be helpful, then the teaching/learning phase should be based on observation." Likewise, a history teacher said, "To transition through the educational levels, students have to enter national exams (TEOG, YGS, and LYS), which consist of multiple-choice questions that depend on memorization." Moreover, teachers, who are aged 45 years and older, tend to resist the use of ICT tools in the classroom; some said they had no e-mail account before receiving their tablets. However, the education system, the innovative projects, and subject curricula must work in partnership to take full advantage of the ICT tools, and student books and resources must be updated accordingly.

3.4. In-Service Teacher Training

In-service teacher training to increase their knowledge of and skills in the conscious use of technology is one of the FATIH Project's most crucial components. Teachers are the ones who will use the technology provided firsthand, but during the focus group interviews, there was a consensus on the lack of practical training sessions despite face-to-face and distant learning (through the LMS). A chemistry teacher at the vocational high school said, "I don't believe the project will be successful if teachers aren't adequately trained," while an elementary school math teacher said, "I have only been teaching with the use of a classic blackboard, pencils, notebooks, and books for 20 years; I can't change the way I teach," views which were common among teachers older than 45. Their attitudes toward technology tend to be negative, not helped by piecemeal training. The majority of the face-to-face training sessions were located in schools other than their own, because the internet connections were not yet established. As a result, these teachers had no opportunity to practice what they had learned and forgot the essentials. Another problem mentioned by the teachers was the incompatibility between the tablets' Android and interactive boards' Windows and Pardus operating systems.

3.5. Provision of Conscious, Safe, Manageable, and Measurable ICT Use

The FATIH Project provides a secure URL and content filtering for internet access: certain Web 2.0 services, such as social networking sites, wikis, podcasts, RSS feeds, and blogs, which facilitate online educational collaboration and sharing, are blocked for learning-related activities. One English teacher said, "It is too secure, making it impossible to access external education links," and was supported by another commenting on the strict measures making internet access problematic. Indeed, the Turkish Ministry of National Education uses many security measures, supplied by Fortinet Web Application Security, which uses information based on the latest application vulnerabilities, bots, suspicious URL and data-type patterns, and specialized heuristic detection engines, to safeguard applications from malware threats. Whether a website is deemed secure depends on its categorization: a Biology teacher said, "I can't even open YouTube pages," due to YouTube being categorized as a streaming media and download website and blocked by Fortinet.

4. JUSTIFICATION FOR THE METHODOLOGY

Of the various approaches that could be taken to the effects of information technology in education, this study adopts the technology acceptance model (TAM; Davis, 1989). Contributions from the TAM literature are therefore included, particularly with regard to the conceptualization and operationalization of IT strategies, as well as the

potential causative links between TAM and its outcomes. This model was chosen due to its extensive use in recent studies: between 1991 and 2019, over 9000 research studies have been conducted, with more than 500 including the phrase "technology acceptance model" in the title, and 1018 within education. Several other models have been developed to investigate and understand the factors affecting the acceptance of technology, but none more appropriate for this study (Wang, 2013).

TAM explains the connections between an individual's motivation and their perceptions, tendencies, intentions, and behaviors in relation to accepting information technology. It is a theory that measures the desires and intentions of users to use technology based on three basic factors:

1. Perceived usefulness (PU).
2. Perceived ease of use (PEU).
3. Behavioral intention (BI).

TAM suggests that perceived usefulness and perceived ease of use determine an individual's behavioral intention, and are thus important variables in their intentions toward using technology. In fact, various researchers have empirically proved the effectiveness of these two variables in measuring individual intentions toward using technology. While Davis defined perceived usefulness as the perception of and tendency for improving their job performance by using technology, perceived ease of use referred to being able to learn and utilize certain ICT tools without difficulty. Therefore, perceived ease of use is related to improved job performance through the use of technology to complete certain tasks and solve problems (Ma et al., 2005). TAM asserts that behavioral intention is the primary factor determining whether an individual will accept and actually use technology; in other words, it plays a significant role in their tendency toward using technology. Likewise, an individual's perceptions of the usefulness and ease of use of ICT tools are also important to their tendency to use these tools. Overall, an individual's behavioral intention is indirectly affected by their perceptions of usefulness and ease of use, which are based on their tendency toward using technology. Davis described perceived usefulness and ease of use as belief sets that are readily generalizable to different computer systems and user populations as determinants of technology acceptance (Davis, 1993), and the TAM model has been widely used in many studies on both higher and secondary education worldwide (Al Masarweh, 2019; Binyamin et al., 2019; Nuankaew et al., 2019). Consequently, this study adapted the TAM model for the purpose of identifying potential improvements for the FATIH Project (Figure 1).
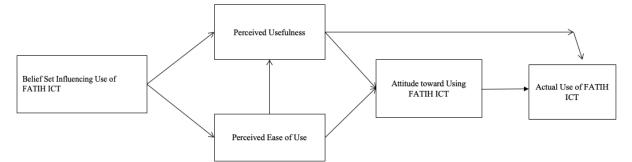

Figure-1. Adapted TAM for improving use of FATIH technology.

5. METHODOLOGY

Data was collected from the four focus group interviews with participating teachers, then examined using content analysis and categorized according to the purposes of this study. In addition, systematic literature searches were conducted on the Web of Science, EBSCOhost, and ERIC specialized databases, as well as Google Scholar and the European Commission database. Despite the growing research, the role of affordable, everyday technologies in supporting EBA has received less attention than other dedicated e-learning tools such as discussion forums and videoconferencing. Table 2 summarizes the previous studies conducted on the usability of the FATIH ICT tools in the classroom; it is evident that the majority have adopted descriptive and qualitative analysis methods.

Table-2. Previous research on the FATIH Project.

Author(s) and publication date	Title	Methodology
Cağlar (2012)	The Integration of Innovative New Media Technologies into Education: The FATIH Project in Turkey and IISTE's Teacher Standards	Statistical Analysis
Ciftçi et al. (2013)	The Opinions of Classroom Teachers about the FATIH Project	Descriptive Analysis
Ekici and Yılmaz (2013)	An Evaluation on the FATIH Project	Descriptive Analysis
Karal et al. (2013)	Assessment of Opinions for the FATIH Project: Reliability and Validity Study	Qualitative & Quantitative Analysis
Kiranli and Yildirim (2013)	Technology Usage Competencies of Teachers: Prior to FATIH Project Implementation	Quantitative Analysis
Kurt et al. (2013)	Evaluation of the Pilot Implementation Process of the FATIH Project: Teachers' Opinions	Descriptive Analysis
Ali and Yildirim (2015)	Investigation of the FATIH Project within the Scope of Teachers, School Administrators and YEGITEK Administrators' Opinions: A Multiple Case Study	Content Analysis
Baz (2015)	Educational Teacher Trainers' Professional and Personal Sense of the FATIH Project	Descriptive Analysis

6. FOCUS GROUP INTERVIEWS AND RESULTS

We conducted focus groups with high school teachers to assess their opinions on the usability of the FATIH Project's ICT tools. Table 3 summarizes the focus group demographics:

Table-3. Demographics of the participants.

Criteria	Demographics
Age	30–50
Gender	60% Female, 40% Male
Years of experience	8–30

See Table 4 for a summary of some sample questions and answers from the interviews.

Table-4. Sample questions and answers from the interviews.

Sample questions	Sample answers
Do you believe that the FATIH Project will improve your performance as a teacher?	In terms of modernizing our teaching practices, it is a positive step forward. If it happens, I believe it will improve my performance. (Math Teacher, 50 years old.)
Do you believe the Project will make the teaching and learning process easier?	I don't find the Project either useful or necessary. Without having a solid infrastructure, the students will not benefit from it. (Literature Teacher, 45 years old.)
Do you believe that you need training before starting to use this technology?	The Project will only be successful if the teachers and students receive the proper training first. (Chemistry Teacher, 43 years old.)
What are the main problems with the technology?	The system is not user-friendly. I don't believe it will make teaching easier; on the contrary, it will create an additional burden. (Biology Teacher, 35 years old.)
What is your attitude toward using this technology in the classroom?	I believe the teacher and the curriculum are most important in teaching and learning; technology has nothing to do with it. (English Teacher, 60 years old.)
What do you think are the benefits of the technology for the students?	They're having fun while watching the simulations or videos about the subjects they can't visualize without seeing them. It speeds up the learning process. (Geography Teacher, 40 years old.)

A tag cloud visually represents text data, depicting keyword metadata from free-form text, according to the frequency, significance, and category of words expressed in the interviews. This method was therefore used to highlight important findings from the interviews, and helped address the problems found during the research. The tag cloud was arranged in line with the visual taxonomy based on a number of attributes, such as context, shape, and alignment, depending on a word's level of importance. The tag cloud was developed using WordArt to control the aesthetics and construct a two-dimensional layout. Figure 2 represents the results of the tag cloud methodology.

Figure-2. Tag cloud metadata description.

7. CONCLUSIONS AND LIMITATIONS

Despite the conclusions drawn on the relationship between acceptance of technology and use of EBA, there are certain limitations to this empirical research study with regard to theoretical questions and methodological issues. In terms of data collection, participants' opinions may have been better conceptualized through more questions and the conclusions made more definitive if the study had covered a longer period. For future research, quantitative methods, such as structural equation modeling and statistical approaches, should be employed. As the FATIH Project and EBA are new innovations, both high and elementary schools will benefit from the findings of this study: Despite the technical inadequacies, both students and teachers are in favor of the FATIH Project, considering it as developing their teaching/learning environment and a role model for other countries.

The opportunities offered by affordable, everyday technologies for improving EBA in high school classrooms and beyond cannot be ignored. Taking into account that technological devices, such as tablets and smartphones, and social media have provided a means for social interaction and communication around shared interests, their potential in educational settings is immeasurable. It is hoped that this study will serve as the basis, or at least the motivation, for future investigations into technology-enhanced learning, which could contribute to a methodological framework for its design and implementation.

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