



**PRIORITY ISSUES IN THE INITIALIZATION OF TABLET PC PROJECTS
FOR EDUCATION**

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FEBRUARY 2016

**PRIORITY ISSUES IN THE INITIALIZATION OF TABLET PC PROJECTS
FOR EDUCATION**

**A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED
SCIENCES OF
ÇANKAYA UNIVERSITY**

**BY
TUNCAY ELVANAĞAÇ**

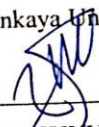
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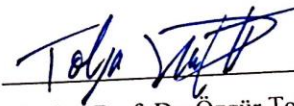
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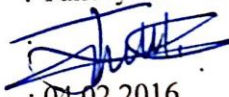






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ABSTRACT

PRIORITY ISSUES IN THE INITIALIZATION OF TABLET PC PROJECTS FOR EDUCATION

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Instances and results of tablet PC usage in the area of education are investigated in this study. In relation, challenges faced/to be faced with the FATİH Project of Turkey are evaluated. The viability and the effects of using tablet PCs in education and related examples in the world are studied. Additionally, integration of tablet PCs into the field of education and problems that have arisen were studied as far as they are reported in the literature.

It is found that the use of tablet PCs in education increases the motivation and attendance of the students. However, required components, including teacher training, planning issues, student training, classroom management software, e-content, infrastructure and addressing technical problems are not always fulfilled; moreover, such an initiative may create distraction for the students. It is significant that tablet PC projects should be subject to pilot applications before applying them across the country so that the results can be analyzed by experts in depth. It is found that society's e-readiness plays an important role in the success of such programs. Furthermore, the components of the FATİH Project are investigated and related abstract experience is reported.

Limitations of the study include the financial and legal aspects of such projects. Additionally, up-to-date data on how much tablets promote the education of the students is considerably hard to find, as the initiative is quite new.

It is concluded that tablet PCs may not replace the printed materials fully, however, they promise to have positive effects in education, such as in the individual learning pace.

Keywords: Tablet PC, Tablet-Based Education, E-content, Interactive Classes, FATIİ Project, Engagement, Technology Adoption, Classroom Management Software

ÖZ

EĞİTİMDE TABLET BİLGİSAYAR PROJESİ GİRİŞİMLERİNDE ÖNCELİKLİ SORUNLAR

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Bu çalışmada, tablet bilgisayarların eğitimde kullanım örnekleri ve sonuçları araştırılmıştır. Bu bağlamda, Türkiye’de FATİH projesiyle karşılaşılacak/ karşılaşılan zorluklar değerlendirilmiştir. Tablet bilgisayarların eğitimde kullanımının uygulanabilirliği, etkileri ve dünyadaki örneklerine bu çalışmada yer verilmiştir. Ayrıca tabletlerin eğitime entegrasyonu ve bununla birlikte ortaya çıkabilecek sorunlar literatüre yansıyan yönüyle araştırılmıştır.

Tabletlerin öğrenci devamlılığını ve derslerdeki motivasyonu artırdığı tespit edilmiştir. Diğer yandan, öğretmen ve öğrenci eğitimleri, toplumdaki algı, ders öncesi planlama, sınıf yönetim yazılımı, e-içerik, fiziki altyapı, teknik problemlerin çözümü gibi konular dikkatle ele alınmadığı zaman, tabletler dikkat dağıtıcı bir unsura dönüşebilmektedir. Ülke çapında uygulanacak olan tablet projelerinde, projeyi uygulamadan önce pilot uygulamaların yapılması oldukça önemlidir. Böylece uzmanlarca pilot uygulama sonuçları derinlemesine değerlendirilebilir. Öte yandan toplumun e-hazırbulunuşluk düzeyinin de bu tür projelerin başarısı için önemli olduğu belirlenmiştir. Aynı zamanda, FATİH projesinin bileşenleri incelenmiş ve elde edilen deneyimler ve gözlemler aktarılmıştır.

Finansal ve kanuni mevzular bu tezde araştırma dışında tutulmuştur. Diğer taraftan, proje oldukça yeni olduğu için tabletlerin öğrencilerin akademik başarısı üzerindeki etkilerine ait yeterli veriye ulaşmak oldukça güçtür.

Sonuç olarak, tabletlerin tamamen basılı materyallerin yerini alabileceğini söyleyemeyiz; ancak bahsi geçen ön şartlar sağlandığında tabletlerin eğitimde pozitif etki yapabileceği ve öğrencilerin bireysel öğrenme hızlarını destekleyebileceğini ifade edebiliriz.

Anahtar Sözcükler: Tablet Bilgisayar, Tablet Temelli Eğitim, E-içerik, Etkileşimli Dersler, FATİH Projesi, Öğrenci-Okul Bağı, Teknoloji Adaptasyonu, Sınıf Yönetim Yazılımları

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LIST OF ABBREVIATIONS

BYOD	Bring Your Own Device
BYOT	Bring Your Own Tablet
CMS	Classroom Management Software
DP	Digital Pen
EAL	Evaluation Assurance Level
EBA	Eğitim Bilişim Ağı
ELT	English Language Teaching
FATİH	Fırsatları Artırma Teknolojiyi İyileştirme Hareketi
ICT	Information and Communication Technologies
IWB	Interactive White Board
ISP	Internet Service Provider
LAN	Local Area Network
OLPC	One Laptop Per Child
OTPC	One Tablet Per Child
OS	Operating System
PAN	Personal Area Network
PC	Personal Computer
TAM	Technology Acceptance Model
USB	Universal Serial Bus
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network
Wi-fi	Wireless fidelity

CHAPTER 1

INTRODUCTION

Technology and Internet use has increased among young children in recent years with the emergence of mobile devices. These devices which attract the children have stimulated governments into initializing tablet PC-supported or tablet PC-based education projects in places such as Turkey, Thailand and South Korea.

We are motivated by the fact that engaging the students, decreasing dropout rates and accessing the information from deprived regions are priority problems for many countries. We focused on dimensions of tablet PC projects, problems liable to be arising and measures to be taken with the widespread use of tablet PCs in schools. Also we plan to investigate the essential components of tablet PC projects such as adoption, e-content/material, validation of the project, engagement-distraction issues, mobile device management and furthermore the social and technical analysis of the tablet PC projects are investigated. At the same time, the researcher is an ICT teacher in a local secondary school and related to this work is a big tablet PC Project called FATIH. Thus, the researcher has observations regarding the progress of the project.

We limited the scope with contributions and drawbacks of the use of tablet PCs in education. In addition, e-content development and accessing to e-content issues are compared between Turkey and the rest of the world. On the other hand, challenges faced by the FATIH Project were handled. End-user devices, classroom management software, e-content, engagement-distraction, adoption, user training, EBA and FATIH Project subjects are reviewed.

To this end, we propose to present all aspects of tablet PC projects in education. Our research shows that the use of the tablet PC in education spreads over the countries. With the widespread use of tablet PCs in education, some problems may arise both

before implementing the project and in the implementation stage. So we focused especially on some issues to be considered and also on what guides decision makers regarding education technology initiatives. According to our findings, an e-readiness level of society has a strongly effective role on the success of the educational tablet PC project. On the other side, the society's habits can influence the adoption of new technology such as tablets. For that reason, demographic structure and the e-readiness level of the country play a significant role in the efficient use of tablet PCs in education.

As our research, one of the main components of the tablet PC projects is e-content/material. The quality of e-content influences the success of the project. In addition, sharing the content and managing the students' tablet PCs are other significant issues. In order to share content and provide efficient classroom management, it should be planned that the stability of the software to be used for managing the devices in the classroom is suitable. Thus, the distraction problems may be lessened.

The importance of user training is revealed and the need of technical personnel is determined in response to problems when using the tablet PCs. On the other hand, infrastructure is a considerable dimension of the tablet PC projects. Lack of infrastructure and problems that arise in the implementation stage decrease the motivation of the teachers. Unlike teachers, the students' motivation increases even though they encounter some technical problems.

The challenges of a huge educational technology project which is spreading throughout the country, such as the FATİH Project, were presented. We found out that there may be a technology gap in some regions and the lack of a pilot project in Turkey.

Within the scope of our thesis while investigating on the goals of this thesis, we aimed to find answers to the following research questions.

Research Questions

The research questions to be answered were:

- What are the main challenges of teaching with tablets?
- Do the tablets promote education in secondary schools?

- If a big tablet initiative is to be implemented in education then what are the essential components and what are the potential challenges to consider?

Outline of the Thesis

This study consists of six chapters and, put briefly, each of them has the following content:

Chapter 2 aims to give information about tablet PCs, their use in education circles, the structure of the mobile-device based education, and the advantages and disadvantages of tablet PCs. In addition it gives brief information about the FATIH Project and the EBA Portal in Turkey.

Chapter 3 includes a literature review on the educational use of tablet PCs, arising challenges in the use of tablet PCs in education, and motivation reasons for using tablet PCs. On the other hand, studies on educational tablet PC usage in the world are overviewed.

Chapter 4 explains the features of e-content and the importance of quality e-content with regard to efficient tablet use in education.

Chapter 5 consists of questions and answers from an interview with an anonymous informant. Received in this way is some information regarding the FATIH project and the EBA e-content portal. In addition, answers taken are discussed in the context of the findings.

Chapter 6 presents the findings regarding the study. This chapter gives the results of the study with a discussion of all the study, and includes some contributions from the countries planning to initialize a similar project in the future.

CHAPTER 2

BACKGROUND

Mankind develops every day and deals with developing new technologies in order to simplify life. Emerging technologies facilitate our life relatively and we can do our work more easily and quickly through the use of these emerging technologies. In addition, almost every technological device gets smaller compared to those from the past. Thus we can carry them and use them wherever we want. This portability provides us with many opportunities in many fields, such as in health, education and business.

When we narrow our scope to education technologies, we see that the tablet use in education has been increasing considerably especially in recent years. There are numerous reasons for this trend. Portability and functionality are two of these. Moreover the evolution of these mobile technologies encourages the educators to use them in the education process. This is especially due to the facts that tablet PCs are now affordable, more functional, and portable than they were, and also because users can use their own handwriting on them, for which reason they are considerably preferred in educational settings. These features have made the tablet PCs attractive for the instructors and all those involved in educational circles. Today there are various tablet brands on the market. While there are many tablet brands, the prominent ones are Samsung and Apple's tablet PCs, as seen on Figure 1.

Vendor	Unit Shipments -2014	Market Share - 2014	Unit Shipments -2013	Market Share - 2013	Year-over-Year Growth
1. Apple	21.4	28.1%	26.0	33.1%	-17.8%
2. Samsung	11.0	14.5%	13.5	17.2%	-18.4%
3. Lenovo	3.7	4.8%	3.4	4.3%	9.1%
4. ASUS	3.0	4.0%	4.0	5.1%	-24.9%
5. Amazon.com	1.7	2.3%	5.8	7.4%	-69.9%
Others	35.2	46.2%	25.8	32.8%	36.2%
Total	76.1	100.0%	78.6	100.0%	-3.2%

Figure 1: Top Five Tablet Vendors, 4 Quarter 2013/2014 (Shipments in millions)

This chart shows which tablet brands are leader of the market. IDC, 2015

It is beneficial to have a brief glance to the history of tablets

The first tablet PC on the market was announced by the Microsoft Corporation in 2001. This generation of Microsoft tablet PCs was designed to run Windows XP tablet PC Edition, the tablet PC version of Windows XP [5]. Although this date is relatively old, many people became familiar with tablet PCs in 2010, because of Steve Jobs’s iPad. This was because he created a new operating system (OS) for tablet PCs, instead of trying to adapt old operating systems for use with tablet PCs. Thus tablet PCs became more stable and had a long battery life. Today many OS and tablet brands are available. While ‘touch screen technology’ develops, in addition some firms have developed ‘pen technology’ that makes it easy to use the tablet PCs, beside them being touch screen. According to the Forrester Report, it was forecast that tablet sales would exceed those of notebook PC sales in 2015.

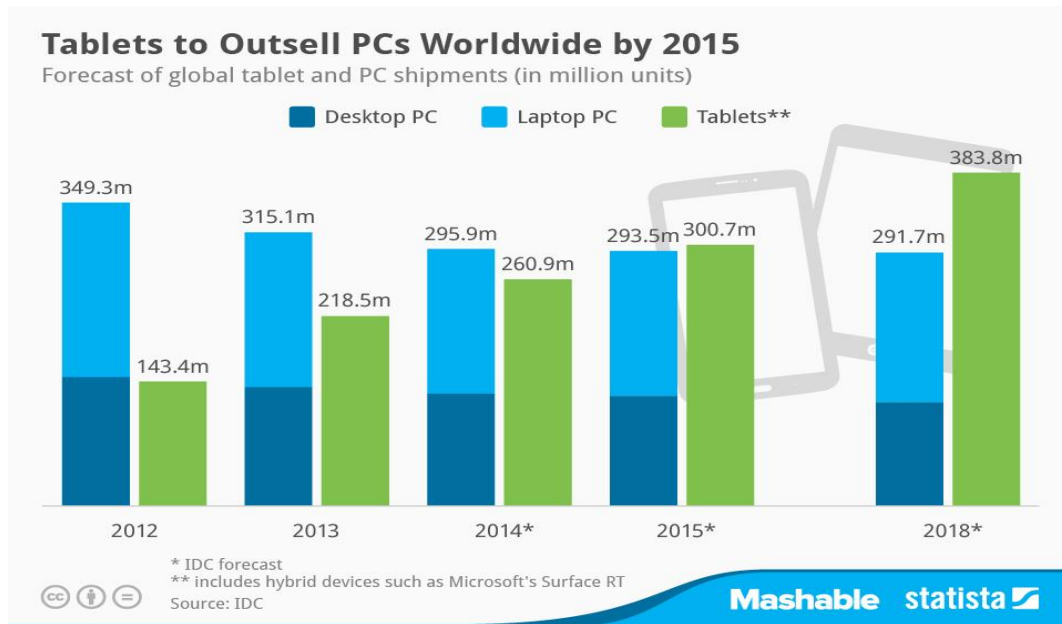


Figure 2: Tablets to Outsell PCs Worldwide by 2015

This chart shows how tablet PCs shipments are expected to overtake PC shipments for the first time in 2015.

According to Figure 2, tablet PC shipments outsell the sum total of desktop and laptop sales. Today people use tablet PCs in many fields such as banking operations, e-commerce, education, medicine, navigation, reading books, taking pictures and watching videos. However tablet PCs have some advantages over desktop computers or laptops, namely: portability, affordability, short battery charging time and longer battery life. One of the most important features of the tablet PCs is their ability to transform handwriting to a digital form of text. Thus, tablet PCs allow you to see the user's handwriting in an electronic form [65]. Tablet PCs generally allow the user a 'digital pen' and this pen has a similar function to that of a mouse, so that click and marking features can be applied with this pen [29].

The tablet PCs were known and started to be used intensely in 2010 when Apple announced the arrival of the iPad [29]. The iPad has some different features in comparison to other tablet PCs. It has a user-friendly interface and uncommon stability. The Apple iOS caters for users using only fingers without even having a keyboard. On the other hand, iPads do not support flash player. This caused the emergence of the different type of web solutions such as jquery and wallaby. Unlike the iOS, android

supports flash-based contents and users may view the content on the Internet. High resolution and stability of iPads also attract the users today.

The second significant dimension of tablet PCs is OS. There are four big OS manufacturers (Apple – Mac OS, Google – Android OS, Microsoft Windows OS, and Amazon – Fire OS).

Period	Android	iOS	Windows Phone
Q1 2015	78.0%	18.3%	2.7%
Q1 2014	81.2%	15.2%	2.5%
Q1 2013	75.5%	16.9%	3.2%
Q1 2012	59.2%	22.9%	2.0%

Figure 3: Worldwide smartphone market share (Source: IDC, May 2015).

It is clearly visible from Figure 3 that the Android OS is selected by the majority, because it is open source and developed every day by users as well but the others have closed source code. However Android applications are developed more commonly and are generally free. IOS can be used only on Apple mobile devices.

On the other hand, educational tablet PCs are available on the market. Around 500 schools across Britain have pushed the use of iPads into their education [88]. As seen in Figure 3, in the younger age ranges, tablet use is very common, so parents and educators desire to canalize this motivation to educational applications on the tablet PCs. In this context, some tablet PCs which include only educational applications, games, and filtered Internet are emerging. On the other hand, according to some studies, these types of tablet PCs have limited features and the children cannot have all the potential benefits of tablet PCs. But recently some tablet PC giants announced educational tablet PCs with various features. One of them is ‘Samsung Galaxy Tab 4 Education’. This tablet PC offers some additional applications regarding teaching and learning activities and classroom management.

	2-5	6-9	10-12	13-17
Mobile Phone				
Own	1%	14%	46%	84%
Use	37%	47%	71%	94%
tablet				
Own	33%	46%	57%	42%
Use	71%	83%	80%	65%

Figure 4: (Source: Communicus, July 2014) – US Children and Teens Who Own vs. Use a Mobile Phone or tablet, by Age.

As indicated in Figure 4, half of school-age students possess tablet PCs, on the other hand 80 per cent of them use a tablet PC in other areas of their lives. Tablet PCs today offers numerous features such as pen supported, multi window, wide screen and transforming the user’s handwriting to digital text, besides being affordable. The pen is used for handwriting on the tablet device and some tablet PCs can also transform this handwriting to digital text. The multi window feature provides users with the facility to display two screens simultaneously, and to perform two operations at the same time. These devices can connect to the Internet via wireless or cellular networks. The new generation tablet PCs have some other features such as long battery life, fast recharge and connecting keyboard and mouse. Unlike desktop computers, mobile devices do not need more hardware such as keyboard, mouse and cables and they need less electric power, which enables mobile devices to be distributed widely and to be more simple and deployable than desktop computers, especially in deprived and remote areas [6].

Some features of the tablet PCs;



Figure 5. Some tablet PCs in different sizes on the market

The sizes as seen in Figure 5, varying between 7 and 12 inches such as 7", 9.7", 10.1", 7.7", 8.9" in the majority of models, are suitable for using in the palm of the hand. In 2014, the weight of the main models on the market ranged from between 230 grams, in the lighter models, and 960 grams in the heavier ones, with the average around 450 grams [7]. However, another important aspect of the tablet PCs is their resolution. There are a variety of screen densities such as: 1280x800 pixel, 1024x600, 1024x768, 2048x1536, 800x480, 768x1280. The weight is also very important for carrying a device easily. Processing, storage and memory capabilities vary significantly between brands and between models of each brand [10].

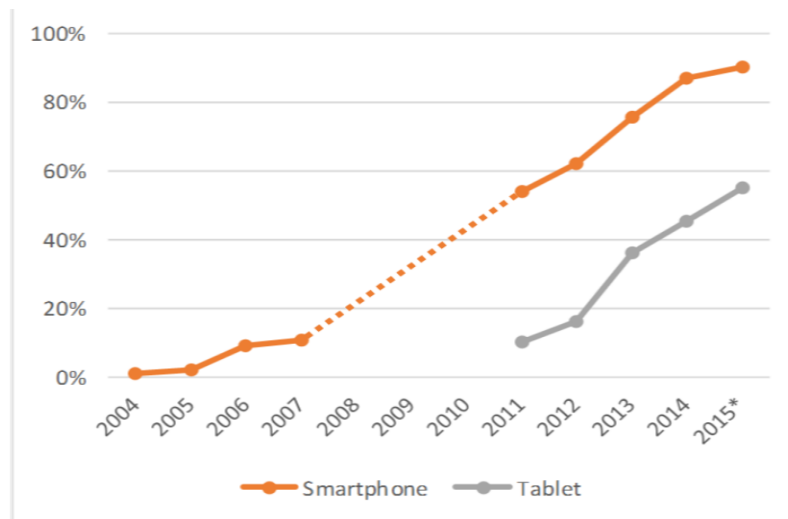


Figure 6: Device ownership across all institutions in the ECAR Survey.

Figure 6 shows that there are substantially common tablet usage among institutions and schools. Governments in multiple countries have eagerly commissioned research and trials to use tablet PCs in schools as a national project to enhance educational environments [11]. Thus education circles study how to use this potential in education and many countries initialize big tablet-deploying projects. Some countries distribute tablet PCs requesting a fee and some have no charge. One of the most important reasons in deploying tablet PCs to students is to provide a single type of OS, which prevents the inconsistency between tablet PCs. “It is especially so for a Bring Your Own Tablet (BYOT) program where added complications such as lack of control over devices and a

multitude of different hardware and software packages increases the complexity in creating an infrastructure to support different student technologies.” [12].

As the ECAR survey shows, students responded to the questions about how important it is to complete particular tasks on tablet PCs on a scale of 1 to 5 in Table 1.

Mobile Device Tasks	UW	Peer Institutions
Communicate with other students about class-related matters outside of class	3.93	3.90
Look up information while in class	3.56	3.54
Check grades	3.47	3.73
Accessing information about events, etc.	3.36	3.37
Registering for Courses	3.18	2.97
Use the CMS/LMS	3.10	3.57
Capture static images of in-class activities	3.08	3.06
Read e-texts	3.04	3.07
Access to library resources	2.77	2.82
Use as Digital Passport	2.60	2.73
Participate in class activities	2.58	2.85
Record lecture or in-class activities	2.47	2.53

Table 1. Importance of completing particular tasks on tablet PCs on a scale of 1 to 5

According to Table 1, the survey indicates that the students prefer to use tablet PCs for communicating with other students about class-related matters and looking up information, while in class in addition checking grades is also popular.

2.1 FATIH Project in Turkey

“Movement of Enhancing Opportunities and Improving Technology”, known as FATIH, is amongst the most significant educational investments of Turkey [13]. The FATIH Project in Turkey includes deploying a tablet per child and per teacher except for undergraduate and primary school students, who also have an interactive white board

(IWB) per classroom and network system to all schools for no charge [38]. This network includes a high speed Internet connection and it is aimed to connect all tablet PCs to each other. Also the teacher is able to control all students over the tablet PCs. These are the infrastructure dimensions of the project. IWB is a 65" device that has a touchscreen and is integrated with an embedded computer. It can be connected to an external device which can be controlled via touchscreen. In addition, IWBs come with an application in order to edit images and draw things. At the same time it has a stylus pen to draw and a remote control for shutting down/opening and choosing the source of device. In this study, we focused on tablets mostly.

On the other hand, the government proposes to provide equal opportunities to all students. Thus they initialized the FATIH Project in order to overcome some technological issues and regional differences in schools. There are five components of the project that have been determined by the project implementers, as following:

1. Installation of Hardware and Software Infrastructure
2. Creation and Running of educational e-materials
3. Efficient use of IT in the Education Programs
4. In-service Training of the teachers
5. Attentive, Safe, Manageable and Measurable IT use

The Project is run by the Ministry of Education and is also supported by the Ministry of Transport, Maritime Affairs and Communications. It started in 2011 by being applied in 52 pilot schools and was planned to finish in 4 years in regions around Turkey; however, this is revised to 2018 [89], recently.

Pilot applications have been implemented in some experimental groups and different regions for evaluating the result of the technology use among people. If the result is positive (encouraging an increase of academic level, efficient learning, collaborative learning, and an increase in student attendance), the project can be spread out across the country. In some cases, although the project can be successful even in one region, it may not able to be successful for another region. It is possible to say that the FATIH Project has a pilot application gap. According to our observations, without

waiting for the result of the FATIH Pilot scheme, it was passed to the implementation stage.

In the FATIH Project's scope, was established a web portal called EBA. This stands for the Education and Information Technologies Network. This portal provides e-contents such as z-books, videos, images, presentations, documents for tablet PCs and interactive boards. Also it was established as an application market for tablet PCs and Interactive Boards. Thus it is proposed to provide content which is suitable for students' level, filtered by authorities and confidential for the students and teachers [14].

	Network Infrastructure Document Reader Photocopier	Tablet PC	Interactive Board
Students		10,800,000	
Teachers		880,000	
Classrooms			607,098
Schools	60,165		
Total	60,165	11,680,000	607,098

Table 2. FATIH Project Figures Planned to Be Completed in 2018.

The Turkish government allocated 803 million Turkish liras for the FATIH Project in 2012, 1.4 billion Turkish liras in 2013 and it is planned to spend in total, 8 billion Turkish liras for the project, as indicated in Table 2 [83].

As informed in [90], the project is almost 10 per cent complete. On the other hand, the number of the tablet PCs distributed to students is about 1.5 million. It is estimated to deploy about 12 million tablet PCs totally. It had been announced that the project would be complete by 2015. This date has been updated to be 2018 at the time of writing this thesis.

2.2 EBA (Education and Information Technologies Network) Portal

The EBA was established for providing e-content to FATIH Project tablet PCs and Interactive White Boards (IWB) in 2012. It is an online platform that is conducted by Innovation and Education Technologies Management.

The aim of the platform is that it continues to be developed in order to provide appropriate support for all grade levels, and to have reliable and accurate e-contents [15].

This portal presents some additional services. For example, the students and teachers can upload some materials to EBA. In addition, a variety of digital education firms contribute to this web portal by sharing their sources. Thus, it is proposed to create a resource pool and to offer this opportunity to anyone who is willing to learn.

The EBA e-content portal includes many modules, such as educational news, world module, e-book, video module, sound module, visual module and debate module. In these modules, you can find many experiments, educational games, crosswords and presentations.

The EBA Market is another dimension of this portal. It is not allowed to install applications from the Android Market to the tablet PCs that are deployed in the scope of the FATIH Project. That is why the students and teachers can just install applications through the EBA Market. The EBA Market was developed specifically for FATIH Project tablet PCs. There are many educational applications, games and so on, as seen in Figure 7.

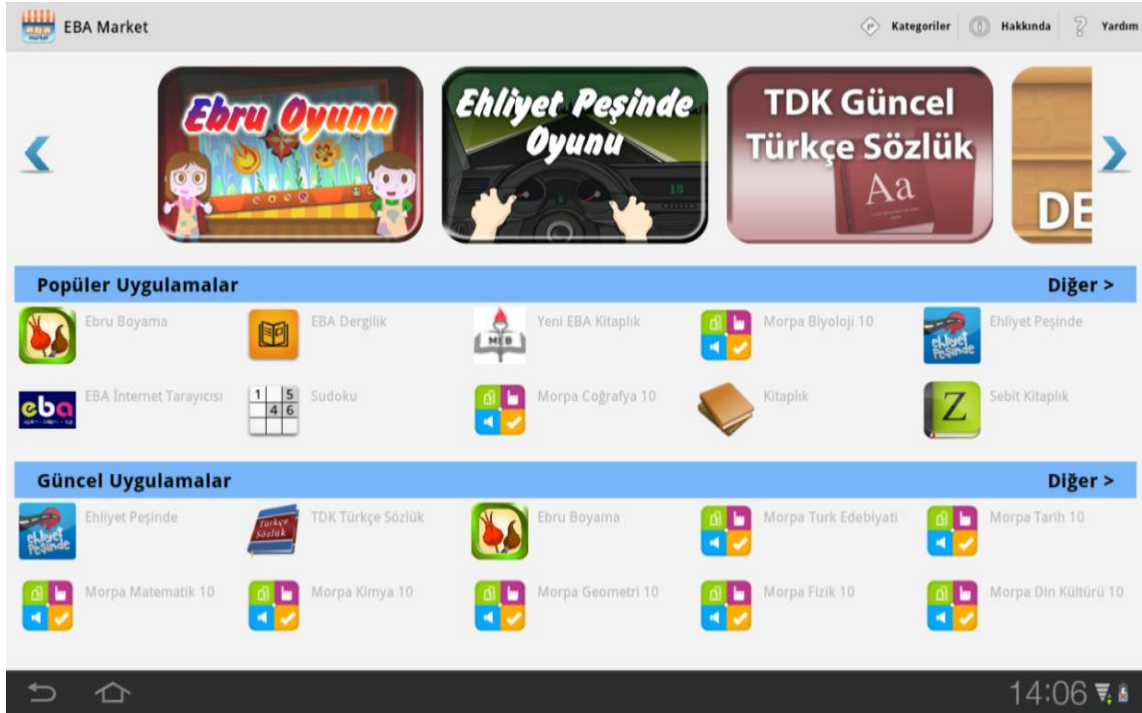


Figure 7. Screenshot from EBA Market

2.3 Network Infrastructure

Big tablet PC projects such as FATİH may need intense Internet connectivity. When all the tablet PCs are online in a school simultaneously, it may cause Internet connection challenges. Internet service providers (ISPs) are expected to provide high speed Internet data transfer and network infrastructure for delivering the signal connections to tablet PCs. When millions of students and thousands of teachers may be using the video and audio files at the same time, the Internet infrastructure should function perfectly. For that reason, WAN (Wireless Area Network) and LAN (Local Area Network) are important factors in order to provide a sufficiently fast speed Internet connectivity to all tablet PCs in a school.



Figure 8: LAN and WAN architectures

Tablet PCs may connect to a wireless network directly (WLAN). WLAN is also known as Wi-fi. By this method, the connection can be provided between different Internet access points. Almost all tablet PCs have the Bluetooth feature to facilitate information exchange. Without the Internet and network connection, the tablet PCs can communicate over Personal Area Network (PAN) or Wireless Personal Area Network (WPAN) and it can make file transfer or connection through Bluetooth protocol. There are 3G- and 4G-supported or Wi-fi-only models of the tablet PCs on the market. Also, users can make phone calls through 3/4G-supported mobile devices.

A WAN is a network that covers a broad area (i.e., any telecommunications network that links across metropolitan, regional, national or international boundaries) using leased telecommunication lines [16]. WAN, multiple servers can be used in different geographic locations to serve the same information set to users [17]. WAN is slower than LAN, because WAN can be used by millions of users at the same time, however LAN consists of less user and closer devices [10]. WAN and LAN architectures are shown in Figure 8.

A LAN is a computer network that interconnects computers within a limited area such as a home, school, computer laboratory, or office building, using network media [18]. LAN networks can be established not only by using cables but also wirelessly.

On the other hand, the Internet data transfer speed in a school is important for uninterrupted connection while using tablet PCs. Today there are some data transfer speeds from 1 mbps (mega bit per second) to 10,000 mbps. 100 mbps Internet data transfer speed is suitable for a school which has 1,000 students. A 100 mbps Internet connection speed means an almost 12.5 mb (megabyte) download speed.

2.4 Classroom Management Software (CMS)

CMS that handles the electronic management of the classroom as well as nationwide, crosses many fields of research including sociology, software engineering and information systems. We limited our research on classroom management, which refers to the wide variety of skills and techniques that teachers use to keep students organized, orderly, focused, attentive, on task, and academically productive during a class [90]. Perfect classroom management is not making the students stay silent, promoting cooperation between the students, and providing students with a rich learning environment. Furthermore, classroom management is an effective way to improve the quality of teaching [19]. The recent popularity of tablet PCs (e.g. the Android-based Galaxy Tab or the iOS-based iPad), which are portable and easily distributable, has created newly imagined possibilities and challenges for teachers in the classroom [11]. The technology sometimes can make it difficult to control students in the classroom. With the use of tablet PCs in a classroom, the students face many distractions on these devices. In order to minimize these problems, there is a variety of classroom management software (CMS) on the market such as NetSupport, Netop School, LanSchool, Gradelink and ProClass. This software helps teachers to conduct the classroom, from remotely running some applications on all student tablet PCs, as well as delivering documents and lesson resources to the class. In addition, whenever the teacher wants to freeze the tablet PC belonging to a student, he can do it. Also the software provided to launch the websites, redirects all students to the same webpage and mirrors the students' screen to IWB. Tracking student activity, setting tests quickly and getting the results instantly, monitoring student progress, making offline all students

simultaneously and monitoring the battery lives of tablet PCs are some of the other benefits of the CMS.

A smart classroom sample is drawn in Figure 9, as administrated by CMS.

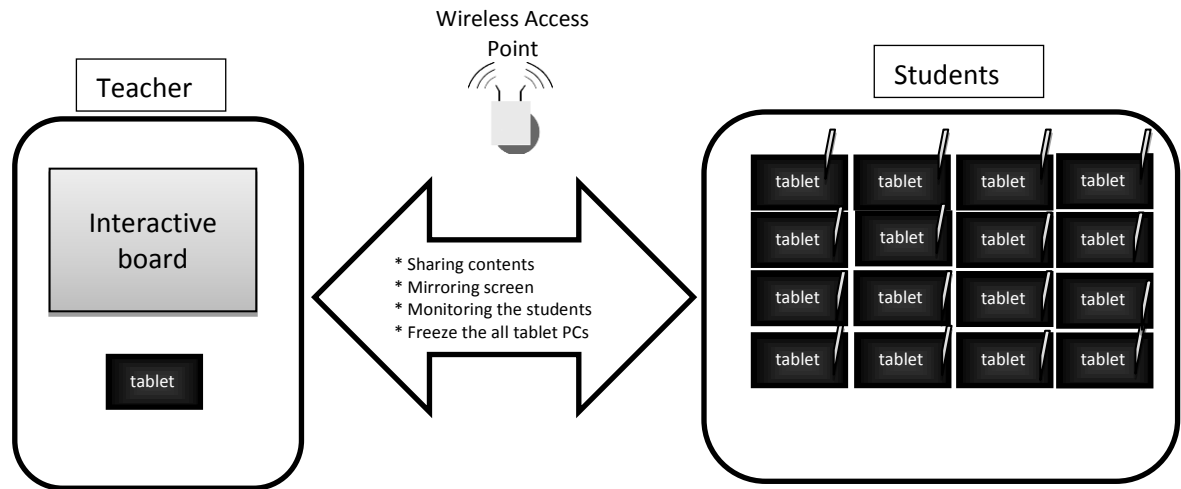


Figure 9. Classroom Management System Architecture. Inspired by ‘Factors influencing students’ beliefs about the future in the context of tablet-based interactive classrooms’

2.5 Discussion

Selecting the right tablet PC is the prior consideration for a project. The project may be interrupted or proceed smoothly according to the device’s features. As is known, iPads have many advantages and disadvantages for use in education. Firstly the iPad does not allow the users to share files, as android tablet PCs do. So this restriction may be a problem in the project’s future. However, android tablet PCs have advantages and disadvantages as well. For example, android tablet PCs are more vulnerable to malicious software than iPads are. In addition, it can be said that android tablet PCs have more free applications than iPads have. All these features should be considered before deciding on tablet PC deployment.

Background research shows that from weight to size, each of the features of the tablet PCs may affect the project. As indicated in the background, the CMS is needed for controlling the student tablet PCs. At this stage, the OS comes into question. It should be fully controlled by the tablet PCs of the students. Closed source OS may not give

enough flexibility to be customized. For that reason, open source (OS) tablet PCs should be used in preference. Preferred tablet PCs should have long battery life and a quality touch screen, as well as being pen supported and durable. It should not be forgotten that the tablet PCs cannot be updated as computers can. Thus, its features should meet the requirement of the applications on the market.

CHAPTER 3

LITERATURE REVIEW

In this chapter, a literature review on arising challenges with tablet PC use in education is introduced. The ‘education purpose’ tablet PC usage is handled in terms of engagement/distraction, adoption, maintenance, content, ownership, personal training and infrastructure. CMS solutions are presented for these problems.

Technological development appears in many fields of human life such as education, commerce, agriculture, sport, music and cinema. Technology simplifies our lives in almost every field. Of course it also affects people’s education. In recent years, technology has widely been used in education. Technological tools can foster students’ abilities, revolutionize the way they work and think, and give them new access to the world [20]. Emerging technologies are used in education in many countries. Furthermore, some countries have been initializing big technology projects to integrate this technology into education. As seen in the following instances, the Magellan Project involved laptop use for every schoolchild in Portugal in 2008, South Korea plans to deploy tablet PCs instead of textbooks in all schools, in Uruguay there is the OLPC Project, in Thailand the OTPC Project, in Turkey the FATIH Project. In Australia there is the ‘Smart Classrooms Strategy’ (Queensland), in the United States has similar projects in Virginia, Maine and Los Angeles districts, and France has the Correze project, while in the United Kingdom there is the ‘Tablet PCs for Schools initiative’. On the other hand, particular drawbacks have appeared in some big projects. Technology addiction and some health problems technology sourced are discussed in education circles and also a high proportion of teachers do not believe that tablet PCs improve the standard of instruction and learning quality [21].

On the other side, there are strong reasons for why the tablet PCs are more popular among educational technologies. The important advantages of tablet PCs are

that they are portable, flexible, affordable, functional and also provide for easy and faster assessments, reduction in the use of paper, facilitates learning after school and more visual learning content. Integrating tablet PCs with a typical rural school environment may provide new opportunities and innovative experiences for students and teachers to promote motivation and positive attitudes toward students' lives [11]. In addition, the use of devices such as Digital Pens (DPs) and Interactive Whiteboards (IWBs) in classrooms opens new possibilities for transmedia navigation in collaborative learning scenarios [1]. Thus they are widely preferred in education. In a recent Center for Digital Education (CDE) survey on 1:1 computing and education technology, IT leaders in K-12 education chose the tablet PC as the most beneficial device for all grade levels, except for grades 9 through 12 (tablet PCs still came in second after laptops).

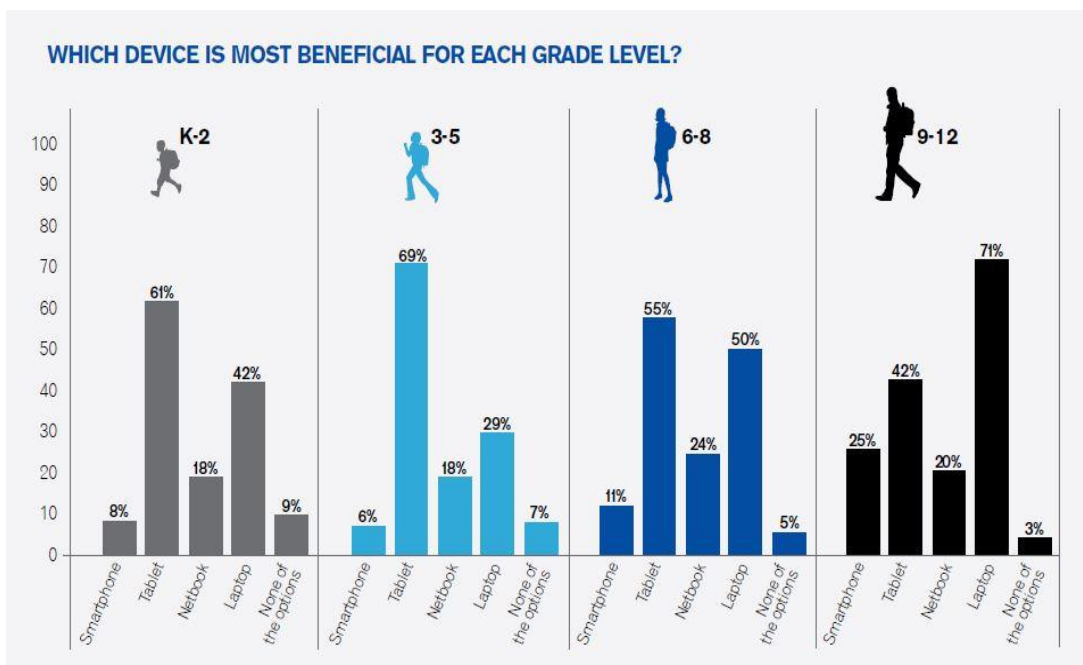


Figure 10. CDE Survey 2013 in California

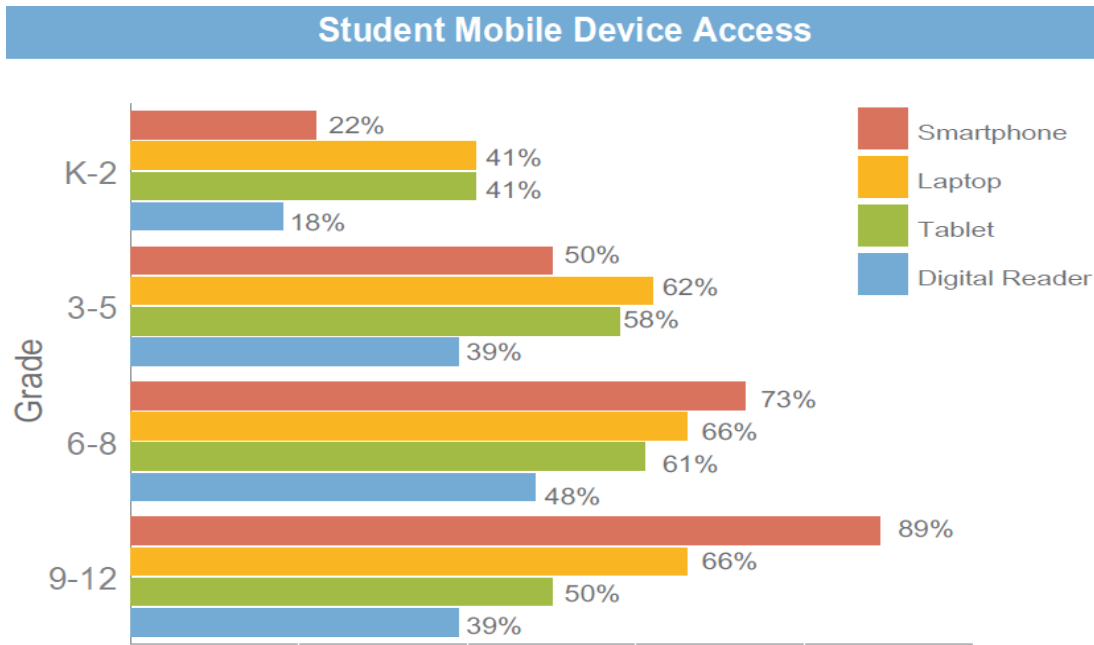


Figure 11. Student Mobile Device Access Rates (Speak Up 2013 National Research)

As seen in Figure 10 and Figure 11, tablet use amongst children is relatively common for the first 8 years and increasing at the 9–12 age range. In 2015, nearly 80 per cent of elementary students reported using a tablet PC regularly, compared with 66 per cent in 2014 and nearly 70 per cent of middle-school students used a tablet PC regularly in 2015, compared to 58 per cent in 2014 [80]. Today, almost 70 per cent of primary and secondary schools in the UK use tablet PCs as an educational material, according to research. Fifty-five per cent of preschool teachers report having at least one tablet PC in their classroom. Tablet PCs are now being used, at least to some extent, in 68 per cent of primary and 69 per cent of secondary schools, according to the study headed by Barbie Clarke of the Family, Kids and Youth research group [23]. Worldwide, over 10 million devices have been purchased by educational institutions [24]. In the Philippines, a number of basic education institutions have adapted the use of tablet PCs for instruction. Schools such as La Salle Greenhills, De La Salle Santiago Zobel and St. Paul University Surigao have acquired tablet PCs and iPad units to be used as pedagogical tools [25].

Eighty-one per cent of teachers think mobile devices enrich classroom education, according to a survey [81]. However we cannot say that tablet PCs will take the place of either books or notebooks. Although quite pretentious explanations have come from

different countries, predicting that tablet PCs would eventually replace textbooks. Whereas, Michael Hiltzik says following words:

Thomas Edison had claimed that motion pictures would replace the books and the books would be history. When this statement was heralded, the date was 1913. As seen in the example, it is not an easy to put something instead of books. [26]. As Hiltzik stated, if the authorities do not plan the whole processes of such types of ‘Tablet Projects’, they are liable to be disappointed and it may entail a considerable budget. Concerning non-academic purposes (i.e. education policy and practitioners), we learned that – at least for the school we studied – a full-scale introduction of tablets is a thorny endeavor [9].

3.1. Engagement and Distraction

There is some research, such as from Munoz-Repiso & Tejedor [27], showing that ICT usage in education positively influences the students’ self-concept, motivation and success, supports thinking and the individual learning pace, and also promotes their review skills. Engaging the students with the school is not an easy task. ICT use supports the engagement of students to school [86]. However, teachers should do some lesson planning before coming to the class. Although ICT usage presents many opportunities for both teachers and students, if the lesson is not planned smoothly, ICT can be a waste of time. If the teacher comes to the classroom having made a lesson plan, this makes the students more engaged and active in class. When we narrow our scope to the tablet PC, it increases the students’ motivation in the classes, although they may encounter some technical problems [48]. In addition, the tablet PC provides collaborative learning and sharing screens in class; in this way students can discuss other solutions and they understand the importance of attending the class. Although there is hardly precise evidence in our hands that tablet PCs increase the quality of education [28], the use of tablet PCs in peer critiquing can encourage students to attend and participate in class [29]. The same study points out that tablet PCs are beneficial and student attendance was increased from 96 per cent to 99 per cent in a college Algebra and Trigonometry class when tablet PCs were used in these classes. This is in addition to another study, where

34 students were implemented with traditional instruction methods and the experimental group (20 students) were instructed in a tablet PC-based classroom. The attendance in the experimental group was 67 per cent, whereas other group's attendance was 32 per cent. The study which was conducted in Computer Technology, a first-year Computer Engineering course, revealed that the tablet PCs provided a higher level of engagement and increment in class attendance [79].

A New York-based educational technology named 'Amplify' will give teachers the ability to both monitor and control what students do with the device. [30]. Classroom Presenter 3.0, a software package produced and freely distributed by the University of Washington [96], is installed on all tablet PCs to enable synchronized data transfer. The instructors can draw on slides and navigate. Additionally all students have a tablet PC and a network is involved. By this method, they can access the instructor's presentation. The classroom has a LAN that enables each student to connect to the instructor's presentation. The instructor may lock all the students on to the same slide and if he wants, something can be drawn on the presentation. Also, students who cannot attend the class for any reason can follow the lesson remotely [29]. The applications in tablet PCs are important for engaging students and conducting the class effectively. For that reason if the tablet PC initiative in education has not sufficient interactive applications, it cannot provide the expected results and parents may think: "What is the difference between textbooks and tablet PCs?"

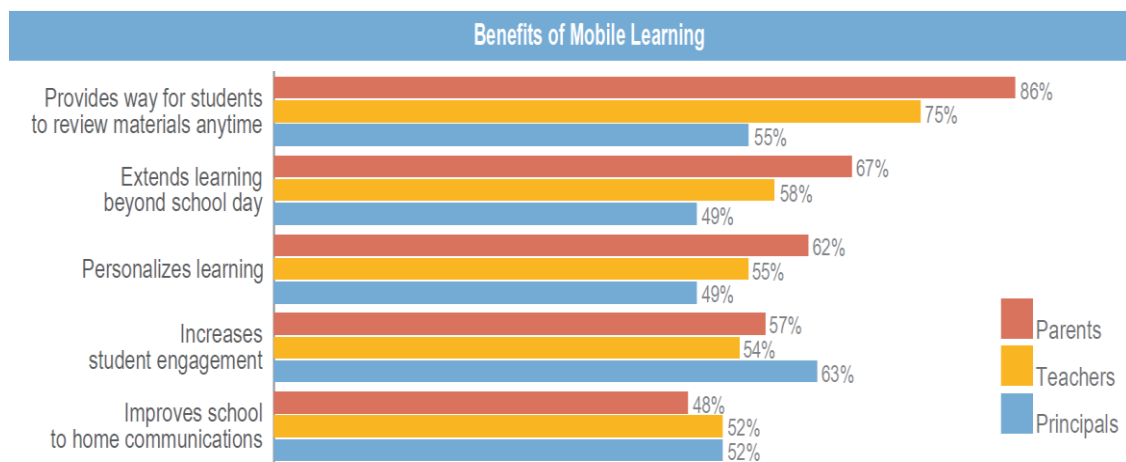


Figure 12. Benefits of Mobile Learning

(Speak Up 2013 National Research)

Figure 12 shows that tablet PC usage enhances individual learning and provides a means to review the materials whenever the learners want. In addition, it enables users to access e-materials beyond the school time.

In secondary schools, some classes may be more difficult with regard to students engaging with teachers. The use of modern tablet PCs and smartphones for visualizing purposes, and as measuring devices, brings significant benefits for achieving learning goals, because they seem to be easier to handle, which allows students to concentrate on their tasks [31]. If the teachers cannot embody the lesson content in their presentation, the students leave the class. However some class subjects are relatively harder to embody the technology, examples being Mathematics, Physics in physical places, not virtual environments. Thus we can benefit from ICT technologies in classes to increase participation.

Dropout and absenteeism are two considerable issues in secondary schools in Turkey and many other countries [82]. Thus, the use of tablet PCs can be a chance for encouraging the engagement of the students with school. In recent years, engaging the students with school is getting harder. For that reason, pushing the tablet PCs into the educational process may encourage students to attend school more.

People frequently use tablet PCs or smart phones in their lives for navigating, e-commerce, banking operations, chatting, watching videos, taking photos, researching and entertainment purposes. We can say that tablet PC usage rates are considerably high in the early ages as reported in [32]. If the children can be directed to use tablet PCs for educational purposes, their engagement in classes may increase. According to one research project it is revealed that mobile technologies increased rate of learning motivation [33].

On the other hand, tablet PCs may not affect all students in the same way. A recent study reports that a number of students stated their interest in classes increased with the use of tablet PCs, however other students reported a decrease in interest because the tablet PCs distracted them [34]. Pupils can be distracted if the tablet PCs are held in their hands and have an Internet connection. There are many types of games available and recently the presence of the social media factor. For these reasons, students may not concentrate on the classwork, totally.

The distraction issue is stated by researchers [66], who report that the tablet PC is used mostly as an entertainment tool among students. There are several problems that may decrease the efficiency of learning and teaching students, such as wasting time in surfing the Internet, watching movies and playing games [66]. A common recommendation inferred from these papers is that if the teachers cannot implement these devices in their class efficiently, it may cause lost time and distract the students from lessons. As a study in the University of Washington found, a majority of the UW faculty (70 per cent) felt that mobile devices in the classroom are distracting [35].

Another significant discussion topic is on deciding the type of systems to be used, i.e. whether tablet PCs will be either in an 'open' or 'closed' system. While both options have advantages and disadvantages, tablet PCs manufactured for pure academic purposes are not on the market. Hence, tablet PCs with open systems provide Internet connection to games as well as serving as application stores. In the Turkey FATIH Project, students are not allowed to enter websites and the apps market for unlimited periods. It makes use of special software which provides a limited access to some features. The government provides a closed market for only educational tablet PCs named EBA Market [13]. With the other option, the closed system provides only limited functionality without Internet access, as online learning materials can be part of the learning curriculum. With this discussion, there are studies reported to the literature [36], where open tablet PCs are presented, as they have the potential to distract the students. It has been documented that students who use laptops in class will often become distracted because they use these for instant messaging, sending personal emails, checking Facebook, Twitter accounts, playing games and watching video podcasts. Tablet PCs can be used for the same purposes by students. This potential risk should be considered by the project implementers.

Similarly, as reported in [69], tablet PCs can be a distraction factor in the classes. According to the study, children who are aged between 7 and 10 said that iPads could distract from learning session work. In the USA, some schools indicated that iPads to be a distraction factor for the students. As Joel Handler states, the iPad was seen as a gaming tool by students. However the chromebook is perceived as a tool for study material. After receiving teacher and student feedback from the 2012–2013 school year,

Handler decided to sell all the iPads and buy chromebooks instead. He will deploy 4,600 Chromebooks in 2014 [37].

When we narrow our scope to Turkey, on an informal observation we see that PC use is common among teachers [84]. The same survey points out that 92 per cent of teachers say that they do not have a problem in using the notebook. So they are familiar with notebook and desktop computers. However, some teachers do not know how to use a tablet PC as efficiently as they do with PCs. According to a study on teacher attitudes [34] the teachers can use notebooks or desktop computers relatively more easily than tablet PCs, because there is no keyboard and mouse on the tablet PCs. This situation may cause some problems in terms of teachers. If the teachers cannot use the tablet PCS easily it can cause wasted time, and during the class the students can be distracted as well as finding a slow adoption of the systems with work-around solutions.

Some studies report that kindergarten and primary-aged children engage with the class and increase their eye-hand coordination, motor and cognitive development and fine-motor skills through using tablet PCs [39]. The use of computers in preschool has also been found to increase children's interest and engagement in drawing [48]. However stylus-interfaced technology increases high levels of student engagement, improves writing skills and influences positively students' attendance at the school [40]. In addition, it is revealed that the stylus is more beneficial for the children's drawing than is the mouse [41].

3.2 Adoption

ICT is integrated to education in many developed countries [42], such as France [43] and South Korea [44]. Many countries allocate considerable budgets to education technologies and implement such initiatives. England spent 1 billion dollars between 2001 and 2004 and USA – 700 million dollars [45] on such initiatives. Some well-known tablet PC projects are: Los Angeles – iPad Project, China's e-school-bag project, Thailand's One tablet Per Child Project and Turkey's FATIH Project.

As the technology is just one dimension of this study, adoption is a significant dimension of a successful project involving human participation too. "Adoption of an

innovation does not ensure its implementation; adopted policies may never be put into action, and adopted technologies may sit in unopened crates on the factory floor” [46]. Some projects were cancelled for students who cannot adopt the use of this technology in education such as the Notre Dame University ‘iPads at Stanford’ project. Some studies show that any random implementation of educational technology has a low probability of success and widespread adoption [79].

According to a study, the pupils who live in rural areas have less experience with mobile technology than their fellows living in urban areas [47]. This means that the poor children will learn to use tablet PCs and will adopt them later than rich children. Economically richer families can provide tablet PCs for their children to use at home, so these children can become more familiar with tablet PCs. Accordingly, those in poor demographic regions will adopt to the tablet PC projects later than those in rich demographic regions. When the instructor gives homework to students, including searching for something on the Internet, poor families may not being able to afford the Internet fee; thus, these pupils may not do their homework in time when only using tablet PCs online. This shows that regional differences may cause disruption of the projects.

As another study [48] stated, children between the ages of 3 and 6 could learn to use tablet PCs quickly, and if they are instructed by an adult, they can use it comfortably [48]. The same study points out that the young children preferred to draw on tablet PCs, rather than using traditional drawing tools.

If teachers, students or parents cannot adopt the innovation, the project might be unsuccessful. According to Davis’ TAM model, perceived usefulness and perceived ease of use are two critical variables that should be considered before applying a technological innovation. These variables determine users’ attitudes towards use, behavioral intention to use and actual system use. Based upon the TAM (Technology Acceptance Model), [66] developed the acceptance of tablet PCs from the perspectives of parents and communities model as in Figure 13.

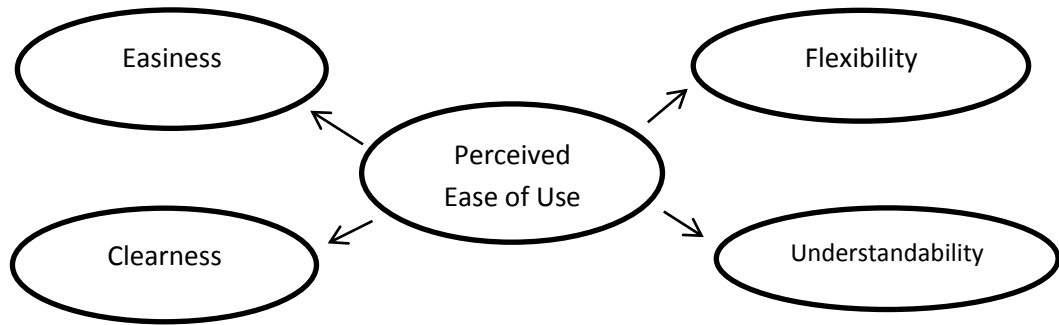


Figure 13. Acceptance of tablet PCs from the perspectives of parents and communities model

As ‘TAM on tablet PCs’ in terms of perceived ease of use, using tablet PCs’ operation system should be easy for students and teachers. It should be easy to do what they want with tablet PCs. It also should be flexible, clear and understandable.

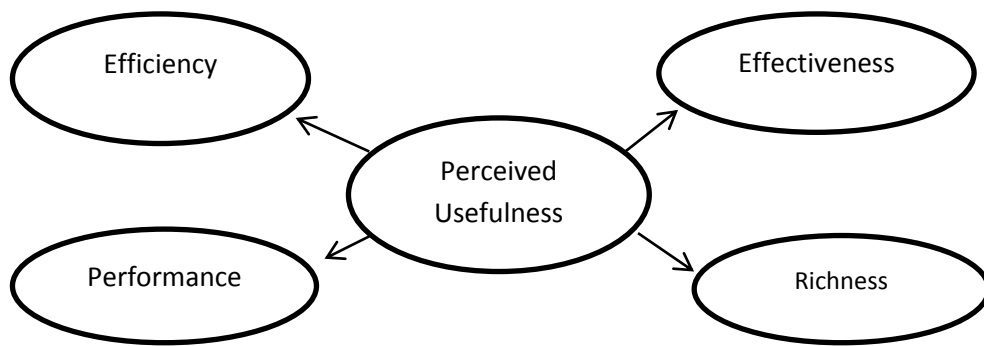


Figure 14. Perceived usefulness of tablet PCs based upon the TAM

In the same study, perceived usefulness of tablet PCs is handled a little differently. Its efficiency, effectiveness, richness and performance influences the perceived usefulness as seen in Figure 14.

The same study reported that students and teachers perceive tablet PCs as an entertainment device or business material/tool. If the students’ point of view cannot be changed, they may waste time doing something else, such as gaming, or surfing the social media. Thus, this may distract the students’ attention from class. On the other side, it was found that the instructors found it useful and enjoyable to use it in classroom and increase interaction among students and teachers [50]. Also all the comments of

students were favorable as regards the use of tablet PCs and ‘digital ink’ in the classroom by the same study.

People do not use a technological innovation that has technical problems. In the implementation stage, the innovation is put into practice. Problems can arise and technical support might be required [51]. In order for teachers and students to adopt an ICT innovation in education, it should be considered what problems can arise in the implementation process.

Gender differences should be considered in order to carry out a big ICT project in education. Female students and teachers are not able to look as positively on computers to the same degree as male students and teachers [52]. The same study points out that if the female or male students did not start to use computer at an early age, they can adopt tablet PCs much later in life. The people who use the ICT in their home are able to adopt the ICT projects in education more quickly [52].

The researcher in a study refers to investigating ninth grade students’ attitudes towards usage of tablet PCs in the FATIİH Project in Turkey [3]. The data was collected from schools in Turkey. The research method used was a survey. Frequency, mean and percentage statistics were used to analyze the data. As the study shows, the students are willing to use tablet PCs in their classes. However they believe that the tablet PCs contribute towards their learning. At the same time it can be said that the students have enough competence to use tablet PCs. In addition, the study revealed that the students who have their own computers at home are more positive than those who have not, in using tablet PCs. According to this data, we can say that the students who have a high socio-economical level can adapt to tablet PCs faster than the others. However, the study indicates that there is no considerable difference amongst the different types of schools in terms of students’ attitudes towards use of tablet PCs. Although statistically male students’ attitudes are slightly more positive than those of female students, we can say that male and female students have almost the same attitudes towards use of tablet PCs.

As a result of the research, although tablet PCs attract the students and provide an entertaining learning medium, according to the majority of students, it cannot increase motivation in class. In addition it is necessary to guide students as to the efficient use of the tablet PCs.

According to the survey of experts [53] some factors affect the integration of this technology in education. The study includes interviews with 20 elementary school teachers and an extensive survey which was applied to 1,030 classroom teachers. The teachers were questioned in eight districts of Ankara, Turkey [53].

As to the study findings, technology integration is the strongest correlated with technology competencies. Secondly, teacher attitudes and beliefs affect the integration of technology and lastly the strongest effect is of college support. On the other hand, if the principal encourages the teachers to use new technologies, it may provide a positive effect on technology used indirectly. This shows that the principals should support the teachers to use new technologies in their classes and should develop some strategies to enhance competence in technology.

Another survey including 65 substances on FATIH Project's adoption was applied to 305 teachers from 24 schools in Trabzon [78]. According to this study, three factors are evaluated. As a result of the study, teachers do not have a negative attitude about the project. Also, their expectations of the project are quite high. On the other hand, the awareness of the teachers regarding the FATIH project is not considerable.

If we pay attention, the technology use in schools is low [54], and this study reflects that the effects of technology use as well as pushing more technology into the schools needs to be researched. Both directors' and teachers' motivation to adopt tablet PCs in the classroom was triggered by the potential benefits of using this technology [49].

The authors investigate school principals' thoughts and opinions on the FATIH Project [2]. Twenty-four principals were asked to answer open-ended questions by using structured interview forms. Their findings were that a big proportion of the principals have a positive opinion about the FATIH Project, also that they think that the project motivated the students. On the other hand, they express concerns that the project should be run smoothly; specialized staff are needed to fix the problems immediately during the use of tablet PCs or IWB.

As the study shows, the principals' answers were generally centred around "effective learning", "saving time and productivity", "motivation, interest and participation". 70.83 per cent of the principals think that the lessons taught with the

support of the interactive panel board and tablet PCs provided more permanent and efficient learning. 50 per cent of them think that the project saves time in classes. 45 per cent of them think that the project increased the motivation of the students in the lessons.

When the principals were asked what the most important issue of the project was, they stated that it was the inadequacy of the in-service teacher training. Also, they thought that the teachers should be encouraged to use the new technology.

Another study was run in Slovenia. Teachers, students and independent observers joined this study. The study was implemented on first-grade students. IWB and tablet PC use was evaluated from the perspectives of these groups [22]. This study was applied to three first-grade classrooms with children aged from six to seven years. These pupils had tablet PCs provided by the authorities and also there was an IWB in each classroom. Although the tablet PCs and IWBs were seen relatively as new educational technologies, frequency of use and the impact of these on students' learning are moot points. However, the pupils expressed some phrases in context motivation, feedback on the correctness of the answers, individualization of the task-solving process categories as follows.

The children said that they liked playing games and studying on their tablet PCs, also that they would like to use them frequently. However, we saw the phrases generally on 'playing games' and 'spending funny time'. This suggests that although there is a motivation factor engendered by the tablet PCs, this does not reflect that the students want to use tablet PCs for educational purposes.

The study reported that the children are not concerned about their answers' correctness regarding questions in tablet PC application. They said that the tablet PC tells them the right answer and they can get a point for each right answer.

There were phrases related to the individualization of the task solving process; the children thought that they did not have to wait for their friends to finish their tasks. Whoever finished the task was able to can pass on to another task. However, each student has to wait for the others to finish first before he can proceed in traditional teaching methods. This is one of the most important features of the tablet PCs.

On the other hand, the teachers answer as in the following regarding context motivation, pupils' persistence in solving the tasks and individualization of the task-solving process categories.

Regarding motivation: teachers claim that the students are willing to use tablet PCs. They are motivated to study with them.

Compared with using textbooks, students solve problems on tablet PCs for longer periods than when using printed workbooks.

About individualization: according to teachers, tablet PCs support individual learning. The pupils can solve the problems or do practice at their own levels. On the other hand, they can solve a question again and again to understand it fully.

According to these phrases, we can say that the teachers' and pupils' approaches are positive towards the use of tablet PCs in classes. Both teachers and pupils believe that tablet PCs increase motivation and promote the pupils' individual learning at their own pace.

The study points out that there are some negative aspects of the tablet PCs as in the following.

Teachers express that there are some technical problems, for instance saying: 'Pupils frequently turn off their tablet PCs by accident or press wrong commands and then need my help', or 'Pupils are often impatient as the Internet connection is sometimes slower than they would expect'.

Relating to preparing for the class, the researcher reports the need for long preparation time to make the tablet PCs ready for use. Teachers complain about the challenges of the control-all tablet PCs in the classroom. To turn on and to write passwords can take a long time, which is wasted. For this reason, teachers find it helpful to instruct the class with tablet PCs in small groups.

Regarding the challenges of the control of the students' work: controlling the students is difficult in general while simultaneously managing the classroom. The instructors say that they cannot track the students' progress when they deal with the tablet PCs.

The sentiments above stress the challenges of the tablet PC usage in the classroom. According to the age of the children, these challenges may vary. The

youngest children are not able to use tablet PCs and they may ask for help more frequently regarding tablet PC use. If the tablet project is implemented in each school throughout the country, new courses which include ‘tablet PC use training’ may be added to the weekly schedule. Thus, the wrong methods of use may decrease in classes.

Similar problems are expressed by students, such as waiting for the teacher’s help, touch screen sensitiveness and accidentally closing the device. The study shows that some problems could be encountered in the implementation stage of the project. The observers express that there is a lack of control over pupils. Thus it should be developed or acquired CMS in order to control pupils individually.

3.3 Software solutions for classroom management

The classroom management is one of the most important components of education and is also a difficult issue to be dealt with by the teachers. When mobile devices such as tablet PCs are pushed into the classrooms, the distraction factors will increase. Thus, the teachers may need to use CMS. Mobile device management is now a central part of classroom supervision, as teachers compete with laptops, tablet PCs and phones for students’ attention [91]. In addition, this software may be used for the other mobile devices brought into the classroom by the students. The used management system can freeze all devices or some devices in particular. It enables someone to block inappropriate applications or to display the same thing on all students’ screens. There are now dozens of mobile device management products on the market, including LanSchool from Stoneware, Vision from Netop, the Casper Suite from JAMF Software, and NetSupport. This software enables teachers to show their screen to students whenever they want to. The teacher is able to prevent certain student activities, such as surfing the Internet, gaming and social media interaction. In addition, the instructor is able to mirror his/her screen to all students or some selected students, and also to show a particular student’s screen to another student. Devices can also be ‘frozen’ by the teacher in order to gain students’ attention. In this way the instructor is able to keep the students following the lesson.

Governments in some countries are spending a tremendous amount of money on using tablet PCs in education by initializing some big projects such as FATIH (Movement of Enhancing Opportunities and Improving Technology) in Turkey, OIPC in Thailand, and the Aakash Project in India. CMS can help to increase the productivity of a government's investment.

The main aim of integrating the tablet PC into the education process is to provide an active learning environment and to promote collaborative work in the classroom [56]. This study points out that additionally, CMS provides a 'quick polling' feature and you can evaluate the students' attainment level in a short time. As the study Net Support School CMS enhances monitoring the group activities in class and supports participating in class discussions. Furthermore, the teacher can record the lesson (for some lessons) and share with students through CMS. Thus the students are able to view the lesson whenever they want. There is obvious benefit in the use of CMS with new equipment and software [57].

The teachers need to diversify their teaching abilities and methods as well as to understand each student's interests and needs, and cope with them properly. These changes in the educational environment also require diverse methods of classroom management [92]. As the study shows, the students started to use the Internet for educational purposes more after Web-Based Classroom Management Support System. This study shows that the students cannot be left adrift with the tablet PCs in classroom or at home. They should be conducted and directed by an instructor with CMS. Every era's method should be suitable for that era. You cannot conduct classroom-equipped tablet PCs by conventional methods. If it is considered that the students are keen on playing games and surfing on social media, the necessity of the classroom management programs may be seen.

In order to find out the level of learning, assessments give us important feedback about classes, and evaluate the level of insight. In addition, if the instructor can get the responses instantly, it is obviously more beneficial for the students. In a study [58], implement and evaluate a Student Response System. The proposed system involves three different components, namely a student application that allows for sketch capabilities, a lecturer application that allows for the viewing and marking of multiple

student sketches and a cloud service for the exchange of messages [58]. The proposed system was initially used by a group of second-year students on the BE in Electronic Engineering degree program at NUI Maynooth. Most of the students found the application easy to use and they thought that the app provided a good way to give feedback. On the other hand, they stated as following:

“The use of the response system makes my learning enjoyable” and “I was motivated to respond to the teachers’ questions using this system”.

This means that the students found the responding system useful, flexible and a good way of interacting in class. On the other hand, the students are willing to use tablet PCs for delivering their answers to the instructor. This response system may be a potential to encourage increased participating in the classes in the future as well. Also it provides quick feedback, and the teacher can correct the wrong answers. If the students’ answers can be reflected to the board via an interactive board or similar system, it will provide more effective learning through discussing the answers in the classroom.

Known as one of the biggest tablet project in the world is the OTPC (one tablet per child) project. This project needs to be reset due to some problems [59]. As the news shows, the alternative could be a ‘smart classroom’ initiative to maximize students’ benefits, said Suthasri Wongsamarn. This news shows us that a big project cannot be implemented without perfect planning.

3.4 Maintenance

Maintenance is a significant issue of the big ICT projects. While tablet PCs are portable and economical, their hardware cannot be updated such as that of a desktop computer can. In the UK in a pilot project it reported that students were asked: ‘When your iPad gets broken, does it take a long time to repair?’ 54.8 per cent of students replied ‘yes’ and 16.5 per cent said ‘no’ [69]. This report shows that before carrying out a big project, maintenance issues should be planned. If a student gets a breakdown with a tablet PC, it should be determined who it will be repaired by, and in how long a time. The students and parents should know whether they will be obligated to pay maintenance costs or not. There are some different implementations in some countries. For instance in Turkey’s

FATIH Project, if the tablet PC is broken by the student, they have to pay if the tablet PC's warranty has ended. This brings another issue for those children who have economic problems. If the warranty is still valid, the tablet PC's manufacturer undertakes to fix it. Throughout the fixing time, school managers track the maintenance process instead of the children doing so. But it cannot be predicted how long various problems will take to repair. In addition, if the parents do not take care with the maintenance of their child's tablet PC, children can fall behind their classmates in terms of curriculum topics covered.

The progress of each student in class can be tracked by the teacher by using tablet-based classrooms. At this point, a challenge might be faced in the implementation phase, if the school has not got a server system [60]. When a child's tablet PC is broken, it may lose all the previously fed-in progress and data. Thus, the server system will provide the backup data for broken devices.

A study on the evaluation of the pilot application of the FATIH Project that asked 15 administrators of 5 pilot application schools in the cities of Ankara, Usak, Karaman and Mersin, points out that there is a need for expert staff who would instantly help overcome possible problems likely to be experienced during the use of the IWBs, tablet PCs, document cameras and multi-functional printers [61]. This study reveals that the problems that may arise in the implementation stage may cause disengagement in the use of new technologies.

While using the tablet PCs, the maintenance of these is not very complicated compared to that of computers. Nevertheless, it is beneficial to touch on some substantial points. Tablet PCs have limited storage capacity. For that reason, it is necessary to delete unnecessary applications and files. On the other hand, if the tablet PC has sufficient storage memory, you do not need to delete applications and files. Because the tablet PCs run stable, while applications that aren't used don't slow down a tablet PC [62]. In addition, the glass touch screens can be cleaned with a microfiber cloth and a special lotion. However, tablet PCs should not be left uncharged for a long time. According to worldstart.com, batteries, especially those used in most tablet PCs, can be damaged by long duration storage at very low power levels. If you are planning to put your tablet PC into storage, you should charge it to about 50 per cent and then turn

the device completely off. Especially, since we consider that the users will be very young children, the project implementers should focus on the tablet PC maintenance challenges.

3.5 Content

In recent years a lot of countries initialized big tablet PC projects. Some countries implemented the project throughout the country, such as Thailand OTPC and the Turkey FATIH Project, however in some countries it has been applied in some regions or provinces (Los Angeles Ipad Project). The foremost problem is to produce quality e-content into the tablet PCs [63]. Some countries created content portals by the state, such as was the case with the Turkey FATIH Project. A governmental body associated technology, which is named General Directorate of Educational Technologies, has prepared a web portal named EBA (Education IT Network) and is continuing to develop it. This portal provides the pupils with textbooks of lessons, some educational games, z-books, animations and some pupil magazines for no charge [15]. Also presentations, videos, images and news-related education can be uploaded to the EBA portal by the teachers and pupils. On the other hand, the private e-content providers make deals with the Education Ministry. Thus, the students who log in to the EBA portal can reach the private e-contents without paying any fee. In this stage, the filtering and controlling of the contents loaded by teachers and students is another important issue. Although, it is stated that all the contents is controlled by EBA authorities, as our observations and interviews with private e-content providers show, the controlling and filtering is not enough in terms of preventing the inclusion of useless and harmful content.

In Europe, the Open Discovery Space Portal is used for tablet e-content. This portal provides possibilities to create communities to share and discuss educational content [31]. The content that includes education apps is not at a satisfactory level in number; however, today there are a variety of educational apps on the market for pupils [69]. However it should not be forgotten that native e-content is still not sufficient for the countries that carry out big tablet-PC projects and do not use the English language. It

should be taken into account whether e-content is intended for pupils' and teachers' use or not.

Although there are some applications and e-contents for tablet PCs about education, these are needing further development. Children like playing 'angry bird' games because there are some levels and progression within it. So tablet learning activities should have a progression element to improve usability [60]. E-contents should not only include textbooks, but also interactive apps for all lessons and some educational games to engage students.

The content that is being loaded into tablet PCs should be richer than that of textbooks but it should not be completely different from curriculum standards. Because in this way, at least, parents may believe that using tablet PCs is not worse than reading printed textbooks in terms of the effects [66].

Some countries present the content to the teachers and pupils as e-books through tablet PCs. This provides a cost reduction compared to the use of textbooks. On the other hand, provided contents' format should be accepted across the world and also be up to date. This is considerably important for meeting the expectations from tablet PCs [77]. Otherwise, the tablet PCs are used such as an e-reader.

In Thailand's OTPC Project some learning content is provided, however it is not sufficient for the future. In the OTPC Project, the authorities believe that each content fits all students. However, this is a 'one size fits all' approach. This may cause some problems for different regions, and different social and cultural backgrounds [60]. Provided learning content should be suitable for each student who is working under different conditions. All regions and cultures should be taken into account, because the examples may be different for different students according to regions. In order to get positive results, the content should be put into the tablet PCs according to the pupils' districts. In the future we can see several different projects regarding tablet PCs in education, but the content challenge will continue to be discussed.

3.6 Ownership

Thailand is known to be the first country that initialized the countrywide tablet PC project in education, by deploying hundreds of thousands of tablet PCs. With the Thailand OTPC Project, the children have ownership of the tablet PC after three years, and they can take the tablet PC home, if parents and teachers allow this. In some countries it is allowed for the tablet PCs to be taken home (as is the case with the Turkey FATIH Project), but for some countries this is not allowed (including USA – Los Angeles Ipad Project, Thailand – only if teacher allows this). In Turkey’s FATIH Project the children can take the tablet PCs to their home whenever they want, but they cannot be allowed to take their tablet PCs when they leave school permanently for whatever reasons, such as dropping out of the school or moving to another region. However if the warranty period ends, tablet PCs are given to the children permanently.

Some countries have implemented a ‘bring your own device’ (BYOD) scheme in their education system. This scheme means that the children bring their own tablet PC, mobile phone or any other device which they already use at home. This project proposes to enhance the personalization of the student’s learning process and to increase students’ responsibility of control in their own learning [12]. In BYOD projects every child may bring a different mobile device, which means that many OS platforms may exist in a classroom. Thus some inconsistencies may occur among the devices. In addition, some children cannot afford the cost of a tablet or any other mobile device. Projects such as OTPC or FATIH eliminate the kind of shortcomings that are mentioned above [60].

As seen in Figure 15, the students can in general take their tablet PCs back to their home. Thus they can benefit from them beyond their period at school. However, some administrators do not allow students to take their tablet PCs home. This latter practice may restrict the benefit of tablet PCs.

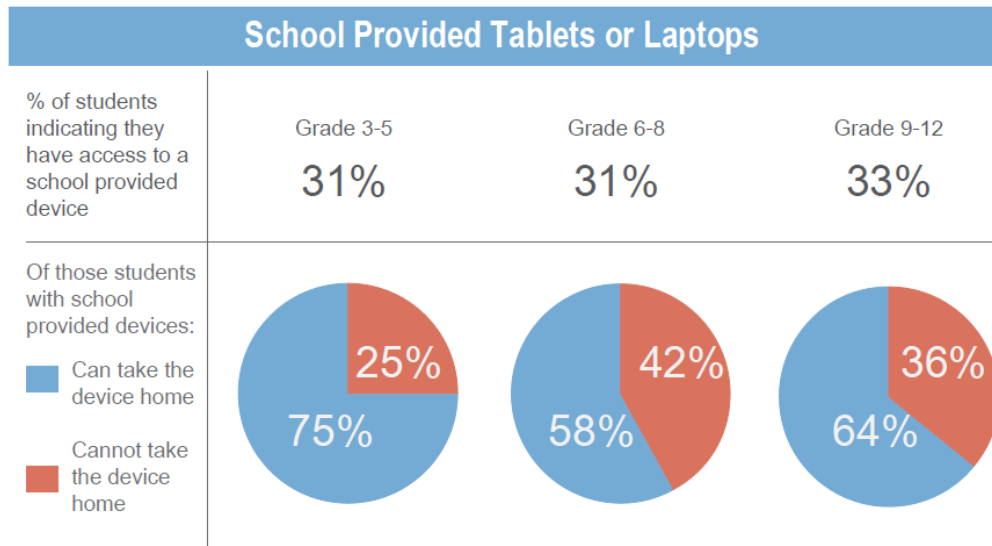


Figure 15. A survey regarding school-provided tablets in 2013 in USA

3.7 Personnel Training

Projects are carried out by people. A big project requires an understanding of the organization, people, and information technology shaping the systems [67]. Especially we need to have trained people if we make a project regarding the integration of technology into education. Many studies point to the fact that teachers should be trained to attain the success of an ICT project in education. Adapting lessons to accommodate tablet PCs has not been easy [68]. So teachers should be trained about how to integrate tablet PCs into the classroom environment. Teacher training is a long-term and difficult process. The Turkish government has planned for teachers to take in-service training about tablet PC and IWB use. It is still continuing to do so [97].

In order to initialize a big tablet PC project, what should be considered are the teachers' e-readiness level and their previous experiences regarding technology use. According to a study, teacher attitudes and beliefs has the second strongest direct effect on technology integration [53]. Another study confirms that teachers are the determining key component for the success or failure of the implementation of technology [8].

What is needed is comprehensive knowledge about the system configurations and features. Thus, when we are creating an activity in the classroom, some students will ask for help from the teacher. In order to help them quickly, the teacher should acquire

comprehensive knowledge regarding the use of tablet PCs. The students have asked questions ranging from the simple – such as how to adjust the screen brightness, to the complex – such as how to synchronize email and calendar functions with their other devices [64]. If the teacher does not have enough experience and knowledge about tablet PC settings and configurations, he/she can waste time in classes. What is more, this has the effect of decreasing the students' motivation.

Professional development for teachers can make or break a tablet PC initiative [71]. As is known, in order to implement a tablet PC project there are some needs such as infrastructure, budget, e-content and teachers who are willing to use tablet PCs. Teachers should be trained not only regarding hardware use, but also should be taught how to develop an application that has an educational purpose. Then schools can create their own content as well [69].

Teachers should be trained in how to use tablet PCs proficiently and how to integrate this knowledge into their lessons. If teachers can use the tablet PCs efficiently in their classes and the pupils can join in learning activities, the students' engagement can be increased. The use of tablet PCs should be taught to the instructors before the pupils. Accordingly, the devices should not be entrusted to the students' hands before being seen by the teachers. Hence, the teacher may therefore prepare lesson plans and develop 'student-centered' strategies for his/her class. On the other hand, Budit Thipakorn, the free-tablet project, was a good initiative, however it failed. This was because it was poorly planned, as teachers were not properly trained on how they could integrate the devices into students' learning [70].

If teachers accept the technology and believe in its benefit then the technology project may be successful. In addition, he/she should integrate the technology into classroom practice. [21]. It cannot be the case that the teacher who does not have knowledge about using tablet PCs may adapt the students into his/her class. This means that the project implementer should plan for the teacher-training process in order to ensure the success of the project.

3.8 Infrastructure

Education technology projects such as the FATIH Project in Turkey and the OTPC Project in Thailand are not comprised of one dimension. For example the FATIH Project in Turkey is supposed to encompass three stages that have to be carried out. The government says that the project consists of one interactive board to all classrooms, a tablet PC for every child and teacher, and wireless infrastructure in every school. These aspects are linked to each other. Because if a wireless infrastructure is not established, all the tablet PCs involved cannot connect to the Internet simultaneously, and therefore a connection amongst pupils and teachers cannot be provided. If an interactive board is not put into every classroom the teachers and pupils cannot project their screen to the board, and the teacher cannot show the screen of any individual pupil to other students. On the other hand, the electrical infrastructure should be updated in all schools to avoid 'out of warranty situations' for the devices.

The infrastructure issue is crucial for a successful big tablet project as well. A thorough evaluation of networking, computing and storage resources is needed. The district Internet connection, enterprise wide area networks (WANs), local area networks (LANs) and wireless LANs (WLANs) should be sufficient to handle a sudden, simultaneous load of thousands of mobile devices [71]. The same study reports that server hardware and architecture should be reliable, highly secure and scalable, to provide smooth access to network resources and applications. In addition, storage can also be virtualized or moved to the cloud for increased cost savings and efficiencies. Thus, before implementing a big tablet PC project, infrastructure issues should be considered in terms of wireless networks, maintenance, storage and security. It should not be forgotten that millions of students and more will try to access videos and audios via their tablet PCs during the future of the tablet project. In this context, the Internet infrastructure should be capable of responding to this huge request. The network interruptions can cause distraction and waste time. In the case of all pupils and teachers joining the network, the connection should not slow or interrupt. The content in tablet PCs may include videos, images, and animations. So the Internet Service Provider (ISP) should provide at least 100 Mbps per 1,000 students/staff (State Educational Technology

Directors Association – SETDA). Regional differences should be taken into account as well if you implement the project throughout a country. Another considerable point is that you cannot use the older versions of the WLAN technologies [71]. This can cause slow connections and problems in accessing the Internet.

Content filtering is another significant issue. This filtering includes protection from malware, viruses, inappropriate content, and from malicious sites. The tablet PCs can be surfed in a reliable and secure zone. If the pupils are able to reach these inappropriate sites and/or some social network websites, it can be harmful for them in terms of pedagogical development.

Connection among student and teacher tablet PCs is important for the success of the project. The considerable benefits of the tablet PCs are related to their capabilities for communication and data sharing. So if a smooth link among tablet PCs is not able to be established, this can cause a limited utilization.

Selecting OS is another subject for countries which initialize big tablet PC projects. There are three main operating systems available: Apple iOS, Android and Microsoft Windows. We can handle these platforms which have some variety features as explained in the following.

3.8.1 Android

The Android system is open-source. Anyone who is curious about software can create and upload new applications for the Android Market. This provides some advantages for Android, such as higher number and free applications on the market, rather than for the other OSs [72]. In addition, there are many competitive Android devices on the market, such as Samsung Galaxy Tab, Google Nexus and Amazon Kindle Fire HDX.

While the Android OS is open-source and has many free apps, simultaneously it has many security problems. Throughout 2012, 99 per cent of all mobile malware detected by Kaspersky Lab was designed to target the Android platform. During the year, Kaspersky's Internet security experts identified more than 35,000 malicious Android programs [73]. The security issues are a considerable concern in education projects, especially if the project includes students who are very young.

3.8.2 Apple iOS

iOS was specifically developed for Apple iPad tablet PCs. Its high security advantages, good battery life and performance are prominent features of iOS. Also it provides shortcut icons, which allow users to navigate it easily. On the other hand, Apple offers over 20,000 high quality educational apps and digital school textbooks with iBooks 2 and iTunesU [72]. If we talk about its disadvantages, it is closed-source and has limited free application for the users. Also, iOS does not provide sharing options to the same degree that Android does.

3.8.3 Microsoft Windows

Windows OS is late to the market compared to the other tablet PC solutions. Early Windows tablet PCs did not offer ‘touch’ interactivity as today’s tablets do. For this reason it could not attain the widespread use that other tablet PC devices have [74]. However it has some advantages, such as availability of Office programs, which include Excel, Word, Outlook, Powerpoint, and OneNote.

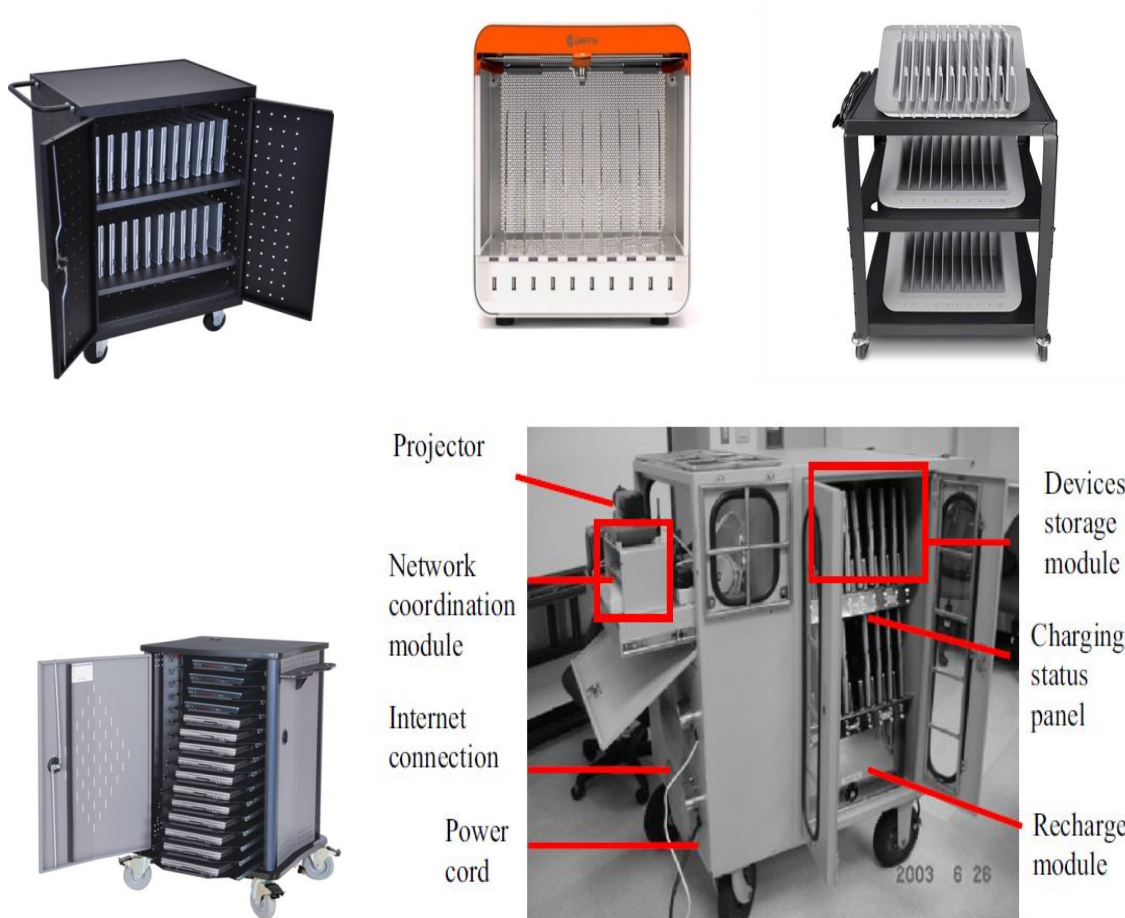
Windows 8 presents the users with a more familiar interface than the others. The laptop and notebook users may adapt to these devices easier than the others. Sharing files, listening to audio and watching video operations could be made more comfortable by teachers. According to Luke Wroblewski from Oxford University, the most suitable device for tablet projects is Windows Tablet. On top of this, it has USB port advantage [75]. In other operating systems you must use an apparatus to connect an external memory, or alternatively use cloud technology.

As a result, each platform offers different features and an extensive range of apps. The selected OS should be flexible, have available data sharing and also be resistant to viruses. However it can be beneficial to consider the pupils’ and teachers’ familiarity with the OS.

The recharging of tablet PCs is also a handicap for schools. The teachers have to be concerned about the battery life of the tablet PCs [21]. The school buildings should

be designed so as to consider the placing of the charging units. In addition, the students should be given the responsibility of charging their tablet PCs before coming to class. Also, extra tablet PCs may be kept in classrooms in order to prevent charging or breakdown problems.

There are some different designs of charge units as seen in Figure 16. The most appropriate one should be selected. Below are presented several types of charge units.



EduCart: A Hardware Management System for Supporting Devices in a Classroom Learning Environment

Figure 16. Tablet PC Charging Cabinets

Today tablet PCs have a battery life of between 5-15 hours. Some tablet PC brands' battery lives are listed below:

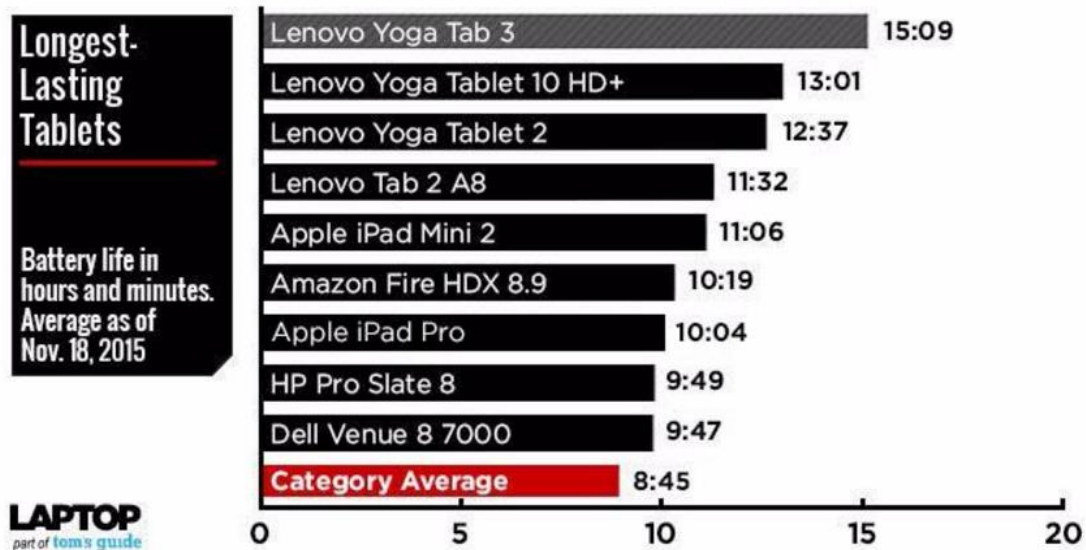


Figure 17. Top 10 tablet PCs with the Longest Battery Life

Although the battery lives of the various tablet PCs seem longer as shown in Figure 17 [76], this time of period decreases as the device is used. This is because batteries deform over time and need to be replaced.

3.9 Discussion

The essential topics are grouped in particular headings in chapter 3. These headings include certain information based on literature. Especially, what is dealt with is how to determine requirements for implementing a thorough project. Although we had some limitations, literature and examples in the world were reviewed. As a result, for countries which include different demographic regions and for groups of people who have heterogeneous e-readiness levels may experience some problems. Technological revolutionizing is not an easy task. Firstly adoption issues should be considered. However, the public who live in the country cannot be adopted into such a scheme in a short time. Before the implementation stage, pilot applications and surveys may need to be done. On the other hand, problems that have already been faced in other countries should be evaluated in depth.

According to the literature, tablet PCs increase motivation, engagement and decrease dropout problems in education. However, as indicated in chapter 3, trained personnel, quality e-content, infrastructure and adoption issues should be handled carefully. In addition, tablet PC-based classes promote both collaborative learning and individual learning. It facilitates the sharing of information amongst students and teachers.

According to our investigation, classroom management software (CMS) relatively contributes to cope with discipline and distraction problems in the classroom. The instructor can control all the tablet PCs in the classroom so that the students may focus on the class. In addition, CMS provides many opportunities to the teacher, such as screen sharing, file transferring, quizzes, surveys, test making, and evaluating the test result in detail.

CHAPTER 4

E-CONTENT

4.1 E-Content for tablet PCs

E-content is one of the key dimensions of the tablet-based or tablet-supported education system (Section 2.7). E-content means not only digital textbooks but also mobile applications, animations and so on. For that reason, as is mentioned chapter 2, the e-content subject material should be handled carefully.

According to some studies, transferring printed papers to the digital medium is not the complete solution in order to overcome all problems (Section 2.4). The digital educational approach prevents wasting paper and reduces the education costs compared to traditional methods [93]. However, when in-service instructor trainings, content suppliers and maintenance costs are added, the result may change. As mentioned in chapter 2, it should be considered that technology, people and organization are needed to perform a technological revolution. When we factor in all these dimensions, the bill has been seen to be rising. Thus, the education costs cannot be calculated by only considering the technology costs.

4.2 The Quality of the Content

Many projects carried out across the world regarding tablet PC use in education suffer from poor quality content. The content presented for tablet PCs should be acceptable worldwide and up to date. On the other hand, created e-books should be promoted with visual and auditory elements. If the content for the tablet PCs is interactive, visual and auditory, the positive effects of the tablet PCs may be seen. Otherwise, it cannot be

providing the expected educational quality through the tablet PCs by the fixed format of the e-books. According to the study [77], e-books for tablet PCs should have certain characteristics as following:

4.2.a. Interactivity

E-books prepared for tablet PCs should be interactive. This provides more permanent learning for children. Thus in order to raise students to the expected and needed learning levels, e-books should include sufficient interactive learning objects with regard to content.

As with our informal observations, the FATIH Project's EBA portal has not got enough interactive content for use in tablet PCs. On the other hand, provided e-books for tablet PCs do not have interactive elements.

4.2.b. Enriched with video and audio

One of the biggest innovations coming to education from the digital world is the ability for video and audio files to be embedded in e-books. In this way all components of learning are collected in one platform during the learning process. Otherwise the learners can be distracted when they surf among different platforms. The students can concentrate on the instruction process if the videos and audios are presented with e-books embedded in them. On the other hand, all videos and audios embedded in e-books may take up a large memory space. In order to overcome this issue, the server system may be used to store videos and audios and this can be linked to the e-book.

The study shows that videos and audios should be presented in e-books in addition to the text and images. Providing the textbooks on a digital platform is not an effective task in terms of increasing the instructional quality. In addition, some animations or educational games can be created for reinforcing the instruction in addition to e-books. As is known, Turkey's FATIH Project provides content for tablet PCs via an EBA portal. This portal currently has 3,009 audio files and 3,543 video files in total for preschool, primary school, secondary school and high school.

4.2.c. Support with visual elements

It contributes to the instructional processes that e-books contain visual elements. Some intangible concepts can be shown as images. Students sometimes cannot imagine something that is described in words. For this reason, the teacher should show these types of ‘hard to imagine’ things to the students, even though in reality no teacher can show everything to the students. At this stage, images help the instructor to show some dangerous things or items which are impossible to see. On the other hand, the visual items should be suitable for the student’s age.

As many studies prove, visual items support the learning process. The visualizations attract all pupils to our informal observations. Although textbooks may contain images as well, e-books can be updated easily and quickly, compared to printed books. Thus, it is a way of saving printing costs and time.

4.2.d. Accessibility

The students can access the e-books from everywhere and whenever they want. This opportunity is beneficial for students at all grade levels. When we narrow our scope to EBA, all content on the portal is accessible online. So each student can access the e-books, videos, audios, animations and e-magazines, when they are online.

Learning is an ongoing process. As our informal observations show, if the students do not repeat their lessons after school, they can forget a large amount of what they have learnt. Thus, students should be able to continue or repeat their lessons at home. The tablet PC provides a good opportunity to do this. However, the content provided for tablet PCs should be accessible at anytime and anywhere by any Internet connection.

As a study conducted at the University of Wisconsin by Güçlü showed, the more interactive the technology is, the more instructive it is. In this context, we can say that the interactive hardware should be supported with the interactive content. However, many studies reveal that interactive instruction materials increase the amount of permanent learning.

4.3 EBA for FATİH Tablet Project

EBA is a content-providing web portal for tablet PCs in which students and teachers can benefit. As mentioned in chapter 2, the FATİH Project includes tablet distribution, an Interactive Board and network infrastructure. In order to overcome arising e-content requirements for tablet PCs and interactive boards, the Republic of Turkey Ministry of National Education has initialized a content-generating project that is under the charge of the General Directorate of Educational Technologies. The EBA portal provides all teachers and students with some opportunities such as educational content, presentations, videos, e-books, audios and educational games. Most of the e-content is created by professional staff in the General Directorate of Educational Technologies. In addition, the students and teachers can upload educational materials to the EBA web portal. All files that are uploaded by users are audited by the authorities. After a while, if the content that was uploaded by users is convenient, it is published on the EBA. A screenshot was presented in Figure 18 as following:

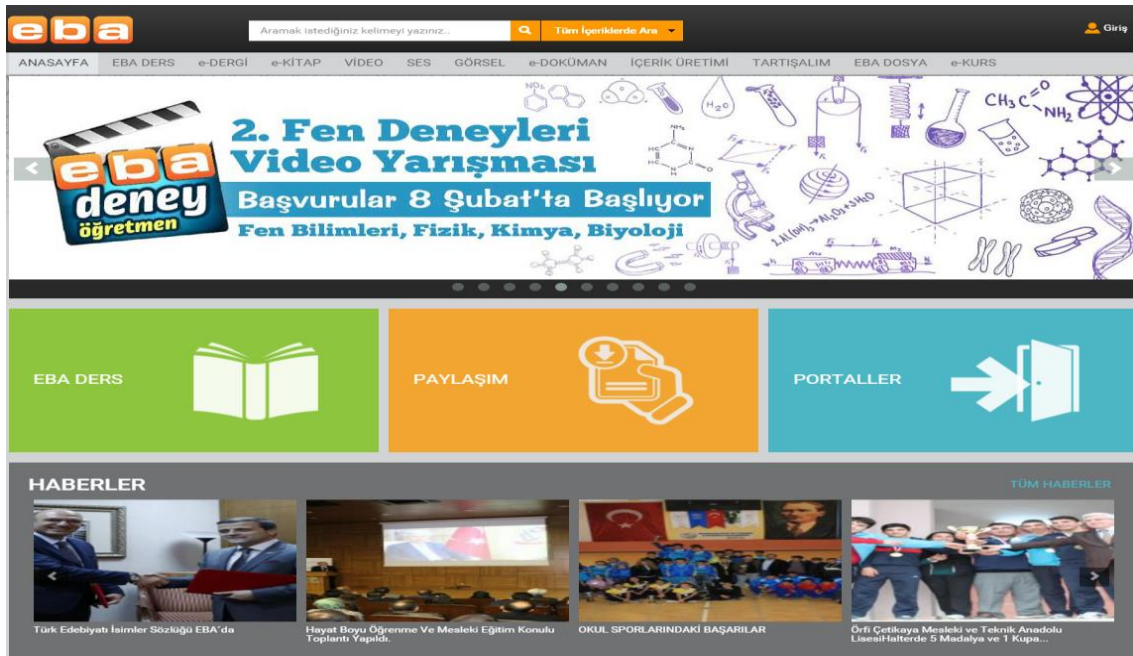


Figure 18. A screenshot of the EBA homepage

As our observations show, there are some popular private content providers, such as science-child magazines. Students and teachers may reach some paid publications at no

charge through the EBA portal. In addition, teachers who work in public schools can reach some private educational web portals such as Morpakampus, Vitaminegitim and Okulistik free of charge. ‘Morpakampus’, ‘Vitaminegitim’ and ‘Okulistik’ are all educational content suppliers of the EBA web portal at the same time. The children can access these portals via the EBA portal as well. There are some screenshots from MorpaKampus, VitaminEgitim and Okulistik in the following:

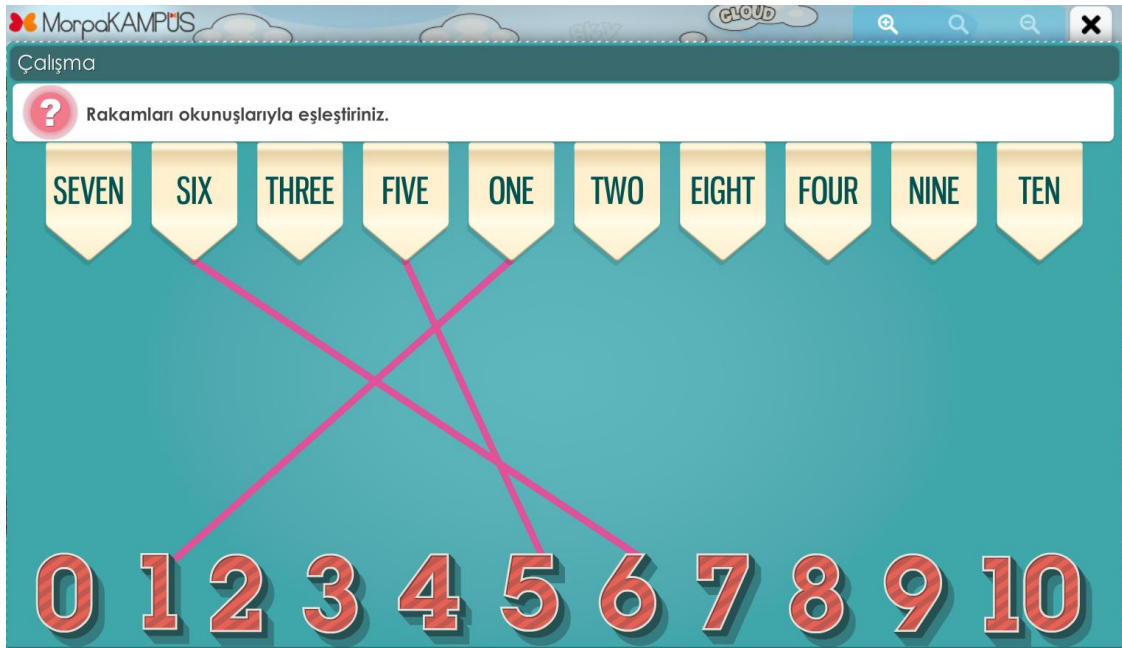


Figure 19. A screenshot from Morpakampus regarding English ‘Numbers’ interactive lesson content

The MorpaKampus e-content platform has almost 1 million active users. There are contents pertaining to Life Science, Turkish Language, Mathematics, Science, Social Studies and English Language, with content suitable for from first to eighth grade students. 350,000 teachers and 1,200,000 students have already been members of this educational portal.

As our informal interviews with the officials indicated, there is no filtering or auditing regarding the content of these private suppliers. On the other hand, this co-operation with the private sector provides teachers with new opportunities in their

classes. They can use these interactive materials in tablet PCs and Interactive White Boards.

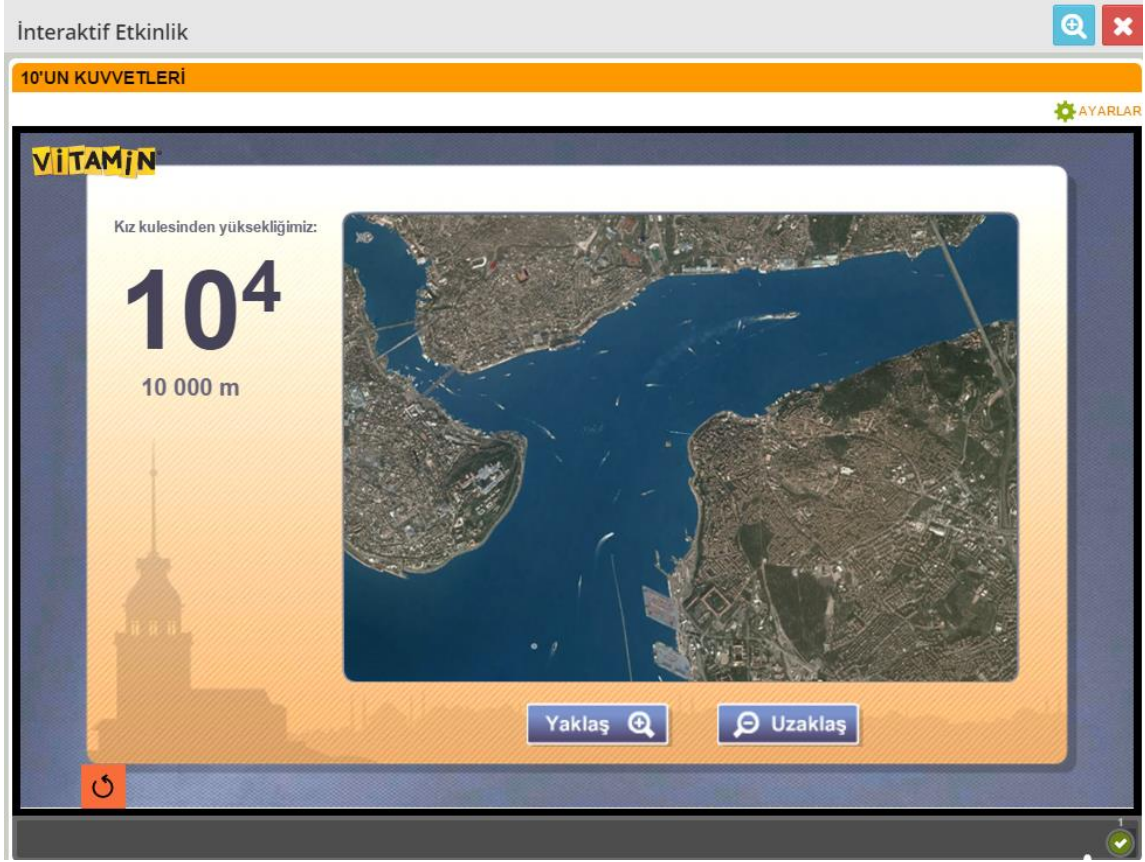


Figure 20. A screenshot from VitaminEgitim Portal regarding Mathematics ‘Exponential Numbers’ interactive lesson content

The ‘VitaminEgitim’ educational web portal has about 400,000 teacher members and also more than 1 million students. This portal includes contents for students and teachers suitable for from preschool to high school. Students may find many content materials here, such as animations, videos, e-books, online tests and problem solutions. According to the agreement with the Education Ministry, all public school students and teachers can access these educational materials through the EBA.

The Okulistik portal provides contents for students from first to eighth grade. Okulistik contributes to an increased awareness of the EBA portal and has more than 3 million student users. The EBA portal has many items of contents from which students may benefit. However, the awareness of EBA is not enough to increase our knowledge.

When we asked in classrooms whether there were any students who knew EBA, generally only a few students raised their hands. This means that the EBA needs to be introduced a wider environment throughout the country.



Figure 21. A screenshot from Okulistik Portal regarding English ‘Describing Characters’ interactive lesson content

Although the EBA grows more every day, details of the full extent of its content of all lessons do not exist to our knowledge. Mostly the content created contains Mathematics, Turkish, English, Social Studies and Science lessons. There is not a sufficient content of items relating to Information Technologies, Music and Art lessons.

4.3.1 EBA Market

The EBA Market has been developed in order for children to download educational and useful applications, games and so on to their tablet PCs. Instead of the Android Market or Google Play, this market was built by the General Directorate of Educational Innovation and Technology and TUBITAK (Turkey Scientific and Technological Research Institution) together. However, the EBA Market provides some software updates for tablet PCs.

The EBA Market has been built in order to present secure applications and games that are appropriate to various children's age levels. Also, it includes e-books, painting applications, an EBA web browser, bookshelf, and dictionary. However, some issues were encountered by students and parents while they tried to download and set up the applications. On the other hand, there is an insufficient amount of content and applications on the EBA Market to our knowledge. This poor content may cause the EBA Market not to be used by children. Although this is an ongoing process and it continues to be developed, this period of time for completion should not be very long. If it takes much more time than usual, this may cause negative attitudes towards the use of tablet PCs.

The EBA provides EBA file application, and children may download this application on an EBA market. Through this cloud system, the students can store their files up to 1 GB and teachers can store up to 10 GB.

4.4 Some International Educational Content Providers and Mobile Applications

Khan Academy: The Khan Academy provides more than 6,500 free downloadable videos, so you can find and benefit from information on everything from astronomy to physics, from finance to art history. Application is free for everyone and they claim that it will remain free forever. It was created by Salman Khan in 2006 and is supported by Google, and the Bill & Melinda Gates Foundation as well.

Coursera: Coursera is an education platform that partners with top universities and organizations worldwide, to offer courses online for anyone to take [94]. You can watch short video lectures, take interactive quizzes, complete peer-graded assessments, and connect with fellow learners and instructors.

Star Walk for iPad: This app is an interactive astronomy guide. You may point the iPad towards sky and 'star walk for iPad' shows you the name of the stars and satellites you pointed to. Also you can see the details about the constellations, stars and satellites

which are appearing on your screen [95]. This explains almost everything about the star or satellite that you point to. You also do not need an Internet connection. It is only available in the AppStore.

TED (Technology, Entertainment, Design): TED began its life in 1984 as technology concerned with organizing conferences, entertainment and design, but today many topics have been added. This is a data tube of over 1,500 videos of the earth's most efficient presenters. Moreover it can be watched in 100 different languages. TED is a nonprofit organization, devoted to Ideas Worth Spreading and free lectures available through TED to contribute their classroom lessons on numerous topics. The people who are expert in their particular field of learning share their ideas all over the world. Also you can firstly download and then watch the videos later without the need for an internet connection.

Academic Earth: This was built in 2009 with the aim of providing equal quality education for everyone. It has a collection including many courses from the world's most important universities. Academic Earth presents over 750 online courses and 8,500 individual online lectures, giving students of all ages access to all college courses. There are many courses such as Science & Math, Art, Business, Design, Humanities, Engineering, Medicine, Healthcare and Social Science. Many universities contribute to this collection, including Oxford University, Stanford University, Yale University, University of Notre Dame, Columbia University and New York University.

4.5 Discussion

This digital and interactive content can be a big market in the future, as mobile technologies grow and are increasingly used in education. The quality e-content is a requirement in order to present students with a richer learning environment using educational technologies. However, the tablet-based and tablet-supported educational systems include digital, interactive, online contents and assessments. In addition, some interactive books are able to be used by teachers and they can track their students' progress online from their home. These types of books can become widespread in the

future. They can be used to facilitate some assignments for the students to do at home. The way of doing homework may change in tablet-based education. Thus, the children can continue to learn on their own and at their own pace.

The e-content pool is being grown every day by both private firms and government agencies in some countries. On the other hand, countries which plan to integrate tablet PCs into their education system should be aware of the e-content issues. The project implementers should create their own content infrastructure according to their own culture norms. This is because some global content portals may not be appropriate for all countries. Some regional and linguistic problems may also arise. For that reason, all countries that attempt to initialize a tablet project in their education systems should develop their own contents and applications.

On the other hand, the server system may need to be established in schools in order to carry out a tablet project. Large size applications and e-books which have videos and audios can be stored in these server systems. In addition, some applications may run with certain system requirements. For that reason the distributed tablet PCs may not meet these requirements. To overcome such issues, it can be used alongside a server system.

The content's quality, accessibility of the content, visualization of the content and ease of use are key factors to consider in order to benefit efficiently from mobile technologies in classes.

CHAPTER 5

In this chapter, we are asking anonymous informants some questions about the FATIH Project and the EBA portal. This section was put separately in order to learn more details about the FATIH Project's implementation outcomes and the benefits arising from the FATIH Project's experiences. Also this section illuminates some parts of the literature review.

5.1 Interview with Anonymous Informant about FATIH Project

An anonymous key informant gave us significant information regarding the FATIH Project and the EBA portal. It is presented as follows:

How much is the total cost of the FATIH Project?

Precise data about the cost of the project could not be taken. The authorities claim that the cost changes constantly.

This question was asked as a means of finding out the cost of this type of comprehensive technology project and reflecting this against other countries that planned to carry out similar projects. It was foreseen that 8 billion Turkish liras was the total cost of the FATIH Project in 2012 (Section 2.1). In this context, it was asked what the cost is today.

How much of the project was completed?

No data could be given about the completion rate of the project.

Although there are some troubles in deploying tablet PCs, interactive boards are being set up faster. Totally, about 10 per cent of the project has been completed.

However, almost 50 per cent of the Interactive Boards have been set up to our knowledge.

What is the result of the FATIH Project's Pilot?

As far as the information we can obtain, there is no clear result of the pilot application of the project. It was piloted on infrastructure use, not in order to evaluate benefit of the project.

Pilot application plays a key role in determining the shortcomings of the project as our research (section 2.1) shows. On the other hand, the pilot application provides a means of assessing the feasibility of the project (section 2.1).

Is there a distinctive difference on attending rates of the children to the schools after the project compared with before?

There is no research on the attendance of the students in schools in which the project had been completed.

As our literature review states (section 3.1), the tablet PCs engage the students at school and increase their attendance. It was asked to learn whether FATIH Project provides an increase in attendance.

As the tablet PC project in Turkey is quite new, we could not get precise information from the authorities.

When it is judged that certain tablet PCs are not updatable devices, how often will the student tablet PCs be renewed?

It is planned to renew the tablet PCs once every four years. On the other hand, the guarantee period of the tablet PCs remains for four years. This means, when the guarantee period finishes, each device will be renewed by the Ministry of Education.

What kind of security measures have been taken against possibility of theft of tablet PCs?

If the relevant department is notified by a student or a teacher regarding any theft situation, the stolen tablet PC is locked and made useless by the authorities. A

replacement tablet PC is not given to the students. This responsibility of care is entirely that of the students.

These security issues can arise in the implementation stage (section 3.6). If the children own their tablet PCs, they are liable to be stolen by malicious people. Thus, some measures should be taken in order to protect children and their tablet PCs. The tablet PCs can be made useless, if they do not receive any signals from the school's wireless connection. On the other hand, all responsibility should not be given to the student. If a genuine theft is proved, a replacement tablet PC should be given to the student.

Do you plan to implement any encouragement or enforcement program to increase tablet PC use in classes by the teachers?

There is currently no enforcement or encouragement program for increasing the use of the tablet PCs.

5.2 Questions on EBA Portal

How many members are in the EBA portal today?

EBA portal has 8,597,957 members including students and teachers.

Even though we could not reach the active data traffic of EBA, it is being seen that almost half of the all students and teachers have become members of the EBA portal up to now. Active data traffic gives us a more clear idea about the use of EBA and how aware the users are. According to our research, tablet PC use may increase with the quality of e-content (section 4.2).

As our observations show, the e-books in EBA portal lacks any embedded video, audio and animation components. Do you have any studies on creating interactive books in the future?

The e-book concept has been abandoned. In fact, it was being developed at first by EBA developers; the Head Council of Education and Morality did not permit some part of e-

book contents. Hence, only several e-books by TUBITAK (The Scientific and Technological Research Council of Turkey) will be developed.

As mentioned in section 4.2, interactive content increases the motivation of the students and engage them with classes. On the other hand, interactivity provides more permanent learning.

E-books play a key role by engaging the students in classes and which teachers can benefit from as lesson material. Thus, e-books make the tablet PCs more meaningful. If it is not developed and interactive content cannot be provided for tablet PCs and IWBs, the FATİH Project adoption may be delayed.

Do you also have agreements with other content providers apart from MorpaKampus, Vitamin and Okulistik portals?

According to the information we received, there are 27 content portals agreed with EBA. These are: “AI Yayıncılık”, “Akıllı Öğretim”, “Analiz Dijital”, “Arı Yayıncılık”, “Ata Yayıncılık”, “Blackswan E-class”, “Çözüm İnteraktif”, “EduKlik”, “Derspektif”, “Eksen DYS”, “Esen Yayınları”, “Express Publishing Yayınları”, “Gür Yayınları”, “İngilizce İzle, Öğren, Konuş”, “İşler Online”, “Kartezyen Kitapları”, “Küresel TV”, “Martı İnteraktif”, “MM Publications”, “Mobil Soru”, “Öğretmen Evde”, “Online İngilizce Öğretimi”, “Oxford Yayınları Kitapları”, “Özer Yayınları”, “Sonuç Yayınları”, “Tudem Online”, “Uygun Akademi”. The teachers can reach these portals by logging in EBA.

The awareness of EBA portal should be increased by making agreements with other content portals (section 4.3). In order to reach other users, it may be beneficial to take from different well-known portals.

Who are the professional content developers in EBA portal?

YEGİTEK (General Directorate of Educational Technologies) has professional studios and opportunities to develop content for tablet PCs. However, we thought that we are not prepared enough to develop all content for teachers in whole branches. For that reason, EBA employees will not continue to develop tablet PC contents. They will give this task to teachers who take courses for developing e-content. The teachers will be

trained on developing content for tablet PCs and Interactive White Boards. There are ongoing courses in different cities.

As our literature review (section 3.5) shows, the quality of e-content and educational applications increases the use of tablet PCs in education.

YEGITEK has wide opportunities to develop educational apps and quality e-content. Hence, it should be continued to create e-content and they should be pioneered for teachers. The EBA portal and the EBA market should be strengthened and provide e-content worldwide.

Which department or persons control the educational contents that it is uploaded by the users and what are the criteria of overcoming the control?

There is a moderation team in EBA and this includes 27 employees who are experts in their fields. This team consists of teachers of all branches and they control the documents uploaded constantly.

There are some general criteria such as prohibition of advertising in content. In addition, the teachers or students who upload content cannot give any link redirecting the users to another external source. On the other side, the content should be appropriate for the children's age level and should be suitable pedagogically. There are a number of criteria according to each branch.

The contents' consistency and suitability are considerable in reaching clear and useful e-contents (Section 3.5).

As the information we have got shows, the moderation team consists of some expert teachers and this team controls the files uploaded by users. However, the private content-providers are not audited by authorities. There is a deal between the parties. Private e-content portals cannot display any advertisement except their logos on the videos or other contents. Videos, presentations or any documents uploaded by the users should be put on the e-content portal. If the students and teachers cannot find the quality e-content on these portals, this causes a delay in the adoption for educational purposes, tablet PC use.

Do you plan to encourage the teachers to create original e-contents such as ‘prize for the best content’ with regard to enhancing the quality of the content?

E-content development courses have been initialized recently and this training is being given to teachers of almost all branches. Also an agreement was made with CEBIT. Hence, the teachers can create their own content and CEBIT may export this e-content abroad. However, the teacher can take 10 per cent of the copyright incomes.

Both adoption to tablet-Based Education and quality e-content generation are two important issues. In order to overcome these issues, the teachers and students should be encouraged to use our literature review (Section 3.2).

As our literature review and answers given by anonymous key informants show, the content development is one of the key factors. Encouraging the teachers and students is important in terms of adoption to the project. If the teachers generate the content on their own and they are rewarded by the authorities, the tablet PC use may increase and their adoption in educational circles is accelerated.

CHAPTER 6

CONCLUSION

In this chapter, findings are grouped under nine headings regarding our study. In addition, limitations and future studies are presented.

6.1 Findings

(1) Tablet usage spreads in the secondary education

Tablet PCs have many advantages in terms of ease of use and usefulness. Thus many developed and developing countries have initialized big tablet PC projects in their education system (Section 3, 3.2, 3.4). In many countries, the tablet PC usage rates has increased, particularly in recent years (Section 3).

There are different reasons for the countries to initialize big tablet PC projects such as FATIH in Turkey (Section 2, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8) and OTPC in Thailand (Section 3, 3.4, 3.5, 3.7, 3.8). Among the motivations, are reducing the use of paper and providing equal opportunities to students for studying in remote areas. In addition, tablet PCs present various advantages including portability, stylus pen use and functionality. These features make the tablet PCs attractive in educational circles, as discussed in Chapter 3.

This type of education is a dynamic process. As Section 3.1 underlines, technology affects the children considerably and it is increasingly difficult to engage them with school. So the teachers face some engagement issues; and attracting the students is getting harder. Due to all these reasons, tablet PC technology is seen as an alternative and motivating feature in education.

(2) E-content and digital materials are essential components of tablet PC projects

In traditional education, materials such as book, map, compass and ruler have been seen as necessary ingredients when attending school. Still materials are required to attend education; however, the type of content needed is getting transformed into e-content and digital materials (Section 3.4).

Achieving a revolution in education by pushing the tablet PCs into the classrooms is not an easy task. This is because using the tablet PCs in education is a rather new approach (Section 3), yet there is no country in the world which gives us positive or negative feedback with respect to outcomes of the learning and instruction processes. The big tablet projects in education provide some advantages such as in finding 1; on the other hand, creating e-content and digital materials are key factors that need to be considered in both tablet-based and tablet-aided education models.(Section 3.4).

(3) Classroom Management Software can decrease distraction hence makes it easy to control students in the classroom

Using the tablet PCs in the classroom can face the instructors with some difficulties in controlling students as the students' concentration is another important issue in the teaching and learning process (Section 3.1). Thus, an unmanaged, hence 'off the control' tablet PCs in the hands of children can be a source of discipline problems (Section 3.8).

Additionally, children under a certain age cannot use these technological devices in the classroom without help and guidance from the instructor. Also, in order to see the feedback instantly mirroring the screens of the students in the classroom, the teacher can be assisted by CMS (Section 3.8).

(4) FATIH Project may challenge technology gap in some regions

The FATIH Project includes tablet PC usage, interactive board and network infrastructure as parts of the education model. On the other hand, Turkey has a wide geography with a diverse adoption of technology. In this geographical area there are many different demographic regions in terms of socio-economic levels as well. Some research reports show that the economically poor demographic regions adopt the tablet PC use in class later than rich demographic regions (Section 3.2). This fact opens up a discussion on implementing the tablet PC project across the country.

(5) The infrastructure should be analyzed to design proactive solutions for potential problems in the implementation stage

The infrastructure requirements for big tablet PC projects include not only software but also hardware, plus network as well as maintenance personnel (Section 3.8). The lack of infrastructure or poor capability may cause failures of such projects. Similarly blackouts can cause negative psychology both in teachers and parents, and hence may cause reluctance in the adoption of tablet PCs in education (Section 3.2).

As the tablet PCs are given to the end-users, their responsibilities increase, naturally. While the authority may warn the users what is considered to be inappropriate usage, it may not control use fully. With the nationwide cyber security issues being discussed more in the development plans, a code of conduct for the security should be clarified. As argued in a study, cyber security should be considered not only from a technical perspective but also from an organizational and individual user dimension as well. For example, the Turkish State has put EAL4+ of TS 15408 restriction to the contractor companies for gateway switches in order to perform new cyber security standards [4]. Additionally, reliability, health, ergonomics and pedagogy should be considered as separate features to be handled for the long term breadth of the project.

(6) There is hardly precise evidence that tablet PCs increase all the students' success in classes

There are many debates about the tablet PCs which increase the academic success of students. In other words, there is not sufficient evidence in our hands to know whether they improve students' learning outcomes or not (Section 3.1). Although it increases the learners' motivation, this is not reflected in the students' academic success. Also there is a considerable body of literature reporting distraction in the classroom (Section 3.1).

(7) The tablet PCs increase the students' motivation in classes

Opposing the finding of 6 (above), tablet PCs motivate students in going to their classes (Section 3, 3.1). Teaching a lesson with traditional methods is getting harder every day with the increment of the visual technologies (Section 3.1). The studies show that the more the lessons are embodied, the more motivation increases (Section 3.1). The tablet PC technology helps the educators to embody the lessons and motivate the children to go to the class (Section 3, 3.1). In addition, the tablet PCs provide the students with the facility to learn outside of school hours as well.

The children want to use tablet PCs in the classes without frustration, although they encounter some technical problems (Section 3.1). It means that they have a high level of motivation (Section 3). The new generation is exposed to more visual items and moving objects in their lives than previous generations. For that reason the tablet PCs' visual and auditory features promote motivation.

(8) Teachers should be provided with proper training in the use of tablet PCs in order to implement tablet PC projects

The teacher is one of the most important pillars of education. Despite the emerging technologies such as e-learning, tablet-based learning or computer-based learning, it is indisputable that education would be hard to carry out without teachers. With technology

getting more adopted in society, being competent/literate in the computer fields is expected as a requirement for teachers as well as having knowledge in their subjects.

IT projects require people, technology and organization (Section 3.6). If tablet PC projects are to be implemented in all schools then all teachers working in these schools should be trained before, or in a short time after, the project is to be launched, so that the teachers can meet the needs regarding tablet PC use in their classes. In order to obtain considerable profit through the tablet PC project, it is considered that the training of the teachers with regard to efficient tablet PC use in the education is important (Section 3.6).

On the other hand, the prize and enforcement system should be implemented in schools to make the spread of tablet PC use in classes to be seen in our informal observations.

(9) Society should be informed sufficiently about the aim of the project

Adoption of the new technology project is significant in terms of its acceptance (section 3.2). Thus the project's components and the aim of the project should be explained to society. As with TAM, if the innovation is not accepted by the local society, it has no chance to be successful. For that reason, all of the project's stages should be transparent and the benefit of such an innovation should be expressed to the community as well.

6.2 Limitations

(1) Collecting data from schools

As a limitation to findings (3), (4), (6) and (7), we have excluded any data collection that requires unstructured/semi-structured and/or structured interviews, or surveys from schools. Not all regions and grade levels in Turkey have been investigated. This limitation restricts findings (3), (4), (6) and (7).

(2) Copyright and legal issues

The copyright and legality issues have not been investigated in depth. It may be necessary to research laws about e-content and e-materials. New copyright issues appear on the Internet and digital media day by day. For that reason this subject needs further research. This is a limitation of our findings (2).

(3) The projects' economic aspect

The economic aspect of the projects has not been investigated. This limitation restricts findings (3), (5) and (8). Findings (3), (5) and (8) include financial issues; hence, economic research on the infrastructure will be beneficial.

(4) Human computer interaction aspect of the tablet PC projects

The findings (2) and (3) have not been investigated in the context of human computer interaction in depth. Human-computer interaction investigates the interface and design of the devices or software. It may be beneficial to overview this field. This is a limitation of the findings (2) and (3).

(5) Sociological Dimension of the Project

The findings (4), (6), (7) and (8) include sociological dimensions; however, we excluded the sociological dimensions of the projects. The project may be implemented more successfully when the dynamics of the society are investigated in depth.

(6) Health issues of the tablet PCs

The health risks of the tablet PCs have been excluded in this study. The tablet PCs and wireless connection in schools can cause some health issues. This limitation restricts findings (1), (7) and (9).

(7) E-management

Electronic management has been limited as to classroom management software. This limitation restricts finding (3).

6.3 Future Studies

(1) Conducting Surveys

To overcome limitation (1), we recommend data collection through questionnaire or surveys. Data collected in this way can be evaluated and the results may give precise information about the future of tablet PC projects.

(2) Investigation of laws and regulations

As limitation (2) states, the regulation and law issues need further research. A detailed research on laws and regulations will be reinforcement for the study. The regulations concerning the use of technological devices in education at all school levels can be researched. By this means, the countries that are initializing tablet PC projects may understand the legal processes better.

(3) Financial and pedagogical considerations

The economic aspect of the project should be investigated in depth. The tablet PC project requires a significant budget. This dimension of the project requires further research. By this method, limitation (3) can be overcome.

(4) Human and computer interaction

Human behavior is a significant factor in the tablet PC project. For this reason human-computer interaction may support the research. It may promote the profit of the tablet PC project. Limitation (4) can be overcome by undertaking further research.

(5) Sociological aspect of tablet PC projects

One of the dimensions of technological projects is people. This makes the sociology more important. If the sociological dynamics are known the project will be more viable and beneficial. Thus, the sociological aspect of the project should be investigated in future studies in order to combat the limitation (5).

(6) Other countries applying tablet PC projects

This thesis does not investigate all the tablet PC projects in the world. There can be more successful countries to implement tablet PC project countrywide, such as South Korea. The Korean government's 'SMART' digital education initiative can be investigated in depth. This thesis is limited to FATIİH project in Turkey.

6.4 Conclusion

As seen in our findings, there are several dimensions to the various tablet PC projects. Our findings show that applying tablet PC projects across the country needs some prior requirements such as personnel training, infrastructure, sufficient e-readiness level, e-content, and classroom management systems. On the other hand, it should be handled over TAM as well. The benefit and usefulness of the project should be perceived by teachers.

As our research shows, maintenance of the tablet PCs is another significant issue in the projects. Principals in schools stress that technical personnel are needed to be in schools in order to be able to fix tablet PC problems instantly.

When we narrowed our scope to the FATIH project, we identified that pilot project gap and regional differences are not considered by the implementers. Although getting information is hard regarding the project, as we get information, quality e-content issues remain. Thus, the project is not completed in its planned duration.

Our research questions to be answered in this thesis were:

- What are the main challenges of teaching with tablets?
- Do the tablets promote education in secondary schools?
- If a big tablet initiative is to be implemented in education then what are the essential components and what are the potential challenges to consider?

Coming back to the research question, as we have mentioned above, there is still discussion whether tablet PCs promote education or not. First of all, it should be implemented as a pilot application. This is a must for a tablet project. E-content preparation should be started before the project starts and quality e-content should be provided for tablets. Personnel training, classroom management systems and infrastructure issues should be planned. As we have mentioned in our findings, considering e-readiness level, it should be decided whether the project should be applied countrywide or in some regions only. Finally society at large should be convinced of the benefit of the project.

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APPENDICES A

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WORK EXPERIENCE

Year	Place	Enrollment
2008-2016	Ministry Of National Education	Teacher
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FOREIGN LANGUAGES

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Football, Skiing, Cinema, Travel, Swimming