

PERCEPTIONS ON THE USE OF PRINTED VS. INTERACTIVE ELECTRONIC
TECHNICAL MANUAL IN A TRAINING: A BASIC QUALITATIVE
RESEARCH

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
COMPUTER EDUCATION AND INSTRUCTIONAL TECHNOLOGY

AUGUST 2019

Approval of the thesis:

**PERCEPTIONS ON THE USE OF PRINTED VS. INTERACTIVE
ELECTRONIC TECHNICAL MANUAL IN A TRAINING: A BASIC
QUALITATIVE RESEARCH**

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ABSTRACT

PERCEPTIONS ON THE USE OF PRINTED VS. INTERACTIVE ELECTRONIC TECHNICAL MANUAL IN A TRAINING: A BASIC QUALITATIVE RESEARCH

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Master of Science, Computer Education and Instructional Technology

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August 2019, 115 pages

The main purpose of this study was to understand the perceptions of participants of a technical training on utilization of interactive electronic form materials prepared with IETM technology. Specifically, the study aims to examine their opinions, comments and evaluations about their experiences and have them compare printed materials with the mobile digital content. The participants of the study were 8 employees who volunteered to contribute to the study out of 25 employees in Integrated Logistics Support department of a company in the defense industry. Basic qualitative research design was followed where the participants were interviewed one on one, and the collected data was analyzed by employing inductive content analysis. According to the results of the data analysis, the participants were of the opinion that the features of IETM made it easy to use, and shortened access to content time. The IETM, which has an interactive interface, 3-D animations enabled users to follow and understand the content better. The results were discussed reflectively with the pre-existing results in the literature.

Keywords: Mobile Learning, IETM, E-Book, Perception, Interactive Learning, Media Comparison

ÖZ

BASILMIŞ VE ETKİLEŞİMLİ ELEKTRONİK TEKNİK KILAVUZLARIN EĞİTİMDE KULLANIMINI KARŞILAŞTIRAN GÖRÜŞLER: BİR TEMEL NİTEL ARAŞTIRMA

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Tez Danışmanı: Prof. Dr. Ömer Delialioğlu

Ağustos 2019, 115 sayfa

Bu çalışmanın temel amacı teknik eğitimlerde geleneksel basılı formdaki kitap kullanıcılarının IETM teknolojisiyle hazırlanmış etkileşimli elektronik formdaki mobil dijital içerikleri kullanmalarını sağlamak ve bu tecrübelerine ilişkin görüş, yorum ve değerlendirmelerini araştırmaktır. Bu çalışma, temel nitel araştırma yöntemi çerçevesinde tasarlanmıştır. Araştırma verisi, bir savunma sanayi şirketinin entegre lojistik destek biriminde çalışan 25 kişiden çalışmaya gönüllü olarak katılmayı kabul eden 8 çalışanla yapılan bire bir görüşmeler sonucunda elde edilmiştir. Görüşmelerden elde edilen veri, tümevarımsal analiz yöntemiyle kodlanmıştır. Veri analizi sonuçlarına göre katılımcılar IETM in sahip olduğu özelliklerin kullanım kolaylığı sağladığını ve içeriklere ulaşma sürelerini kısalttığını belirtmişlerdir. Etkileşimli bir ara yüze sahip IETM de, 3 boyutlu animasyonların olması kullanıcıların içeriği daha rahat takip edebilmelerini ve anlayabilmelerini sağlamıştır. Araştırmanın sonuçları, literatürde önceden var olan sonuçlarla yansıtıcı olarak tartışılmıştır.

Anahtar Kelimeler: Mobil Öğrenme, IETM, E-Kitap, Etkileşimli Öğrenme, Medya Karşılaştırma

To My Family

ACKNOWLEDGEMENTS

I would like to use this opportunity to express my gratitude to everyone who supported me throughout the course of this thesis.

Firstly, I would like to thank Prof. Dr. Ömer Delialioğlu for his invaluable support and guidance. Also, I would like to thank my instructors Dr. Göknur Kaplan and Doç. Dr. Bilal Atasoy for my examining committee.

I would like to thank my colleagues for their help and support. Additionally, I would like to express my heartfelt gratitude to my husband and family whose love, support and encouragement always helped me to find the right path. None of these would have been possible without love and patience of my family.

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LIST OF ABBREVIATIONS

DM	Data Module
IADS	Interactive Authoring and Display System
IETM	Interactive Electronic Technical Manual
ILE	Interactive Learning Environment
ILS	Integrated Logistic Support
IPC	Integrated Parts Catalogue
PC	Personal Computer

CHAPTER 1

INTRODUCTION

1.1. Overview of the Study

The main aim of this study is to investigate the opinions, comments and evaluations of the participants on the utilization of the technical education materials prepared with IETM (Interactive Electronic Technical Manual) technology for using in the tablet personal computers instead of printed books during their training. IETM technology has been compared with traditional printed materials in terms of searching required information, the rate of reaching accurate information, the duration to reaching accurate information and quality of the images/animations. IETM has been prepared with the help of animation and interactive interface with three-dimensional models, whereas paper-based materials have been prepared with the two-dimensional visuals. The participants of this study were eight experienced employees in a defense industry company. All employees in the company can access all kinds of information about vehicles produced in the company. Technical manuals for the products are also prepared and are grouped under three main types;

- a. Operator's Manual: Used to get basic information about the vehicle,
- b. Maintenance Book: Shows how to make technical maintenance of the vehicle, and
- c. Illustrated Catalog of the Vehicle Parts: Consists of vehicle's parts in detail.

In the study, with the help of IETM technology, the 2D illustration of task steps in these three types of books was transformed into 3D animations. The employees involved in the study used the printed technical manuals to read and practice the challenging tasks. After a week, the same participants were given the equally

challenging tasks on the tablet PCs with IETM. Finally, they were asked to compare the two dimensional visual media with three dimensional animations. Furthermore, they were asked for their opinions regarding accessibility, speed and accuracy of searching for information in the two media types.

1.2. Background of the Study

1.2.1. Mobile Learning

Mobile devices are tools that make life more convenient in many areas. With the increase of the functionality of mobile devices, the trends and expectations for these devices have also increased (Sarwar & Soomro, 2013). Based on the development of technology, the amount of usage of mobile devices has also increased and mobile devices that are accessible everywhere have gained importance. Thus, mobile technology has become a vital part of users' lives (as cited in Kukulska-Hulme & Traxler, 2005, p.3). Along this lines, in addition to the researchers' predictions about the future, handheld devices have already surrounded our lives. According to the International Telecommunications Union (ITU) statistics reported by Sanou (2014), the total number of people using mobile devices is approaching the number of people in the world. The latest mobility report shows that there are more than 7.3 billion people that use mobile devices, and it is predicted to rise to 9.1 billion by 2021 (Ericsson, 2015).

One of the areas where mobile devices are widely used is learning/education. Thanks to the increase in the number and capabilities of mobile devices, students have mobile access to their timetables and course materials (Williams & Showers, 2014). In this respect, different training methods have also been developed for employees as a result of the increase in the capabilities of mobile devices. The exchange of data using mobile devices and the Internet has become faster and more accessible, and hence, a new type of learning environment has been formed which is referred as mobile learning (Ebied & Rahman, 2015). It can happen anytime, anywhere with the help of a portable computer device (Dye, Solstad, & K'Odingo, 2003). Similarly, mobile

learning is supported by mobile devices and smart user interfaces (Sharma & Kitchens, 2004). Laurillard (2007) defined mobile learning as a digital support for learning activities that are accessible, communicated, adaptable, collaborative. Trifonova and Ronchetti (2004) and Brown (2005) defined mobile learning as an e-learning variant where content is presented through wireless, portable communication tools. Sharples, Taylor, & Vavoula (2005), Cochrane (2010) and Evans (2008) explained that mobile learning is separate from all other learning types and that the most crucial difference is that students can learn continuously, regardless of time and place. Traxler (2007) mentioned the educational dimensions of mobile learning and emphasized that mobile technologies can be individual or socially supportive, which can maintain any pedagogical option. Mobile devices have many advantages such as flexibility and mobility (Lam, Yau, & Cheung, 2010, p.307). Among the benefits of mobile learning are the types of content that can be used in different formats (videos, sounds, images) that provides access to the same educational content regardless of distance. Therefore, employees are more motivated to learn something new because they can take their mobile devices everywhere with them.

1.2.2. Interactive Electronic Technical Manual (IETM)

Thanks to the developments in information technologies, there have been major changes in the field of training as in many other areas. One of these training areas is technical training. To ensure that the materials used in the technical training are kept up-to-date and in a manner that do not repeat similar contents become crucial day by day. IETM is a technological solution to the problems such as increased data amount, cost and storage of printed books. An information system infrastructure based on printed copies was requested to be transformed into a computer-controlled infrastructure that is capable of providing high-speed, online availability worldwide (Fuller, Joseph, & Jorgensen, 1997). IETM has enabled all these materials to be digitized and transferred to end-users.

The main purpose of IETM architecture is to provide a basis for the acquisition and distribution of shareable and interoperable technical data, distributed to end user's' working place. In this context, IETM can be considered as a technical training materials in a personal portable computer. End-users can use IETM as a source at their workplaces. In this study, IETM was given to users with tablet PCs. IETMs are working with the Interactive Authoring and Display System (IADS) application and they can be used through supporting tablet PCs. (IADS is a project created primarily for the purpose of creating technical manuals in electronic format instead of paper for military purposes. The team behind IADS has been developing IETM software since 1989. What originated as a “paperless” initiative has become a full-featured application with many features users are familiar with from other programs including navigation history and search capabilities (“About IADS”, n.d.)).

It is quite costly to produce and store conventional printed books. In order to avoid high costs, there is a need to switch to a new high-efficiency system in accordance with the S1000D standards (Szymanowski & Karim, 2010). The S1000D specification (International Technical Publications Specification using the Common Source Database) is an internationally accepted guide recommended by companies for the technical publication production process (Xing-Dong, Z., Yi, L., & Jian-Hua, S., 2014). The IETM is designed to meet this need and can work accordance with the S1000D standards (Koh, Kwon, Kim, Nam, Jang, Lee, & Lee, 2000). The inclusion of mobile learning environments in technical training through IETM, and the digitalization and transfer of printed technical hand-books to these environments has become an important task. Interactive technical manuals do not only reduce printing costs but also provides convenience to users. There are three innovative characteristics that are not possible with traditional printed technical manuals (TMs). These characteristics are frame-oriented presentation, improved access to required information with different ways, and interactivity between the users and manuals (Fuller, Joseph, & Jorgensen, 1997). In this study, according to the data obtained with interview from the defense industry company, the results of IETM and printed

materials comparisons in terms of reaching the desired information, accessing accurate information, and visual quality are included.

1.3. Statement of the Problem

Technical training has become essential for increasing staff competencies. When technical training is necessary, some of the problems that departments encounter are reducing expenses, shortening the training circle and improving the quality of training (Jiaju, Zheng, Zhenji, Yufei, Quangen, & Yonghui, 2018). The primary objective of IETM is to find out what the problems are in complex technical systems, and then to provide maintenance and repair (Ammar & Ghobashy, 2001). In this sense, IETM is an interactive platform, which can present up-to-date information to end-users according to current conditions and users' inputs (Jiaju, Zheng, Zhenji, Yufei, Quangen, & Yonghui, 2018). Besides, IETMs reduce the costs of printing as well as storage, and increase the comprehensibility of complex subjects through three-dimensional (3D) animations. Although IETM provides such advantages when compared to printed books, the number of projects based on IETM in technical training in Turkey is limited. Since the S1000D standard is a more common standard and technology used abroad, it is included in the contracts for foreign joint projects. Therefore, companies using these standards in Turkey are usually foreign companies engaged in joint projects (Bayrak, 2013). In order to contribute to the literature on IETM in Turkey, it would be useful to compare the advantages of IETM with books in traditional printed form so that the comparison could guide companies, which might consider switching to this technology.

1.4. Research Questions and Purpose of the Study

The main purpose of this study was to understand the perceptions of participants of a technical training on utilization of interactive electronic form materials prepared with IETM technology. The study aims to examine participants' opinions, comments and evaluations about their experiences while using these two media types. The study also aims to compare the quality of the images in two platforms while evaluating the

accessibility, speed and accuracy of the searching information. The study is a basic qualitative research. Therefore, the emphasis is to understand how participants interpret their experiences of two different media and what their experiences mean for them (Merriam, 2009, p.5). In the context of the study, participants who experienced an IETM were asked to state their experiences and opinions about the application in terms of the clarity of the visuals in the documents, the accessibility, speed and accuracy of the searching information. It was aimed to investigate how participants perceive the system, how they gave meaning to the application. The main research question, which was formed in parallel to the main purpose of the study, is as follows:

- What are the opinions of employee (Integrated Logistics Support Department) on the efficiency of IETM (Interactive Electronic Technical Manuals) with comparison to traditional printed book forms?

The more specific sub-questions are:

- What are the participants' opinions about how the IETM and printed book forms affect users' ability to follow task steps?
- What are the participants' opinions about searching for the required information?
- What are the participants' opinions about the rate of finding the accurate information?
- What are the participants' opinions about the duration to reach the accurate information?
- What are the participants' opinions about the quality of the visuals?
- What are the participants' opinions about the IETM system in general?

1.5. Significance of the Study

IETM is particularly used in technical training and has an important role in conducting Integrated Logistics Support (ILS) processes. ILS is a process in which administrative

and technical activities include design, development, operation, and maintenance planning of the products. It is also a management approach that allows planning and developing systems and optimized support to ensure proper availability throughout the life cycle of the products. The life cycle of a product is the process that includes the training and maintenance process required by the end user, starting from the time the product is manufactured. The main purpose of Integrated Logistics Support process is to increase the usage period of the products while minimizing the need for support; thus, achieving higher benefits throughout the “Life Cycle,” of the products and financial benefits (Timur & Eren, 2018). Although the use of IETM is increasing, the search for literature yielded no comprehensive research studies on the usage of IETM technology in the Turkish defense industry.

One of the most important activities in the field of integrated logistics support is preparing technical documentation and training (Timur & Eren, 2018). In the defense industry, it is necessary to prepare technical documents and training materials so that end-users operate the systems effectively. IETM technology adds a new dimension to the technical documentation, which is an important issue for the defense industry. In this context, the results of the study on the opinions of the users regarding the use of IETM are significant for subsequent studies as well as companies that might use the IETM technology. The findings of the study can shed light on the design, development and use of digital content as technical manuals.

1.6. Assumptions

For this study, the following assumptions are made:

- The participants answered the interview questions accurately and honestly,
- The data have been accurately gathered and analyzed.

1.7. Limitations of the study

It is necessary to reach the appropriate participants so that one can conduct comprehensive research. In this study, the convenience sampling is used so that

appropriate participants can be found easily. However, contextual factors may influence the results. For example,

- The honesty of the subjects' answers to the instruments,
- The possibility that participants might have seen similar task steps before the study,
- The total number of tasks in the book and IETM is different (IETM has more tasks),
- The results of the research may be changed by the comparability of results across different settings.

1.8. Definition of Terms

IETM: IETM (Interactive Electronic Technical Manual) is a portal for managing technical documentation. IETMs compress text to online pages that may contain animation and allow readers to find the necessary information. IETM, published in electronic format, is becoming more popular than paper-based guides for interactions and ease of use.

S1000D: It is defined as an international specification for technical publications using a common source database. The S1000D standard is used while the contents are produced in the technical documentation process of the defense company. The S1000D is an international standard that covers the processes related to planning, management, production and updating of the technical documents of any civil or military project. The information produced according to the S1000D standard is formed in a modular structure called a data module. Data modules are stored in a database called common source database, which allows easy access and reuse of information. Data modules that are created using S1000D standard and XML codes enable the creation of content in IETM and printed books.

Mobile Learning: Mobile learning is defined as the use of wireless mobile technology products to access information and/or learning materials whenever and wherever the learner wants (Ally, 2009).

Traditional Printed Book: Document with instructions for configuration, operation, use, maintenance, parts list, support and training requirements for the effective utilization of an equipment, machine, process or system (“Business Dictionary”, n.d.).

Maintenance Manual: The manuals contain information about the actions required to maintain or restore an equipment, machine, or system component to the specified executable condition to achieve maximum lifetime (“Business Dictionary”, n.d.).

Operator Manual: The manuals contain basic level information about operator-level vehicle systems and their use.

Tablet Computers: Tablets are mobile devices that can detect finger-pencil movements. They can be combined with mouse and keyboard, and be equipped with sensors such as cameras. They are used with virtual keyboard plugin. A mobile learning environment that is provided through mobile applications can directly be installed on these devices.

Integrated Logistics Support (ILS): It is a management process in which supportability and logistical support issues are integrated into the design of a system or equipment and taken into account during its lifetime. It is the process by which all elements of logistic support are planned, acquired, tested, and provided in a timely and cost-effective manner (“ILS”, 2005).

1.9. Summary

The introduction chapter included the background of the study, statement of the problem, research questions and purpose of the study, and the significance of the study along with assumptions, limitations and the definitions of terms.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the sources related to the field are reviewed based on the research question. This review will point out the importance of the research questions. This section includes synthesis of the literature under some important headings: development of the traditional printed books and e-books, mobile technology, mobile learning, interactive electronic technical manuals, reasons for using IETM in this study, e-book, S1000D specification, integrated logistic support, access to information, interactive learning environment, visual/animation quality and effects, structural flexibility comparing two different types of media and disadvantages of IETM.

2.1. Synthesis of the Literature

2.1.1. Developments of the Traditional Printed Books and E-Books

Undoubtedly, the most fundamental element in the development of civilization is knowledge. In this context, the importance of books as a source of information is obvious. Book, which still exists in printed and electronic form, continues to be the main source of information (Dalkıran, 2013). The traditional book has undergone many changes from its first appearance until today (Hidayetoğlu & Çoruh, 2016, p.183). Various civilizations used different materials as a basis for writing during all the stages of development of book until it took its present form from the first appearance. The form of book has varied depending on the possibilities and limitations of the materials used throughout the ages. These materials include clay tablets, tree bark, papyrus, parchment, paper, rarely silk/fabric, bones and animal shells, bronze, and even microfilms (Hidayetoğlu & Çoruh, 2016, p.184). The invention of paper and press has been an important point in the history of culture by providing a low-cost

book production technique, and thus reaching a wide audience. (Ocal, 1971, s. 77). In order to define the new form of book, new terms derived such as digital media, e-books, digital books and so on. Although many terms are derived to refer to the new form of book, the term e-book (electronic book) is commonly used (Chen, 2003). Put another way, the name of the “E-book” is used to describe the new book form, and it appears to be sufficient because it refers to the electronic version of traditional book. However, the e-book is not just the electronic version. The name adversely affects the correct perception of the new form with very different characteristics than the previous one. The book word in the e-book term inevitably reveals a connotation of the Codex form so that the characteristics of the new book form can be perceived as confined to the characteristics of the traditional book. (Martin & Aitken, 2011, s. 139). E-books can include features such as video, animation, animated texts (kinetic typography), and hyperlinks. They have gone beyond being simply electronic versions of printed publications in that they can continuously update the content, do advanced search in the content, adjust text size, convert text into sound, include links to web sites, underline text in some kinds of e-books, highlight text with color, etc. (Abott & Kate, 2004, p. 1). In this study, traditional printed books and e-books (IETM) were used.

2.1.2. Mobile Technology

Naismith, Lonsdale, Vavoula and Sharples stated that we are observing the formation of a mobile society connected to a wide range of information sources and communication tools in every aspect of our lives in today's world (2004). People can take their mobile devices with them wherever they go and access to a variety of information sources at any time. Statistics demonstrate that the quantity of cell phone clients, which was 4.15 billion in 2015, increased by 53 million in 2019 and reached 4.68 billion. This number is expected to reach 4.78 billion by 2020. Parallel to the increase in the world, Turkey has seen a gradual increase in tablet and smartphone ownership rate (TurkStat, 2019). In April 2016, 96.9% of households had mobile phones or smartphones, while 22.9% of households had desktop computers and 36.4% had laptops while 29.6% had tablet computers (TurkStat, 2017). According to data

released by TurkStat (2018), there were 5 desktop computers and 3 tablet computers in 10 houses. Turkcell's 2013 survey reports that the number of tablet users aged 12 and over has reached nearly 1 million (Turkcell, 2013).

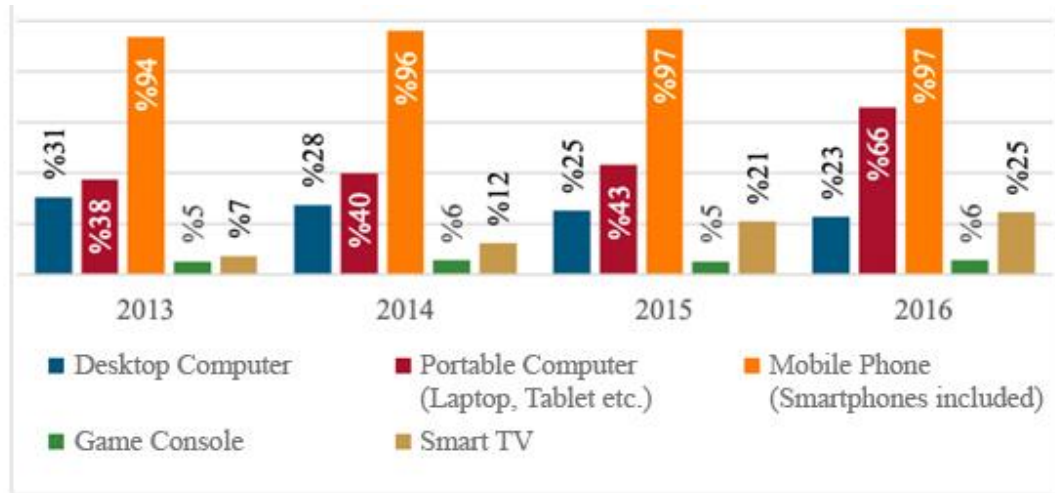


Figure 2.1. Rate of Presence of Technical Devices in Households (TurkStat-2013-2014-2015-2016)

In the field of technology, “mobile” refers to personal and portable devices such as mobile phones (Naismith, Lonsdale, Vavoula & Sharples, 2004). As the mobile name implies, mobile devices help overcome space limitations (Gerard, Knott & Lederman, 2012). The portability of mobile devices provides an unrestricted opportunity. Tablet technologies such as e-readers, smartphones and tablets have turned out to be progressively prominent because of advances in touch screen, handwriting recognition and flexible computing applications, empowering producers to readily address the issues of consumers (Gerard, Knott & Lederman, 2012). IETM application in the study was used with tablets. In this way, the feature of mobile technology were used. According to Gerard, Knott and Lederman, there are three basic features of tablet technology universally. These are digital ink, portability, and unobtrusiveness (2012).

The digital ink feature of tablet innovation improves content with various choices, enabling users to write, edit, delete, and draw text. Besides, features such as adding

notes to PDFs, text highlighting or handwriting recognition make tablet technology more useful (Gerard, Knott & Lederman, 2012).

The portability of tablet technology increases access to learners' thought, problem definition, communication, and then analysis through physical and temporal portability. It also makes more use of space and time traditionally unavailable for learning (Gerard, Knott & Lederman, 2012).

The unobtrusiveness refers to the physical design of tablet technology devices that help preventing distractions and focusing more on teaching and learning (Gerard, Knott & Lederman, 2012).

2.1.3. Mobile Learning

Technology, the systematic information required to provide products and services in many fields such as industry, agriculture, trade and education (Durukan, Hacıoglu & Donmez Usta, 2016), has become an important part of human life. Since the industrial revolution, there are robots and cyber technologies that are capable of doing simple, heavy or complicated jobs (Hayırlı & Isler, 2018). In the information age that we are experiencing nowadays, technology plays an important role in globalization as a source of information, access to it and educating individuals. For example, information and communication technologies and the Internet are mostly used for research, training, homework, reading newspapers, communication/chatting (facebook, e-mail, etc.), playing games, listening to music, watching series/watching movies, shopping, reading books (Karaman & Kurtoğlu, 2009). Naismith, Lonsdale, Vavoula and Sharples expressed that mobile technologies are turning on progressively embedded, ubiquitous and networked, with improved capacities for rich social interactions, context awareness and internet connectivity (2004).

The use of mobile devices is increasing day by day. Due to this increase, mobile technologies have affected almost every area of human life. The technological developments that occur with the use of mobile tools also affect the education process (Aktaş & Çaycı, 2013). Most technologies such as tablet computers and smartphones

have an impact on learning and teaching (Martin et al 2011). The idea of m-learning has turned out to be famous in new instructional design because of the advancement and expanded utilization of new devices and innovations like tablets and smartphone (Korucu & Alkan, 2011). E-learning model that includes learning and teaching activities by providing mobile devices and technologies to learners is called mobile learning. It can be anywhere, anytime with the help of a portable computer device (Dye, Solstad, & K'Odingo, 2003). Mobile learning is supported by mobile devices and smart user interfaces, independent of space and time (Sharma & Kitchens, 2004). Park (2011) defined mobile learning as the employment of mobile or wireless technologies for learning purposes. Similar to this definition, Trifonova and Ronchetti (2004), and Brown (2005) described mobile learning as an e-learning variant where content is presented through wireless, portable communication tools. Nowadays, mobile learning is done through smartphones and tablet devices, and such advancements can significantly affect learning.

Mobile learning is separate from all other learning types. The most important difference of mobile learning is that students can learn continuously and without any restriction in terms of time and space (Sharples, Taylor, & Vavoula 2007, Cochrane 2010 & Evans 2008). According to Laurillard (2007), mobile learning is a digital support for learning activities that are accessible, manageable, adaptable, collaborative and creating in the remote location of the learner and the teacher. Thanks to mobile tools used in education, useful outputs are obtained; with the developments in technology, mobile learning has become wide spread (Simsek & Doğru, 2014). With the mobility, learning does not remain in the classroom environment and move into the learner's surroundings, both real and virtual, thus becoming more situated, personal, collaborative and lifelong (Naismith, Lonsdale, Vavoula & Sharples, 2004). The use of portable technologies in education also makes the learning process more effective (Aktas & Caycı, 2013). As Uden (2007) observes: "Mobile technologies offer new opportunities for students' educational activities in that they can be utilized crosswise over various areas and times." Tablet computers can be easily used in

education due to their small size, ease of use and transportation (Ozoglu, Kaysi & Ozoglu, 2013; Simsek & Dogru, 2014). Klopfer, Squire and Jenkins (2002) and Ozdamli and Cavus (2011) identify some properties of mobile devices that produce unique educational characteristics. These features can be listed as follows:

- Portability – the small size and weight of mobile devices means they can be taken to different sites or moved around within a site.
- Connectivity – a shared network can be created by connecting mobile devices to other devices or to a common network.
- Interactivity – might be useful to keep users active by engaging with mobile devices, users can access learning content without any borders so that it can be accessed at any time.
- Reliability – content be displayed in a consistent manner, regardless of the browser, device, and screen size.
- Ubiquity – mobility of the devices provides context aware condition meaning that user is not bounded to time and space conditions.
- Immediacy – provide an opportunity to learner for immediately accessing to information.
- Individuality – scaffolding for difficult activities can be customized for individual users.

Since mobile learning is a new field, research is still at a stage where different categories of m-learning pedagogy are developed, defined and researched (Alsaadat, 2017). Traxler mentioned the educational dimensions of mobile learning and emphasized that mobile technologies can be individual or socially supportive, which can support any kind of pedagogical option (2007). In the formal education, mobile learning environments are used at different levels ranging from small age groups to university education. In a study conducted in China (Chen, 2013), it was concluded that tablet computers and other mobile technologies are ideal tools to encourage student autonomy and learning in- and out-of-school environment. In particular, mobile technologies have been carefully studied and clearly demonstrated to be useful

as language learning tools with a positive attitude towards activities with tablets. User feedback on the use of tablet PC is extremely positive (Mock, 2004). In the same way, mobile devices are used in the trainings given in the workplaces after formal education to increase the productivity. All these features have increased the importance of mobile learning (Traxler, 2009). Mobile technologies contribute to learning in many ways and can be applied to in- and out-of-class learning, i.e., non-formal learning environments with e-learning or traditional learning methods/devices. As it evolves, technology is expected to innovate more options for mobile learning (Alsaadat, 2017). In this process, it is important to focus on the fact that the goal of mobile learning is to facilitate learning. (Alsaadat, 2017).

2.1.4. Interactive Electronic Technical Manuals

The most important reason for the increase in real-time information needs is the widespread use of the Internet. Nowadays, the demand of the computer literate society is electronic media, not paper copies. (Koh, Kwon, Kim, Nam, Jang, Lee, & Lee, 2000). All these technological developments and trends affect the field of education and even technical training. With the developing technologies, such as tablet PC, the transfer of paper-based technical manuals to digital media has become important. This transformation movement, which aimed at reducing the increasing printing costs, first appeared in the 1980s and became a reality in the 1990s, and thus the IETM emerged (Fuller & Jorgensen, 1997).

IETM is a technical manual constructed in digital format by means of an automatic writing system on a suitable tool (e.g., tablet). IETM utilizes the strategies of compilation and storage on text; graphics and images take the place of the paper-based manual with respect to the functions and services. By employing the database index technology, it is possible to search the contents of IETM directly and fast. Also, it is more useful than traditional forms due to its storage feature. In the IETM, there are simulation images of instrument operations and maintenance dynamically. According

to *Introduction to IETM* (2013) results, IETM is designed to be used in a technological environment and often has three features:

The presentation format is page-oriented, not frame-oriented. The format of the information presented through IETM is arranged to be compatible with the device used. It is also designed to provide maximum comprehension when used in devices of different sizes.

The necessary information can be obtained in a variety of ways. The technical data elements in IETM are related to each other so that a user can access the necessary information as convenient as possible.

The computer-controlled IETM display device can function interactively. The IETM provides procedural guidance, navigation instructions and supplementary information to users. The users can intervene or edit some parts of the IETM content, and hence, the system works according to these actions interactively.

2.1.5. Reasons for Using IETM in This Study

Technical publications provide the data and operations necessary to carry out scheduled and unscheduled, preventive and corrective maintenance tasks on the equipment of interest. Unless technology publications are accurate, comprehensive, understandable and accessible, there would be the potential for improper maintenance, leading to an accident or serious damage. At the very least, maintenance time and effort would increase, which affects the availability and cost of ownership of the system. Traditionally, technical publications have been paper-based. The current documentation methodology is predominantly based on paper documentation. With the increasing complexity of systems, paper documentation becomes difficult to use, consuming an excessive amount of paper that tends to deteriorate easily when used by multiple users or frequently used (“Introduction to IETM”, 2013). Technology publications using a text-based format with supporting figures and diagrams have a table of contents and a structured format to ensure readability. In the maintenance environment, there are a number of shortcomings that increase maintenance time and

increase the risk of maintenance errors (Edwards, 2004). These limitations can be overcome by adopting electronically generated technical manuals known as IETM.

IETMs are prepared using an automated authoring system, and are designed for electronic display (Edwards, 2004). It allows a user to find the requested information faster and easier than a traditional printed book. It can be combined with a single large database powered by video, audio, animation and interactive training software modules (“Introduction to IETM”, 2013). IETM provides information where the user needs it. With this technology, information is faster and more accessible for users. Interactive electronic information guides are the most efficient and cost-effective way to control, transmit and store data (“Introduction to IETM”, 2013). IETMs are digital technical manuals designed for electronic display using an automated writing system. According to Edwards, IETMs have been developed to overcome some of the shortcomings of paper-based publications and have the following features (2004):

- The format and style of the information presented and the use of features such as scrolling, zooming, color, motion and sound are optimized for maximum comprehension,
- The technical data elements that constitute the IETM are interconnected, so that users can access to the desired information with lots of different ways,
- The electronic display device’s interactions provide procedural guidance, navigation instructions and additional information.

In addition to all these features; in our country, IETM is a technology that has recently begun to be used in the field of defense industry. It has started to be used as an alternative to paper based technical publications and is relatively new compared to paper based technical publications. The low number of studies using IETM in our country was influential in using IETM in this study.

2.1.6. E-book

E-book is a media format that is published electronically or transferred to electronic media and used in this environment, which contains text and image that can be read

or viewed with various software and devices. (Gurcan, 2005). Technically, e-books, which can be defined as electronic files that can be read on desktop computers and portable devices (such as laptops, pocket computers, smartphones, tablets and other e-book readers) and that are created as copies of printed books, are a new book format that offer all the features of printed books as well as different possibilities for the user (Rukancı & Anameric, 2003). After discussing the literature about the e-book definition, Kaya (2013) stated that e-books are designed to be read in computer or electronic media; they are non-printed but carry all the features of printed books. E-book is a portable book format that includes interactive links with audio, image, video, multimedia items. It is a computerized version of printed books. Texts written in books in pdf, e-pub, doc, or txt format are called e-books (Salman, 2013). It can be used via computer or a handheld device designed for this purpose, it contains all the features of the printed book, but also includes multimedia and interactive links. (Ulke, 2016). Textual digital objects, which are composed of a book with similar features, such as interactive tools, multimedia materials, footnotes, accents, bookmarks, linked/bridged texts and reference functions, are called e-books (Juarez, 2014). Electronic content, which is a combination of software and hardware that can be viewed on any device with a screen or on a special hardware, is called an e-book (Dogan, 2012). Based on this definition, when the IETM application is used over the tablet, the tablet also has the e-book function.

One of the biggest features of the innovations in the digital world is that the contents of e-books are supported with audio and video, allowing them to be embedded into the e-book as part of it. In this way, during the learning process, all components for learning are collected on a single platform, and learners do not distract themselves by moving between different platforms in these processes. In the literature, studies generally have positive results of e-book use in education for example presenting audio or video files together with e-books can help learners to focus their attention on the learning process. E-books attract the attention of users thanks to their high storage capacity and portability (Celik, Yıldırım, Yıldırım & Karaman, 2013).

2.1.7. S1000D Specification

The S1000D specification (International Technical Publications Specification using the Common Source Database) is an internationally accepted guide recommended by companies for the technical publication production process (Xing-Dong, Yi, & Jian-Hua, 2014). Information generated according to S1000D standard is formed in a modular structure called data module (DM). This specification covers the processes related to data planning, management, production, updating, exchange and distribution of the different types of technical documents of any civil or military project (Bayrak, 2013). The S1000D standard has not been widely used in technical documentation processes in our country (Bayrak, 2013). In the technical documentation process carried out in the defense industry company (in this study), the S1000D standard is used while the contents are produced. The IETM application used in the study was prepared according to S1000D standards.

In the traditional method, the engineering data is selected according to the type of technical document where the data is to be used (e.g., operator manual, maintenance manual, illustrated parts catalogue). The writing, publication and storage of data and preparing the training documents processes are carried out separately (Jordan, 2011). There is usually repetitive information in these documents since the operator-maintenance manuals and training documents are prepared individually. Recurring the repeated information each time leads to inefficient use of time and storage. Basic structure's of S1000D standardization is to create a data module with text content, visual, graphical and procedural, reference and management information. In addition that, S1000D enables to store these data modules in the common source database, which allows easy access and reuse of information (Xiaofeng, Xufei, Xiucui, Li Zhenliang, & Ruisheng, 2015). Through these data modules, the same information is not created over and over again. It is very important to not to repeat same content in terms of concerns over time saving, storage and consistency.

2.1.8. Integrated Logistic Support

This study was conducted with employees of integrated logistics support department. Integrated Logistic means the system-wide management of entire logistics chain as a single entity, instead of separate management of individual logistical functions (Jones, 2010). The main purpose of the integrated logistics concept is through management of the main and related flows in the integrated business structure: design - procurement - production - distribution - sales - service. The concept of integrated logistics involves the integration of functional areas and their participants within a single logistics system in order to optimize it (Jones, 2010). Integrated Logistic Support (ILS) offers a disciplined, unified and iterative approach to the management and technical activities required for integrating support issues into system and equipment design, developing support requirements that are relevant to the preparation objectives, designing and consistency. It provides the necessary support at the minimum cost during the operation phase (Frager, 1986). According to Frager, these management and technical activities can be listed as (1986):

1. Define the support,
2. Design for support,
3. Acquire the support,
4. Provide the support.

In this study, there are four units under the Integrated Logistic Support (ILS) department of the defense company. These units are “Reliability”, “Usability”, “Maintainability,” and “Technical Documentation”. The definitions of these units related to their duties are briefly as follows (Jones, 2010 & Frager, 1986):

Reliability: The duration or probability of failure-free performance under stated conditions. Possibility of an item performing its intended function within a specified range under certain conditions.

Usability: The range that a product can be used to achieve specified goals with effectiveness, efficiency, and satisfaction. The word “usability” also refers to methods for improving ease of use in the design process.

Maintainability: The measure of the ability of an item to be retained in or restored to specified condition. In this process, personnel who have the required skill level perform maintenance using the maintenance procedure and resources.

Technical Documentation: The technical data element of the Integrated Logistic Support process develops the technical knowledge necessary to generate engineering and logistical support documentation.

2.1.9. Access to Information

With the increasing use of mobile devices and increasing internet connection speeds, the contents are rendered with more visual, effective and attractive than standard printed books. (Gumus, Guler, Guler, & Ozogut, 2012). In the first e-books, only the ease of transportation came to the forefront, but nowadays e-books are used in which the user interacts more. Today, interactivity of the books is more important for users. As the meaning of the word interaction suggests, the user and the tablet should interact where the user can alter the content in various ways. IETM has an interactive interface and offers users a variety of features during interaction. For instance, users can reach the task steps by writing the name of the task correctly on the search button. IETM's interactive interface also allows users to start and resume the videos in the content, or to re-start a video. Images can be opened by clicking on the visual's name (see Figure 2.2 for a visual representation of some of the features of IETM).

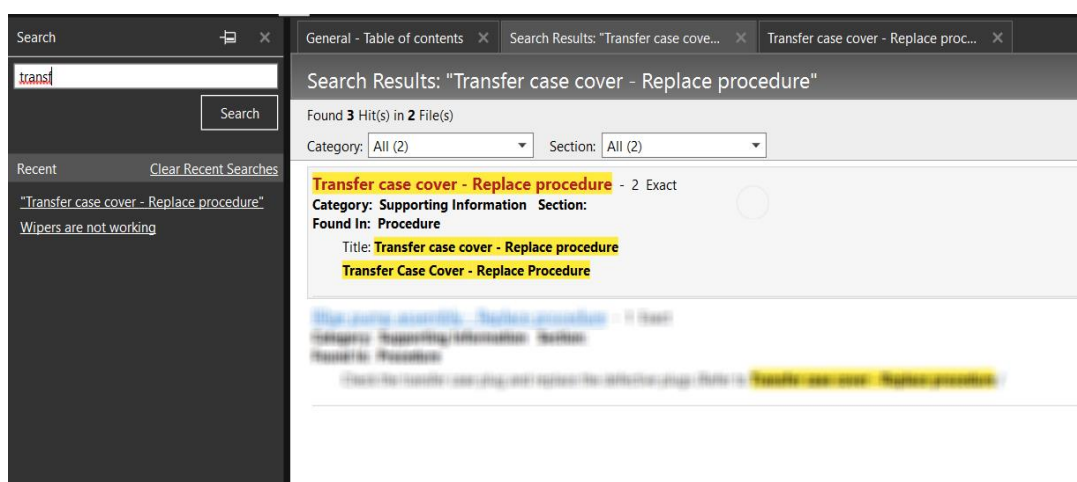


Figure 2.2. Searching Options

In the literature, books that contain multimedia materials and enable user to interact with the content are defined as interactive e-books. Studies on e-books or interactive books suggest that students and teachers have positive opinions about interactive e-books (Simon, 2001; Ismail & Zainab, 2007; Duran & Ertugrul, 2012; Mansor, Hassanuddin & Abdullah, 2012; Ozturk & Can, 2013). The studies show that the interactive e-book in the learning-teaching process helps students facilitate the learning process while improving understanding (Aedo, Diaz, Fernandez, Martin & Berlanga, 2009; DeFrance, Khasnabis & Palincsar, 2010; Grimshaw, Dungworth, McKnight, & Morris, 2007; Korat, 2010).

E-book offers users the possibility to browse and search content. The search feature, which is not found in the printed book, allows to use time efficiently in the process. Due to these features, e-books are preferred by the users in the process (Bodomo, Lam & Lee, 2003; Chu, 2003; Chen, Li & Jia, 2005; Gunter, 2005). There are studies show that users have more favorable view of e-books in terms of interactivity, in the literature. For example, Rogers (2001) and Soules (2008) state that e-books have more interaction and personal use for convenience. According to the research result (Ongo, 2010), search the information, download the content to computers or the handheld device, copy and paste the content were some of the extending features of the e-books. Easy to search and find information is also extending feature according to participants

of Ongozi (2013)'s study. According to 80% of participants in Ongozi (2013)'s study, the most important features of the e-books were; anytime access the contents, ability to search and download it on laptops and carry it with the mobile devices.

It is important to reach the information quickly as well as accurately (Ongozi, 2010). This means that users need to find the piece of information they aspire to with minimum error ratio. The criterion here is that the result obtained after the search should be accurate. For example, a table of contents is used to reach a point in a book and a page number corresponds to the content to be accessed. Nevertheless, it may not be possible at the first try to access desired page because of clicking on a wrong link. Then, it would be necessary to return to the table of contents and repeat the steps. Such a cycle wastes time of users. Necessary information can be gotten in an assortment of ways. The technical data elements that make up the IETM are related to the way that a user can access the necessary information as easily as possible ("Introduction to IETM", 2013). Since the search option is used in IETM, return and rediscovery is quick even if an incorrect page link is clicked.

2.1.10. Interactive Learning Environment

Interactive learning environment (ILE) should be explained starting from the word interactive which is also placed in the "Interactive Electronic Technical Manual." An *Interactive* document is an electronic medium that takes shape in response to a user's request and offers new options compared to previous selections. By following different selections, the user can check or change the action of the device or the result of an applications ("Business Dictionary", n.d.).

The interactive learning environments with special software and hardware equipment are created to produce learning and teaching environments. This learning can be academic, informal or business related. The IETM application can be used interactively (as a result of the user's request and input of information) to provide procedural guidance, navigation instructions and supplementary information

(“Introduction to IETM”, 2013). IETM provides an interactive learning environment to users such as search features, video start and stop keys and so on.

2.1.11. Visual/Animation Quality and Effects

One of the biggest features of innovations in the digital world is that e-books are supported with audio and video content allowing them to be embedded into the e-book as part of it. E-book content that provides visual elements contributes to the learning process (Kaysı & Aydın, 2014). IETM is a technology that can be used on a tablet and contains content such as animation and text, and thus has interactive features. Thanks to these features, IETM can be likened to e-book, tablet or interactive book. E-books containing material supporting the written text in it enrich the learning environment unlike printed books. Since interactive books have a different format than known e-books, they can contain elements such as video, audio, animation and interaction and support written content. Due to these characteristics, interactive books are seen as favorable for users and preferred against the printed book (Abdullah & Gibb, 2008; Schwartzman & Tuttle, 2002; Soules, 2008). The participants have a more favorable view of e-books since they can accommodate multimedia material (Kılıc Turel & Ozer, 2015).

2.1.12. Structural Flexibility - Comparing Two Different Types of Media

In today’s world where digital change is taking place rapidly, tablet computers are gradually being used to support learning. According to the results of research conducted in different countries, tablet computers can show very positive results in learning and many researchers accept the advantages of using electronic devices in learning (Kaysı & Aydın 2014). In terms of education, tablets are reasonably priced computers that provide the user with an interactive learning opportunity. (“10-Benefits-of-Tablets-in-The-Classroom”, n.d.).

The most important structural flexibility feature of tablet computers compared to traditional books is the storage because all books are in bulk in one place in a tablet computer (Hayirli & Isler, 2018). They are preferred by more users because of their

advantages such as portability, immediacy, individuality, physical space saving, comfort, time and money saving, ease of use and accessibility (Rosso, 2009 & Ally, 2009). The other feature is the interactivity. Users have no interaction with traditional printed books. For example, they cannot search content, play-pause the animation options, etc. Information access through the interactive user interface provides convenience for accessing information (Edwards, 2004). Tablet PCs also provide an unlimited hyper linking capability that allows the user to access the required information with a single click. The size and weight of printed books are another matter. Thousands of pages in IETM take up very little space. The maximum average weight of a tablet loaded with IETM is 1.5 kg, which shows how advantageous tablets are in terms of weight. The format and style of the information presented in IETM are prepared for window presentation either on a desktop or a laptop or any other portable electronic hand held device. Therefore, all of the above advantages of a mobile device apply to IETM.

2.1.13. Disadvantages of IETM

In spite of all of the advantages, there are some negative aspects of the use of IETM. Generally, disadvantages related to the use of mobile devices are also valid for the IETM (Ebied & Rahman, 2015). Some of these negative features are:

- Unnecessary distraction: It applies to adult employees as well as students. A web-enabled device that can take individual thousands of miles away from a stuffy classroom, it can be difficult to focus solely on the topic.
- Technical limitations: When tablets cannot support multitasking, many files or windows can complicate course integrity. In addition, online security needs to be taken seriously and requires a professional IT workforce, which means extra cost.
- Budget issues: Despite the long-term benefits, tablets are quite costly.
- Training and adaptability: Ensuring the electronic conversion of all educational materials is a very costly task at the first stage.

- Size of mobile devices: Despite the advantages of small mobile devices, small screen size and slow text input are restrictions on the size of mobile devices.
- Short battery life: Tablets work with batteries, and they tend to discharge at the most unfavorable time.

2.2. Conclusion/Summary

In the literature review chapter, the sources related to the study are reviewed based on the main research question, “What are the opinions of employees (Integrated Logistics Support Department) on the efficiency of IETM with comparison to traditional printed book forms?” The literature shows that there are some positive as well as negative aspects of using IETM in education. In accordance with the subject of the study; mobile learning, e-book, interactive learning, and comparison of traditional book forms with IETM are included in the literature review chapter. The IETM consists of technical contents which are used in technical trainings and prepared according to certain standards. IETM has become an accepted and preferred technology in terms of what it provides to its users. In relation to users’ perceptions on the mobile learning and IETM, evaluations are reported as positively. For example, some of its advantages are being portable, hosting many book contents, being interactive, etc. (Edwards, 2004 & Ally, 2009).

With the spread of technology, data exchange methods and large file transfer methods emerged. These activities are rendered new and unique function which name is mobility (El-Hussein & Cronje, 2010). Although the content of the training remains the same, mobile learning can be regarded as portability “at anytime and anywhere” (King, 2006, p.145). The betterment of the capacity and capabilities of mobile devices along with technological developments indicate that these devices will improve learning environments too (El-Hussein & Cronje, 2010). On the other hand, some technical problems, device sizes, distractions etc. are negative features that affect the use of IETM (Ebied & Rahman, 2015).

To conclude, IETM's enable a mobile learning environment when used on a tablet allowing users to work independently of space and time. Thanks to its features, it has an increasing usage rate today. In this study that aims to increase the usage rate of IETM in our country, the effects of IETM especially in the field of mobile learning and its use in technical trainings are discussed in regard to the studies conducted in the literature. In this way, participants' opinions of IETM and books in the traditional printed form also suggest that researchers should do more study in this area.

2.3. Implications

Most of the learners are pleased with the advantages of mobile learning and prefer it because of its ease of application and standards as well as its philosophy (Lan & Huang, 2012 & Little, 2012). The use of IETM is directly related to mobile learning. With IETM, users can improve their mobile learning skills. In this study, mobile learning has many effects on users since it is a subject that is intertwined with vocational technical training in the field of adult learning except for formal education. In contrast to ongoing methodology in the field of technical education, IETM provides the use of tablets rather than printed books, and this allows for interconnection with technology. In addition, users have some mobile learning capabilities developed through the use of IETM on tablet during the technical training process:

- Mobile learning devices are capable of increasing the users' sense of individuality, community and desire to learn with participation in collaborative learning environments (El-Hüseyin & Cronje, 2010).
- Users change from passive learners to engaged students who are involved in learning materials behaviorally, intellectually and emotionally (Wang, Shen, Novak & Pan, 2009).
- Mobile devices engage users to activities related to learning in various physical places (Huang, Huang & Hsieh, 2008).

- Tablet features, such as ease of access and flexibility, enable students to learn actively at any time and place (Traxler & Kukulska-Hulme 2005).

The present literature review reveals that there are several studies on the effects of employing mobile learning in educational circles in different countries and levels of education such as undergraduate and graduate. However, the literature is short of studies where opinions of users regarding the use of IETM in technical training is discussed. The study at hand gathers the opinions of the users on the utilization of IETM technology in technical training. By doing so, it proposes to contribute to fill aforementioned gap in the field while also forming the basis for new studies on this topic.

CHAPTER 3

METHODOLOGY

This chapter will present the information about the overall methodology of the study. In this chapter, there are sections such as research design, research questions, research population, instructional settings, instrumentation, data collection process, data analysis process of the study, respectively.

3.1. Research Design

The qualitative research makes use of comprehensive data on many variables in a natural environment (Gay & Airasian 2000, p. 627). Since qualitative research focuses on revealing the meaning in the research context, it is necessary to use a meaning-sensitive data collection tool when collecting and interpreting data (Merriam, 2009, p.2). Descriptive qualitative research, instead of collecting numerical data and investigating objectively, treats thoughts of people in a subjective way (Creswell, 2012). “Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences” (Merriam, 2009, p.5). According to Merriam (2009), most commonly used qualitative research types are basic qualitative research, phenomenology, grounded theory, ethnography, narrative analysis, case study, and critical qualitative research. Each of these types of research differs in terms of some focal points such as how to ask the research questions, sample selection, data collection method and analysis.

According to Merriam (2009), the research is divided into two main categories, which are basic and applied. Basic research is motivated by intellectual interest in a phenomenon and its aim is to disseminate knowledge. Applied research is carried out to enhance the quality of practice of a specific discipline (Merriam, 2009, p.3). These

basic and applied types of qualitative research have some characteristics in common, hence, they fall into the umbrella concept of qualitative research (Merriam, 2009, p.22).

This study is designed as a basic qualitative research. It, in line with the nature of all qualitative research, aims to figure out how participants explicate their experiences, how they construct their worlds, and what sense they attribute to their experiences (Merriam, 2009, p.5). The main characteristic of qualitative research is that individuals construct their reality in interaction with their social worlds (Merriam, 2009, p.22). Basic qualitative research is by far the most common type of qualitative study found in training and most likely in other fields of practice (Merriam, 2009 p. IX). Also, observing, interviewing and analyzing data is necessary for qualitative research, and people are best suited to this process (Merriam, 2009, p.2).

Butina, Campbell, & Miller (2015) stated that the study design in qualitative research is usually flexible, data is collected from a natural environment, data can be collected with several forms, and sample selection is often purposeful and small. Fraenkel, Wallen and Hyun (2012), and Butina, Campbell, & Miller (2015) also specified that the primary characteristics of qualitative research:

- The focus is on understanding participants' experiences with an intent to convey experiences into meaning, understanding and process,
- Individuals make sense of their own experiences since this process is individualistic, and there is no independent reality,
- The researcher is the key instrument for data collection and analysis,
- The research process is inductive, not deductive,
- The data analysis is inductive and comparative,
- Generalization is not possible,
- Research might be subject to alternative interpretations,
- The findings of qualitative research are richly descriptive and presented as themes/categories.

Merriam (2009) stated that basic qualitative research is philosophically derived from other qualitative research types, and the other qualitative types differ from basic qualitative study in terms of some additional characteristics. Regardless, the overall purpose is to understand how people make sense of their lives and experiences (p. 23). This study is designed in the form of basic qualitative research rather than other types of it since the aim of the study is to explore the opinions/perceptions of participants who experienced the IETM via tablet PCs during their technical training in Integrated Logistics Support department at the defense industry company.

3.2. Research Questions

In this study, the main goal was that to investigate the participants' opinions about the use of traditional printed book form and IETM technology via tablet in a technical training. IETM technology had been compared with traditional printed materials in terms of searching the required information, rate of reaching the accurate information, the duration to reaching the accurate information and quality of the images/animations. The main question in this study was "What are the opinions of employees (Integrated Logistics Support Department) on the efficiency of IETM with comparison to traditional printed book forms?"

"Employee" in this context refers to participants who work in the Integrated Logistics Support Department at the defense industry company. Employees in the ILS unit have prior knowledge of the use of printed books and IETM.

"Interactive Electronic Technical Manual" in this context refers to learning materials which compress text to online pages that may contain animation and allow readers to find the necessary information.

"Printed Book" in this context refers to learning material which is a document with instructions for configuration, operation, use, maintenance, parts list, support and training requirements for the effective utilization of an equipment, machine, process or system ("Business Dictionary", n.d.).

The sub-research questions to be answered based on the main question are as follows:

- What are the participants' opinions about how the IETM and printed book forms affect users' ability to follow task steps?
- What are the participants' opinions about searching the required information?
- What are the participants' opinions about the rate of reaching the accurate information?
- What are the participants' opinions about the duration to reach the accurate information?
- What are the participants' opinions about the quality of the images/animations?
- What are the participants' opinions about the IETM system in general?

3.3. Participants

The participants of the study are the workers of a defense company's (Ankara /Turkey) integrated logistics support department. The participants of the study were 8 (3 females and 5 males) employees who agreed to participate voluntarily in this study from 25 employees in Integrated Logistics Support department. All participants have background information and experiences about the technical training context. In the study, convenience and purposeful sampling was done.

Among the duties of the employees that was included in the study are the preparation of technical documents and training contents for the systems produced within the company. Within the scope of the study, participants who have sufficient knowledge about the use of two different materials evaluated IETM, which has recently been used in the company and printed books that have been in use for a long time.

There were some points to consider when choosing participants from the employees: The fact that the participants had prior knowledge of tablet usage was important in

terms of compensating for the effect of innovation in the study; therefore, among the ILS employees, people with prior knowledge of technology use were preferred. It is assumed that the participants will be able to grasp quickly the steps because they are familiar with the use of the traditional book and have prior knowledge of the use of IETM on a tablet. The fact that the participants had been working for many years, most recently for two years, in the preparation and editing of the content, was important in terms of their adaptation to the flow of the study. For these reasons, it was assumed that they could easily perform in the expected manner and order.

In addition, it is important to indicate that availability of participants who already have had background knowledge at the beginning of the study to use tablets and who are familiar with IETM—a tool used in technical training mainly in the defense industry—made the sampling somewhat convenient. Convenience sampling is a type of nonrandom sampling where individuals who are members of the target population that meet certain criterias such as accessibility, geographical proximity, availability at a given time are included in study (Dornyei, 2007). In other words, it allows to conduct research with subjects of the population that are easily accessible to the researcher (Kristie & Given Lisa, 2008).

Purposeful sampling is an appropriate sampling technique that enables researchers to work with individuals with specific characteristics. This type of sampling includes identifying and selecting an individual or group of individuals who are particularly knowledgeable or experienced about a phenomenon of interest (Cresswell & Plano Clark 2011). For this study, purposeful sampling was utilized, meaning that volunteer participants who had experience of tablet PC with IETM technology were included in the study.

3.4. Instructional Setting

The employees involved in the study work in the technical documentation unit, which is a sub-unit of the integrated logistics support department. Technical documentation refers to any type of documentation that describes usage, functionality and architecture

of a technical product. Documents define the technological cycle of the product and provide necessary information for organizing production and repair of the product (Mead, 1998). Technical documentation has to be usable. With the technical documentation, one can:

- Troubleshoot issues related to the product easily,
- Find the best ways to use the product,
- Know about the various safety rules to be kept in mind,
- Understand the product from scratch,
- Know the various developments or updates taking place in products.

Technical training teaches the skills that are necessary to design, develop, implement, maintain, support, or operate a particular technology, application, or product. In other words, it includes activities that are intended at providing information or instructions to improve the recipient's performance or to help them to reach a needed level of knowledge or skill ("Business Dictionary", n.d.). Technical training is the process of teaching employees how to perform more accurately and thoroughly on the technical components of their jobs. Unlike the soft skills, technical skills are job-specific and they are transferable (Kokemuller, 2017). Technically well-trained employees have the confidence and skills to do their job in the best way. Their self-confidence increases their motivations and productivity. Companies that offer technical training gain advantages such as reduced operating costs and a better reputation for quality (Kokemuller, 2017).

The technical training materials, technical documents included in this study, contain information prepared for the produced systems at the company, whose goal is to assist the end users with the usage and maintenance of the product. The employees who volunteer to participate in this study are involved in the preparation of these technical training materials. These employees are responsible for preparing the text-content of technical training documents enriched with visuals. Yet, they are not involved in creation of animations, video contents or any other part of the IETM preparation process.

The study was conducted in two stages with volunteer participants on predetermined dates and times. The participants were contacted at their work offices. The traditional printed books and the IETM include tasks for the maintenance of vehicles manufactured in the defense company. The task steps used in the study were selected according to difficulty levels of steps (The technicians gave the necessary information about the difficulty levels of task steps.). Since the main purpose of this study is to enable participants who use printed books in technical training to use interactive electronic form materials prepared with IETM technology, and to examine their opinions, comments and evaluations about these experiences by comparing two forms, the participants were asked to find the task steps from the traditional printed book by calling the task name, individually. At this stage, the participants were not given any information about the ways to be followed, as they had prior knowledge of this issue.

In order to follow task steps, the participants should find content's place in the book from the table of contents. The task includes main task steps and required conditions. The required conditions are the first steps of many tasks in the book and they are created with references that link to different task steps. The required conditions steps must be completed before the main task steps. In the required conditions part, there are preliminary steps to complete the main task. (For example, to access the CPU of a computer, you first need to open the case. In this example, opening the case is a required condition. If there is a particular task written to open the case, there is a link near the task name.) The important point here is that the content of a task written as a required condition can also have a required condition. To complete every new task, user has to look at the required condition task and their page number first. For this reason, the user look at the table of contents continuously and this may cause confusion. In order to complete a task, it may be necessary to reach ten or more required condition steps, as in this study. (see Figure 3.1 for a visual representation of Flow of the Task).

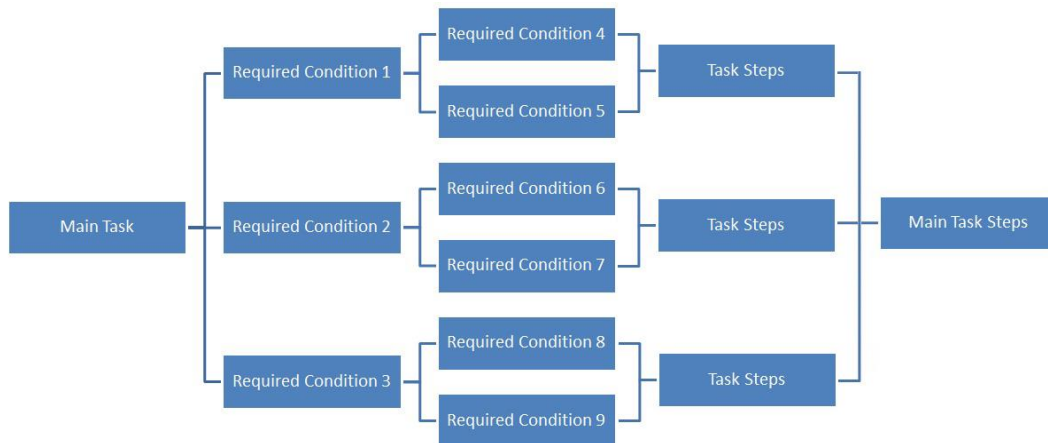


Figure 3.1. Flow of the Task

The first phase of the study was completed after the participants met all the required conditions and read the main task steps in the traditional printed book. While the process steps were followed, the time was kept. In doing so, the time spent at each step and the points where the participants had difficulty were noted. In the first stage, no comments were received from the participants about the process.

In the second stage of the study, as in the first stage, the application was carried out face to face in the work offices of the participants at the predetermined date and time. In the second stage, users were given tablets with IETM application installed and was asked to find the task steps again. They have a prior knowledge of the use of the tablet, hence, they can easily navigate using the tablet PC's digitizer pen. Participants had to reach the same required condition task steps to complete the given task. However, unlike the traditional printed book, the search option in the IETM's interactive interface allows the task name to be typed with a single keystroke. As it is an electronic learning material, the preliminary steps in the task are linked and can be opened directly by clicking on them. The other required conditions in the opened task are also linked so that they can proceed quickly. To return to the main task, they can go back to the previous page with the back key or by typing the name of the main task in the search bar. By using IETM features, participants can watch the animation in the main

task steps. At the same time, participants can watch the animation from one part of the split screen and follow the task steps from the other part while completing the main task. The second phase of the study was completed after the participants completed all the required conditions, read the main task steps and watch the animations through the IETM. While the process steps were followed, the time was kept, the time spent at each stage and the points where the participants had difficulty were noted.

Technical properties of the tablets (Panasonic - Toughpad FZ-G1) used in the study are Intel Core i5 Processor, Windows 10 Pro, Intel HD Graphics 620, 10.1” display, capacitive 10 finger multi-touch screen, up to eleven hours battery life, and lightweight design approximately 1.1kg (see Figure 3.2 and 3.3 for a visual representation of tablet PC) (“Toughbook Rugged Tablets”, n.d.).



Figure 3.2. Panasonic - Toughpad FZ-G1



Figure 3.3. Panasonic - Toughpad FZ-G1 with Pen

During the application phase of the study, the total time spent by the participants in both phases, the time they spent to find the task steps, to complete the preliminary steps, and finally to complete the task were noted. After completing the two stages, one-to-one interviews were conducted with the participants. During one-to-one interviews with the participants, comparative questions were asked about the first phase and the second phase. These questions are in Appendix B. The detailed description of the Interview process can be found in “Instrumentation” section.

3.5. Features of Traditional Printed Book Form and IETM

The general characteristics of the two training materials used in technical training and the steps taken when using them are as follows:

Traditional Printed Book Form - Document with instructions for configuration, operation, use, maintenance, parts’ list, support and training requirements for the effective utilization of an equipment, machine, process or system (“Business Dictionary”, n.d.) (see Figure 3.4 for a visual representation of traditional printed book).

The page number of the tasks is found by following the pages in the book. The headings on the opened page are checked to ensure that the correct page is reached first (see Figure 3.6 for a visual representation content of the book).

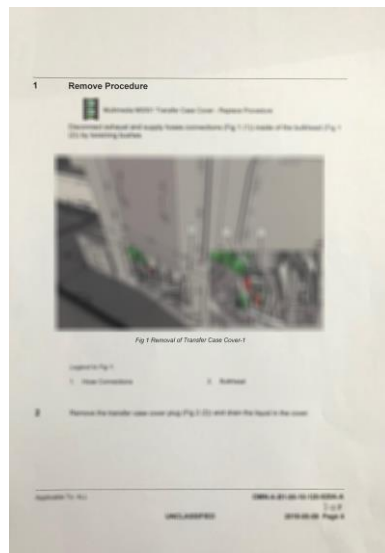


Figure 3.6. Content of The Book

The first step is to check the required conditions of tasks before starting the main task steps first (see Figure 3.7 for a visual representation of preliminary requirements table).

[illegible]

Figure 3.7. Preliminary Requirements Table

The requirements for achieving required conditions task steps are the same as achieving the main task steps. Hence, it is necessary to find the page number from the table of contents and then to proceed. In this way, after the completing required conditions tasks, the main task steps can be implemented. Throughout the book, the expressions in the task steps are made clear by the visuals first. These are the steps to be followed during the process because the book does not have interactive features.

Interactive Electronic Technical Manual Form - IETM is suitable for various devices such as computers, laptops and tablets. It is designed to interact with the user. From time to time, it requests information from the user and based on this entry, it decides which information is displayed next. IETM allows user to go step by step throughout the procedure. This interactive mechanism can effectively direct a user through a procedure that paper cannot do (Rainey and Fuller 1991). IETM has:

- Simple user interface with completely hyper-linked table of contents,
- Powerful search capabilities with hyperlinks to referenced text and illustrations,

- Animated and 3D interactive graphics to display parts and assemblies.

The IETM's interface is divided into several sections: Main Menu Bar, Icon Menu Bar, Guidepost, Display Area and Active Configuration Display. IETM makes use of a well-known computer technology called hypertext to move from one frame to another frame (i.e., table of contents to a replacement procedure). The well-known technology is called a hotspot. Selecting a hotspot may take the user to the next logical step or procedure (Rainey & Fuller, 1991). Some icons and menus which are located on IETM interface are shown in Table 3.1:

Table 3.1. *Icons of the IETM*

Icon	Meaning
Back Arrow Icon	Allows the user to go back to the previous page visited as noted in the history list.
Forward Arrow Icon	Allows the user to advance to the next page visited as noted in the history list.
History Icon	Allows the user to open the history list.
Table of Contents Icon	Allows the user to open the table of contents.
Search Icon	Allows the user to open the interface for searching the entire data set of the IETM. Recent searches are automatically saved in searching history list.
User Notes Icon	Allows the user to open the interface for creating new or viewing existing user notes.
Exit Icon	Allows the user to exit the IETM and close the software application.

Table 3.1. continued

Split Screen Display	Select a figure hotspot to activate the split screen viewing capability.
Multiple Tabs Options	Multiple documents can be opened using the “Open in New Tab” option.

When following the steps in the study with the IETM, after opening the Interactive Authoring and Display System (IADS) application and running IETM, the user can click on the search icon to enter the name of the task sought.



Figure 3.8. IADS Application Icon

The table of contents can be used to access the desired content (see Figure 3.9 for a visual representation of table of contents).

UNCLASSIFIED		
Title	Data module code	Issue No./Date
Introduction: Report Manual		
General safety precautions	25AF10-000-000-0000-0100-00	0000
Alerts and warnings	25AF10-000-000-0000-0100-00	0000
Precautions	25AF10-000-000-0000-0100-00	0000
Chapter 1 - General Information		
Chapter 1 - General Information	25AF10-000-000-0000-0000-00	0000
Introduction - Description	25AF10-000-000-0000-0000-00	0000
Precautions - General Information	25AF10-000-000-0000-0000-00	0000
Fuel system - General Information	25AF10-000-000-0000-0000-00	0000
Exhaust system - General Information	25AF10-000-000-0000-0000-00	0000
Power system - General Information	25AF10-000-000-0000-0000-00	0000
Water system - General Information	25AF10-000-000-0000-0000-00	0000
Control and display - General Information	25AF10-000-000-0000-0000-00	0000
Brake system - General Information	25AF10-000-000-0000-0000-00	0000
Light - General Information	25AF10-000-000-0000-0000-00	0000
Alarm - General Information	25AF10-000-000-0000-0000-00	0000
External volume - General Information	25AF10-000-000-0000-0000-00	0000
Auxiliary controls - General Information	25AF10-000-000-0000-0000-00	0000
Control and display - General Information	25AF10-000-000-0000-0000-00	0000
Spill-free - General Information	25AF10-000-000-0000-0000-00	0000
Insulation - General Information	25AF10-000-000-0000-0000-00	0000
Buildings - General Information	25AF10-000-000-0000-0000-00	0000
Order component flow plates - General Information	25AF10-000-000-0000-0000-00	0000
Order component flow plates - General Information	25AF10-000-000-0000-0000-00	0000
Auxiliary buildings - General Information	25AF10-000-000-0000-0000-00	0000
Index - General Information	25AF10-000-000-0000-0000-00	0000

Figure 3.9. Table of Contents

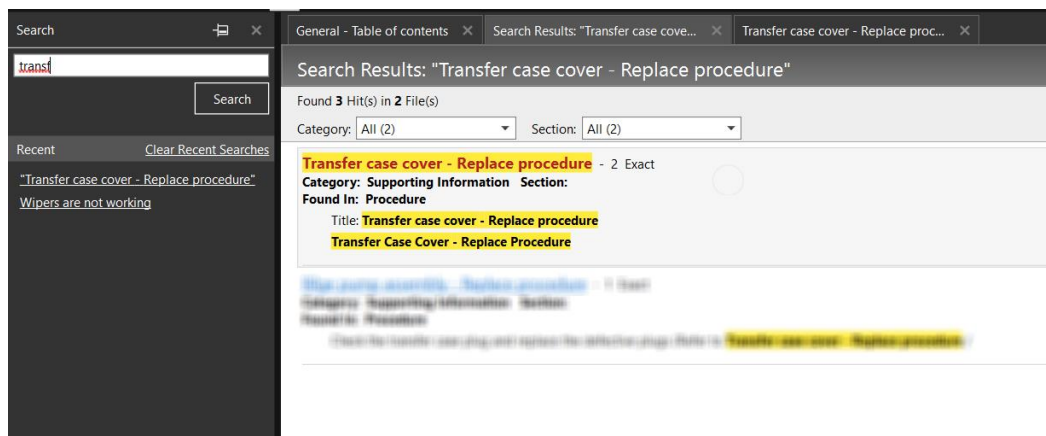


Figure 3.10. Searching Results

Task names are displayed under the search icon; users can click on the task name to open it. Clicking on the task name opens directly in the task steps window.

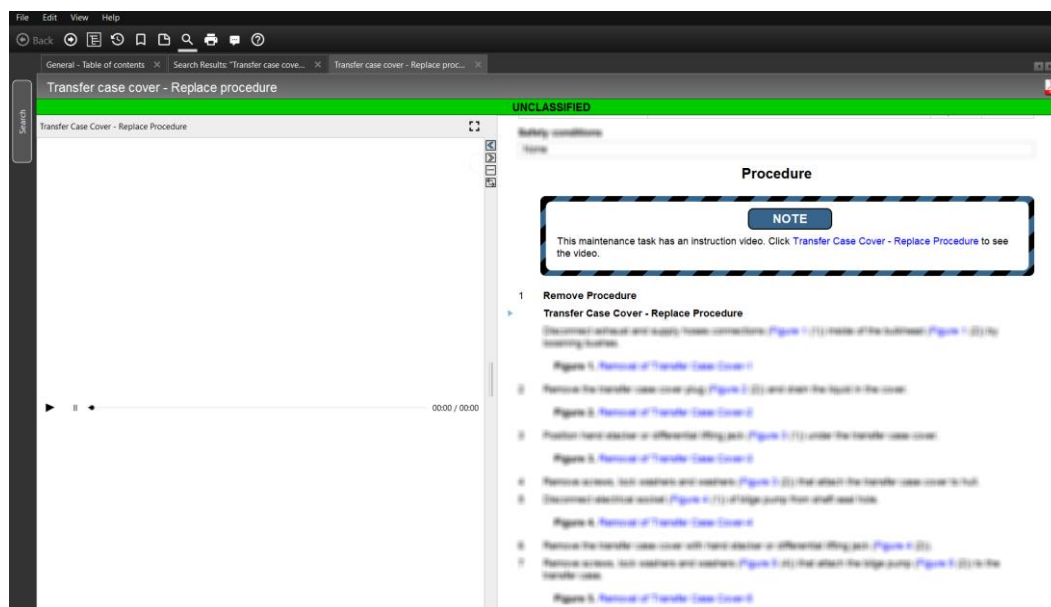


Figure 3.11. Task Steps Window

The first step is to check the required condition tasks before starting the main task steps. The requirements for achieving required condition task steps are not the same as achieving the main task steps. The required condition tasks are accessed by clicking the links in these table. With the help of hypertexts, there is no need to search the page number.

Transfer case cover - Replace procedure

References:

[6-35 Transfer case shaft - Replace procedure](#)
[Transfer case cover - Replace procedure](#)
[Transfer case bottom right bushings cover - Replace procedure](#)
[Testing assembly - Replace procedure](#)

Preliminary requirements

Required conditions

Condition/Requirement	Tools, materials, equipment, qualifications
Vehicle parked on a 2% gradient ground	
Remove transfer case shafts	6-35 Transfer case shaft - Replace procedure
Transfer case used on the transfer case cover	Transfer case cover - Replace procedure
Remove transfer case middle bushing bushings cover according to removal procedure	Transfer case bottom right bushings cover - Replace procedure
Remove the edge pump shaft seal from the right outside of transfer case cover in order to reach one end of the transfer case cover (Refer to Transfer Case Repair Manual (PAC) TST200-0001-000)	
Remove transfer case shaft seals	Testing assembly - Replace procedure

Figure 3.12. Preliminary Requirements Table

After completing the required condition task stages, users may click on the “Back Arrow Icon” to return to the main task steps and begin to implement it.

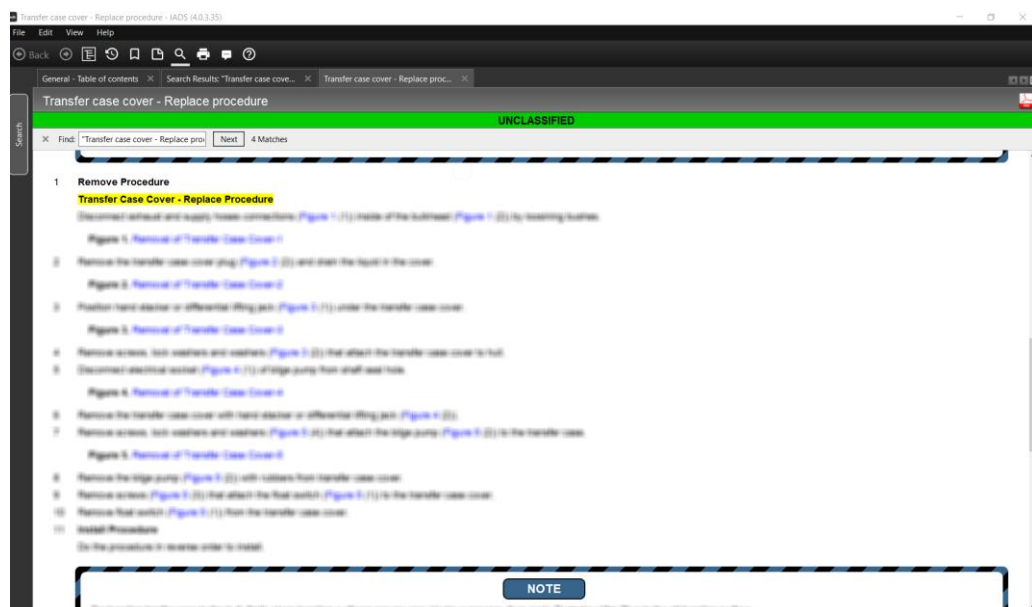


Figure 3.13. Content of the IETM

Throughout the IETM, the expressions in the task steps are made clear by the visuals and animations. Since the visuals are 2D in the printed book, they may not be enough to explain the task steps. It may not be possible to transfer the whole detail to the user with a single visual, especially since the detailed information and parts of the large systems are included in the technical training documents. This negative situation can be overcome by using 3D animation as well as visuals. To access the visual and animations in IETM, one can click on the links in the document.

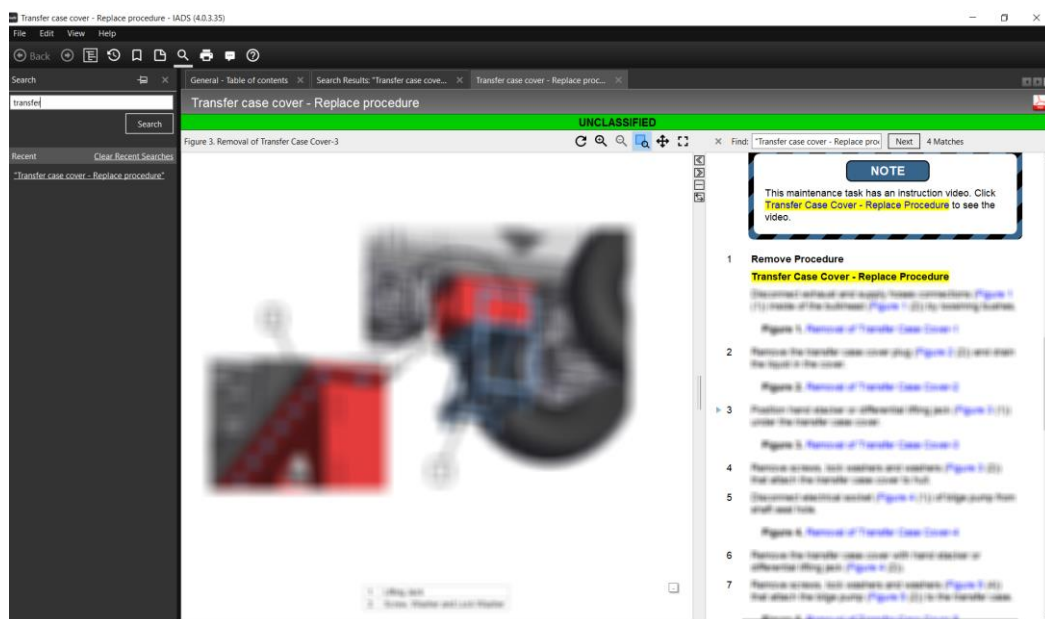


Figure 3.14. Visuals in the IETM

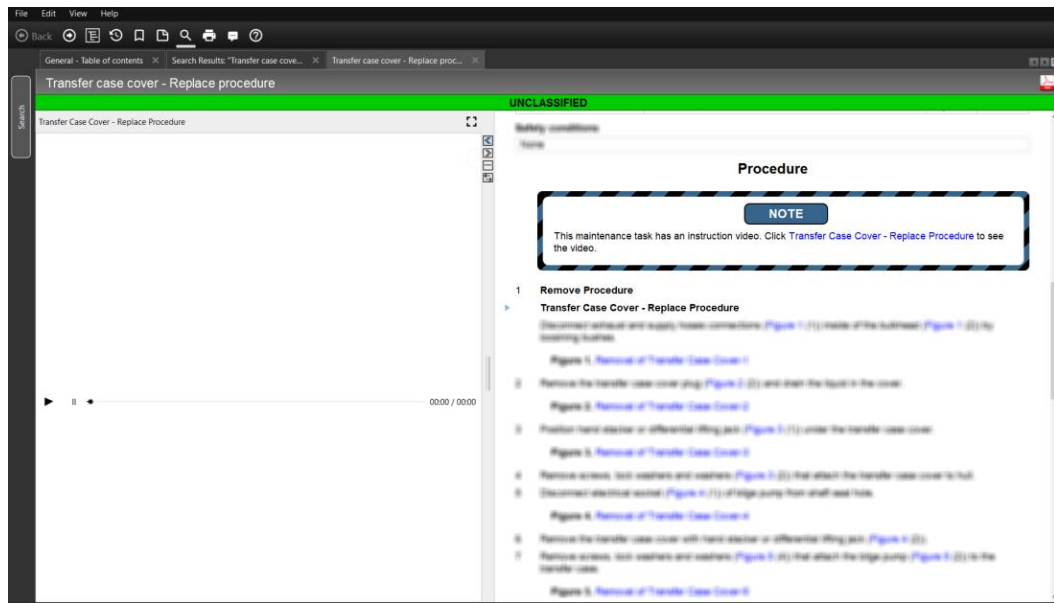


Figure 3.15. Animations in the IETM

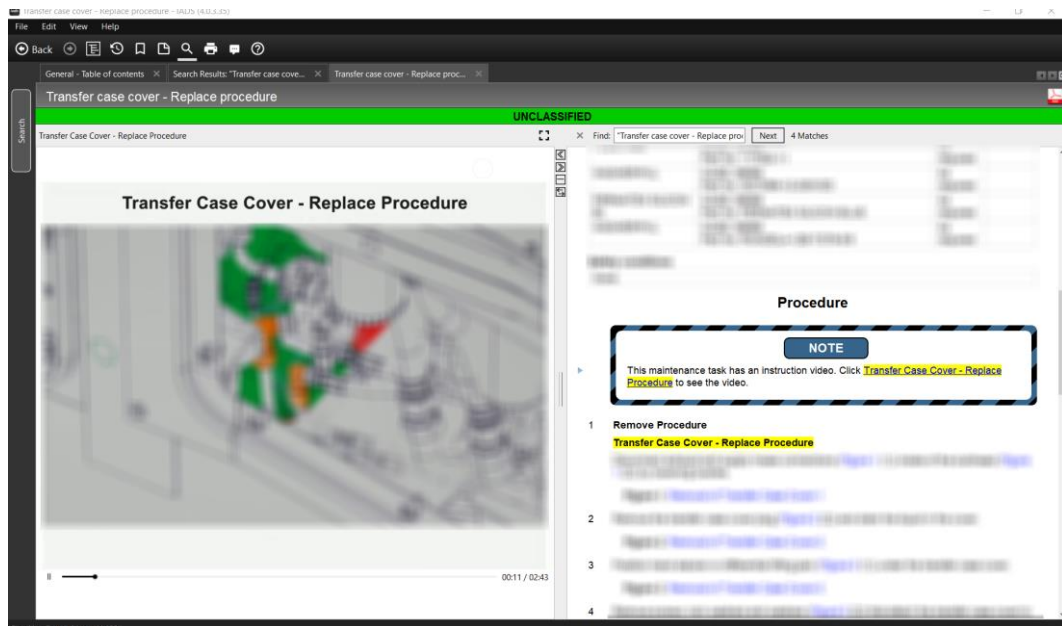


Figure 3.16. Animations in the IETM - 2

A user might click the start icon to start the animation. The video can be rewound by moving back and forth on the bar after the animation starts, any instant animation video can be stopped.

3.6. Instrumentation

The main goal of interviews is to obtain a specific type of information as it relates to the phenomenon of interest. Through interviewing participants, researchers want to figure out what participants have in mind (Patton, 2002, p. 341). In this sense, interviewing is to allow researchers to insert the other person's perspective (Patton, 2002, pp. 340–341). According to Patton, qualitative data consist of “direct quotations from people about their experiences, opinions, feelings, and knowledge” obtained through interviews (2002, p. 4).

Interviewing is necessary if researchers cannot observe behaviors, emotions or how people interpret the world around them (Merriam, 2009, p.88). DeMarrais (2004) describes the interview as a process in which a researcher and participants engage in a conversation focused on questions about the topic of research study (p. 55). Interviewing is presumably the most widely utilized form of information gathering in qualitative studies. Briggs (1986) argues that the interview is the most common data collection method used in research in the field of social sciences. The strengths of the interview technique can be listed as flexibility, response rate, nonverbal behavior, control over the environment, question order, instant response, verifying the data source, completeness and in-depth information (Yıldırım & Şimşek, 2008).

Flexibility - Interviewing provides a great deal of flexibility for researchers. The researcher may ask additional questions for more in-depth answers or in case of misunderstanding, may ask some alternative ones (Yıldırım & Şimşek, 2005).

Response rate - As the researcher is personally involved in the data collection process, the response rate is high.

Nonverbal behavior - The researcher has the opportunity to observe and record the other party's behavior, facial expressions and body movements during the interview process (Piskin & Oner, 1999, p.2).

Control over the environment - The interviewer can arrange the environment for an effective interview and compose a comfortable and quiet interview environment (Piskin & Oner, 1999, p.2).

Order of questions – Throughout the interview, the order of questions can be changed or questions can be asked without any order.

Instant response - In a typical interview process, the researcher has the opportunity to record instant responses and responses developed by the interviewee (Yıldırım & Şimşek, 2005, p.125).

Confirming the data source - The questions are asked directly to the individuals who have agreed to participate in the study. The data obtained by this method will have a higher validity than the data obtained through surveys (Bailey, 1987, p.174-177).

Completeness - As the researcher is present in the interview environment, the response rate is almost complete (Bailey, 1987, p.174-177).

In-depth knowledge - Experienced, skilled and well-trained interviewers in the interview technique can create a rich set of data on a complex topic or problem (Bailey, 1987, p.174-177).

Applying the interview technique well by using the interview protocol, which facilitates access to qualitative data, provides an efficient and effective data collection process. Interview protocol prepared according to interview principles (Yıldırım & Şimşek, 2005). Preparing a protocol is very important for the validity and reliability of interview and for a healthy conduct of it. There are points to be considered in the preparation of the interview protocol (Yıldırım & Şimşek, 2005, p. 130). These are:

- Preparing easy-to-understand questions,
- Preparing focused questions,
- Preparing open-ended questions,
- Avoiding asking multi-dimensional questions,

- Preparing alternative questions,
- Including different kinds of questions,
- Organizing questions logically.

In this study, the semi-structured interviews were carried out to investigate the perceptions of the participants about the traditional printed book and interactive electronic form materials prepared with IETM technology. The perceptions of the participants and their comparison of the two materials were gathered through an interview consisted of 15 questions. The researcher constructed the interview questions. The questions were originally written in English, and then translated into Turkish. For credibility of the questions, they were presented to an experienced subject-matter expert.

In terms of number of participants that are being interviewed in one setting, interview technique can be said to have two types. The first one is the focus group interview while the second one is individual or one-to-one interview. Both one-to-one and focus group interviews can be defined as conversation; but this conversation should be aimed at a purpose (Dexter, 1970). For individual interviewing, purposeful sampling should be used to include people who know the most about the topic (Merriam, 2009, p.94). The most common form of interview is the person-to-person encounter in which one person elicits information from another (Merriam, 2009, p.87). In this process, it is the main task of the interviewer to ensure that the interviewee reacts comfortably, honestly and correctly to the questions asked (Yıldırım & Simsek, 2008). The quality of the questions, questioning techniques, listening and interviewer-interviewee interactions are very important for achieving a successful result (Ryan, Coughlan & Cronin, 2013). In this study, one-to-one interview is preferred.

In this study, the participants were asked for their permission to record their responses with a recorder, and the interview was recorded. Recorded interviews provide important conveniences for the researcher since taking notes while interviewing causes problems that hinder interviewer's ability to elicit rich responses from

interviewee. Through recording interview's responses, a researcher can question and listen more effectively (Yıldırım & Simsek, 2005, p.147).

3.7. Data Collection

The data collection technique in this study was interviewing (one-to-one interview). Open-ended questions were asked during interviews. These questions helped to get interviewees' elaborate thoughts without being constrained by any viewpoints (Cresswell, 2012).

One-to-one interview is a data collection technique that is widely used in social sciences research. This technique usually consists of a dialogue between the researcher and the participant, guided by a flexible interview protocol and supported by follow-up questions, probes and interpretations (DeJonckheere & Vaughn, 2019). In the literature, more attention has been given to the interview process, particularly in relation to the role of the interviewer and the relationship between the interviewer and the interviewee (Cresswell, 2012). The individual interviewing is a valuable way for researchers to gain insight into the perceptions, understandings and experiences of individuals on a particular phenomenon, and can contribute to in-depth data collection. However, interview is beyond a mutual interaction between two persons, and thus, requires considerable knowledge and skills on behalf of the interviewer (Ryan, Coughlan & Cronin, 2013).

Since interviewing is an artistic skill, there are some points to consider while making use of it (Yıldırım & Şimşek, 2005, p: 140-147):

- Making changes in the interview questions according to the flow of speech,
- Asking questions in the style of speech,
- Encouraging and giving feedback to the interviewee,
- Controlling the interview process.

Dexter (1970) states that in each interview situation, there are three variables that determine the structure of the interaction (p. 24):

- The interviewer's personality and skill,
- The interviewer's attitude and orientation,

During the interviews, the interviewer should cooperate, be natural and objective, and avoid the directing and should not express his/her opinions during the interview (Yıldırım & Simsek, 2005). The role of the interviewer is to help define the situation first. Another role of the interviewer is to cooperate with the interviewee to motivate him/her to answer the questions seriously as well as to ensure that the interviewee understands the questions correctly (Yıldırım & Simsek, 2005). Simultaneously, the interviewer should listen and maintain eye contact with the interviewee during the conversation (Plano Clark, 2012).

Writing an interview question is not a simple and linear process. In general, good interview questions are open-ended, which are descriptive and related the phenomenon. The more descriptive and detailed questions are better for the interview. In other words, questions are the heart of the interview. The researcher should ask good questions to collect comprehensive data. The questions should be evaluated very well before the interview. This evaluation would provide good questions (Merriam, 2013). In order to write good questions, the researcher needs to interact effectively with the relevant literature (Yıldırım & Simsek, 2005). In addition, it would be very useful to get opinions from people who are experienced in qualitative research in terms of expressing interview questions more effectively.

The development of the interview plan is an important first step in the implementation of the interview process. Every step of the process should be considered in this plan including deciding which data collection method to use, preparing questions, determining interview schedule and audio recording, etc. (Ryan, Coughlan & Cronin, 2013). The interview protocol is a structure planned by the researcher, containing directions for the interview procedure, the questions to be posed, and a spot to take notes of responses from the interviewee (Creswell, 2012 & Tesch, 1990). In this study, the issues to be considered during the one-to-one interview process are detailed below:

Recruiting Participants: At the beginning of the study, convenience and purposeful sampling was done. The participants of the study were 8 (3 females and 5 males) employees who agreed to participate voluntarily in this study from 25 employees in Integrated Logistics Support department.

Table 3.2. *Details of One-to-One Interview*

Participants	Gender of Interviewees	Length of Interviews
Participant I	Male	00:09:18
Participant II	Female	00:07:12
Participant III	Female	00:09:08
Participant IV	Male	00:09:11
Participant V	Female	00:11:12
Participant VI	Male	00:11:09
Participant VII	Male	00:14:11
Participant VIII	Male	00:07:50
8 Participants	3 females, 5 males	01:19:20

Informing the Participants: The volunteer participants in the study first completed the first two steps (complete the task steps from the traditional printed book and IETM) of the application and then were interviewed. The participants were informed about the context of the interview before getting started. During this briefing, participants were informed about the purpose and possible duration of the interview. Participation form was completed. It was stated that they could stop the interview at any time and they had no obligation to continue.

Location: The interview should usually take place within the reach of both the researcher and the participant preferably in a quiet place to protect the privacy of the participant (Plano Clark, 2012). Therefore, the office environment in which the participants worked was used during the interview.

Making Contact: Interview dates and times were decided by talking to the participants, then, they were notified by an e-mail.

3.8. Data Analysis

A goal statement usually includes sub-components in the form of research questions. The goal of the data analysis is to find answers to research questions. These answers are also called categories, themes, or findings. Data analysis is the process of making sense of the data. And it involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read; it is the process of making meaning. Data analysis is a complex process that involves moving back and forth between concrete bits of data and abstract concepts, between inductive and deductive reasoning as well as description and interpretation (Merriam, 2009).

The category construction process begins with reading the interview transcript, the first set of field notes-the first document collected in the study. This process of making notations next to bits of data that strike researcher as potentially relevant for answering the research questions is also called coding (Merriam, 2009). Creating a category starts with assigning code to pieces of data. After all the transcripts are reviewed in this way, researcher goes back through the notes and codes (comments) and try to group these codes and notes that will appear together. The groups of comments and notes that will appear together create categories. Assigning codes to pieces of data is the way you begin to construct categories (Merriam, 2009). The researchers extended the meaning of the analysis to categories or themes that interpret data. The “categories” became the “findings” of the research. Marshall and Rossman (2006) describe these categories as buckets or baskets where text sections are placed (p. 159). The categories constructed during data analysis should be (Marshall & Rossman, 2006, p.159):

- Sensitive to the data as possible,
- Exhaustive,
- Mutually exclusive,

- Conceptually congruent.

According to Heritage, qualitative data should be converted to a format that is easier to work with (1984). In the study, the audio recordings were converted to text before starting the encoding because the collected data was in the form of audio recording. To ensure the validity and reliability of the transcription, the second person independently checked the audio recordings and transcription and took notes (One master student who is either doing qualitative research or have experience of doing qualitative research from the department of Computer Education and Instructional Technology, compared the findings of the researcher study and codes.). Then, two transcriptions were compared for the measured reliability check. The differences between the two transcriptions were followed and adjusted from the notes taken to ensure correct valid transcription. Kvale and Brinkman (2009) states that a closer look at transcripts' reliability and validity reveals the constructive nature of them:

Reliability: In interview research, questions about interviewer reliability are frequently raised. Even the same written word in a transcript may have two very different meanings, depending on how the transcriber chooses to include period and comma.

Validity: Determining the validity of interview transcripts is more complex than securing their reliability. Different transcripts are structures of different worlds, each designed to fit our particular theoretical assumptions and allow us to explore their consequences. For reliability and validity of transcriptions, Kvale and Brinkman's (2009) recommendations were followed.

While performing data analysis, the methods that Creswell recommends (2012) was used:

- 1) Transcript the Data: Converting audio tape recordings into text data,
- 2) Explore the General Sense of the Data: Writing notes in the margins of the transcript helps in the first phase of the review process,

- 3) **Code the Data:** Coding is the process of segmenting and labeling text to form descriptions and broad themes in the data. Encoding allows data to capture a certain integrity of meaning. Although there are no established rules for coding data, there are some general procedures (Creswell, 2012; Tesch, 1990). Essentially, six steps were followed during the coding process:
- As a first step, to get a general idea, read the transcription several times by writing some notes in the margins of the transcription.
 - Then, analyze each respondent's response further to get a more specific idea.
 - The code words and sentences that explain the meaning of the text sections are determined.
 - The codes are listed and reduced to manageable numbers.
 - Then use this code list to check for there are new codes or not.
 - Once all the codes have been identified, categorize similar codes to get the main idea.
- 4) **Group the Similar Codes:** After encoding the entire text, make a list of all the code words and group similar codes and look for backup codes.
- 5) **Create Themes from Codes:** Identify five to seven themes by reviewing the codes. Themes (categories) are similar codes that are gathered together to form an important idea from the data.
- 6) **Representing Findings:** Displaying the research's findings visually (Miles & Huberman, 1994) by using figures or pictures that augment the discussion.

3.9. Credibility

There are three primary forms typically used by qualitative researchers to ensure credibility (Creswell, 2012): triangulation, member checking, and external auditing (external auditing was not preferred to be used in this study).

Triangulation - Patton (2002, p. 560) suggests an associated approach where two or more individuals evaluate the same qualitative data separately and compare their

results. Based on the Patton's triangulation strategy, the same interview records were independently coded by two people and the transcripts were compared with each other (The master student from the department of Computer Education and Instructional Technology).

Member Checking - This is also known as respondent validation where the idea is to ask some of the interviewees for feedback about your findings (Merriam, 2009). It consists of coming up with the findings, going back to participants and asking for the accuracy of findings organized (in written or in the interview) (Creswell, 2012). In the study, after the third step of the data analysis, codes were formed, and at some point, the participants were consulted to ensure the accuracy of the findings.

Some other alternative techniques to Creswell's main ones are:

Adequate participation - In data collection, it is a strategy that makes sense when trying to approach participants as much as possible to understand a phenomenon (Merriam, 2009). Sufficient participation was achieved in data collection; all volunteers were interviewed one by one.

Peer Review - Each member of the peer member committee reads and comments on the findings (Merriam, 2009). Two different individuals repeatedly analyzed the same transcripts for this purpose. Then, different and similar points were compared and evaluated.

Reflexivity - The values and expectations of a particular researcher affect the conduct and results of the study (Merriam, 2009). As the researcher is the main tool of a qualitative research, the findings were critically discussed by comparing them with the results presented in the literature.

3.10. Researcher's Role

When conducting qualitative research, the researcher often has many roles and responsibilities that she needs to pay attention simultaneously. The researcher's role in this study might be summarized as follows:

Complete Observer: The researcher was present in the setting but only listened and observed and did not interact (Given, 2008).

Insiders: They are individuals who are experienced or have knowledge about the topics studied or are members of the group being studied. As insiders, study participants know first-hand concerns, feelings, beliefs, daily activities and/or cultural practices related to the topic or group (Given, 2008). The researcher took part as an insider because she is working in the same profession with the participants.

Reflexivity: Reflection is about the need for the researcher to think about the roles and the general nature of the relationship between the researcher and the subject being studied. (Given, 2008). The researcher prepared the content specific to the study to be used by the participants for both the IETM and the printed document. The researcher arranged the tablet computers necessary for the use of IETM. Afterwards, she gave information about the points where the participants might need help during the application.

The researcher checked the charging status of the tablets to avoid distress during the application. She participated in both implementation processes by observing the participants without any intervention. Constructing the interview protocol and conducting interviews were all done by the researcher. After the application, she took part in the data collection and interview process and recorded audio and collected the opinions of the participants.

3.11. Consistency

As Merriam stated, although qualitative researchers never achieve objective truth or reality, reliability in a research design is based on the assumption that there is only one reality, and that repeating it will produce the same results. This is a key notion of

traditional experimental research focusing on investigating causal interactions between factors and uncovering legislation to explain phenomena (2009, p.220). In this research, several methods were applied to ensure consistency.

Peer Examination - In essence, peer examination is no different from the member control approach used to improve the investigation's credibility (Bitsch, 2005; Krefting, 1991). The feedback from peers helps the researcher to improve the quality of the inquiry findings. During peer examination, researcher discussed her research process and findings with master students who are either doing qualitative research or have experience of doing qualitative research. One master student from the department of Computer Education and Instructional Technology compared the findings of the researcher study and codes. Peer review results showed that the similarity rates of the codes and categories were 80% according to Miles-Huberman formula (Miles & Huberman, 1994). In this study, codes and categories formed as a result of mutual interviews were used. (In Miles and Huberman model, the similarity that is called internal consistency and conceptualized as consensus among coders can be calculated using their formula.)

External Audit – As Creswell states, researchers may also ask a person outside the project to perform a thorough research evaluation and report the project's strengths and weaknesses in writing. External audit is a process in which the researcher receives services from an individual outside the study to look at the research from different angles (2012). That is, one subject-matter expert from the department of Computer Education and Instructional Technology, presented the findings of the study and coding.

Code-recode Strategy - The investigator codes the same information twice during the code-recode approach by providing standby time between each coding for at least one week. The two coding outcomes are contrasted to see if the findings are identical or distinct (Chilisa & Preece, 2005). As a result of this application, the second examined data did not differ significantly from the first one.

3.12. Transferability

Transferability relates to the degree to which other respondents can transfer qualitative research outcomes to other contexts or settings (Bitsch, 2005; Tobin & Begley, 2004). According to Bitsch, through a dense description and purposeful sampling, the researcher promotes the transferability evaluation of a potential user (2005). Information was given about the working techniques of the study environment, and the extensive explanations of the materials used in the study were included. In order to increase the transferability, it is necessary to pay attention to the selection of the study sample. Whether the sites selected for a survey or the respondents interviewed, the maximum change in the sample provides a wider range of applications by the readers or consumers of the survey.

3.13. Dependability

According to Bitsch, dependability relates to the stability of results over time (2005). Dependability includes participants' evaluation, interpretation, and recommendations of the study, all supported by data from the study's sources of information (Cohen, 2011; Tobin and Begley, 2004). Dependability was assessed using the following strategies in this study: code re-coding strategy and peer review.

3.14. Ethics

Ethical issues related to participant safety are of interest in any qualitative study (Merriam, 2009). The ethical concerns pervade the entire process of qualitative research, from conceptualization of the study to dissemination of findings. To ensure the ethical sensitivity while conducting research, it is vital to include ethical practices from the planning of the research to the reporting stage. Especially in the qualitative study, research projects should follow ethical considerations rigorously when dealing with human participants.

Like all research, it is very important to start with meaningful research questions; that is, the findings should contribute to the current literature and improve the current

situation of people (Merriam, 2009). The main purpose of this study is to enable the participants who use printed books in technical training to use interactive electronic form materials prepared with IETM technology, and to examine their opinions, comments and evaluations on these by comparing two forms.

The importance of the research, research questions and possible damages were shared with the “Ethics Committee” for approval. After obtaining the necessary approvals, the participants were informed both in writing and orally about the purpose of the study and the research process. It was emphasized that they were expected to participate voluntarily and that they could leave the study at any time.

Some significant ethical concerns to be considered when conducting qualitative studies are: anonymity, confidentiality and informed consent (Richards & Schwartz, 2002).

Informed consent has been recognized in various areas as an essential aspect of ethics in studies. It is highly essential for qualitative researchers to indicate in advance what data is being gathered and how to use it (Hoeyer, Dahlager, Lynøe 2005). Participants were notified about the research’s overall purpose and the research question.

In terms of confidentiality, participants were able to experience the IETM system without using any personal information during application. After all the interviews were made individually, the personal opinions of the participants were hidden from other users. This study was based on the confidentiality of personal data and the personal information of the participants was not used.

Transcription is also subject to ethical issues. Interviews can address sensitive issues where it is important to protect the issue and the privacy of the persons and institutions identified in the interview. At the beginning of the study, approval forms were obtained from the students. In addition, volunteer students participated in the interview. Participants were informed that records and transcripts will not be shared with anyone for privacy purposes. Other ethical issues may arise when analyzing

information. Since the researcher is the primary data collection tool, data was filtered through its specific theoretical situation and biases. (Merriam, 2009). The literature review was performed to determine how to interpret the transcripts. It is claimed that thematization should define the importance of the interview; that is, the reasons and needs behind interviewing should be explained. To ensure this, an overview of the interview investigation was considered. During the verification phase, it is emphasized that the researcher should share the information as secure and verified. Therefore, the opinions of the experts were gathered. Finally, during the reporting phase, the researcher should be sensitive when reporting specific interviews. To ensure that, the results of the interviews were reported and the private information of the participants was hidden.

In summary, ethical aspects were taken into consideration in all stages of the research. For example, in procedures such as obtaining consent forms from the participants before starting the study, indicating that they can leave the study at any time during the study.

3.15. Summary

In this study, qualitative research methodology was used and two technical training materials, traditional printed book and IETM form, were compared. The opinions of 8 (3 females and 5 males) volunteer participants were collected. The semi-structured interview protocol was used for data collection and transcription of the audio recordings of the interviews conducted one-to-one was inductively coded. With the implementation of IETM, data collection, data analysis and reporting, credibility, consistency, transferability, dependability and ethical issues were considered.

CHAPTER 4

RESULTS

In this chapter, the results of the data analysis were presented parallel to the research questions mentioned in method chapter. Each research question was elaborated with thick descriptions of participants' self-reported statements.

4.1. Participants' Opinions About How the IETM and Printed Book Forms Affect Users' Ability to Follow Task Steps

Participants were asked about the path they took to reach the task steps and the effects of the material they used in this process in terms of usability. They were also asked to evaluate the effects of visuals and animations in terms of the facilities they provided during the implementation of the task steps. Participants stated that visual and animations increased intelligibility. Participants stated that they used the table of contents in the book to reach the task steps, but they generally slog on. In IETM, they emphasized that the process was shortened thanks to the search option and links. Details are shown in Table 4.1.

Table 4.1. *Following the Task Steps*

Theme - Visuals and Animations			
Categories	Participants Quotations	Codes	Frequency
Impacts of Visuals	INT6: "The clearness and comprehensiveness of images affect the completion of a task. I think it affects completing the task and also completing it correctly."	Clearness Capacity Understandable	6
	INT7: "The visuals have a certain capacity."		

Table 4.1. continued

Impacts of animations	INT4: “Of course, animations are more useful and easy. You can visualize it in a much better way. And you can understand where you are pointing.”	Useful Understandable Steps Clear	6
	INT6: “The animation gives a very nice idea about a whole. And it shows us step by step how to do something.”	Easy Transferability	
	INT7: “The animations in IETM bring together many images and show them very easily. Therefore, supporting IETM with animation will give a user the opportunity to transfer a thousand-page book to the user in a matter of hours.”		
Clear and Understandable Visuals	INT6: “Clear and understandable visual should be a visual that everyone can understand in the same way from any user level.”	Clear Relevant Defined	4
	INT7: “Clear and understandable visual is the visual concentrate on what is defined in the relevant step, defined in the corresponding step.”		
Theme - Process/ Steps			
Categories	Participants Quotations	Codes	Frequency

Table 4.1. continued

Search Option	<p>INT2: “In the IETM, I can filter the name of the task according to the results in the search tab and click on the relevant task.”</p> <p>INT4: “You are searching by pressing the search key. Then, the mission comes.”</p> <p>INT5: “IETM is easier and have the search part. Since we can see it in more detailed list, it can be used more easily.”</p>	<p>Search tab</p> <p>Search key</p> <p>Search part</p> <p>Search engine</p>	7
Links	<p>INT4: “Then if you need to go to another step in that task, if you need to go to another task, you can also click there.”</p>	<p>Linked</p> <p>Click the links</p>	6
Follow The Steps (getting lost)	<p>INT4: “Which was in the book? You cannot find. If there are too many steps after a certain time. At IETM, we can go comfortably and return. We're not getting lost in the content.”</p> <p>INT5: “After reading I had some difficulty turning back to find the first main step of the procedure.”</p> <p>“In IETM, it is easier to return with the back button.”</p> <p>INT7: “The user is very likely to get lost in the book. It is very likely that you will reach the wrong place and lose time again.”</p>	<p>Getting lost</p> <p>Back button</p> <p>Return easily</p> <p>Wrong place</p>	5

Table 4.1. continued

Table of Content	<p>INT1: “First of all, I found the task I was looking for. Then I went on the task. Of course, I had to turn over a few hundred pages for that. After I found the task I was looking for, I saw that I had a front step. I’ve reopened the contents to find the preliminary requirements.”</p> <p>INT2: “I find the name of the task for the book from the table of contents and go to the relevant page.”</p> <p>INT4: “First you need to find the task in the book.”</p>	Find Table of contents Relevant page Page number	5
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4.2. Participants’ Opinions about Searching for the Required Information

The participants were asked their opinions about searching for the necessary information. Participants talked about the points they have difficulty in searching through IETM and the book. They stated that the biggest difficulty in searching through the book was to move within the book since there was no interactive interface. On the other hand, they emphasized that IETM does not have this problem. In IETM, they said that the search and back options make things easier. As a problem in IETM, the touch of tablet used in the study should be a little more sensitive. Details are shown in Table 4.2.

Table 4.2. *Searching the Required Information*

Theme - Searching from the book			
Categories	Participants Quotations	Codes	Frequency

Table 4.2. continued

No Interaction	<p>INT2: “Each time, I was going back and forth in the book to get that information and then go back to the main task. Of course, the book pushed me a bit.”</p> <p>INT6: “The fact that you do that search manually is one of the most difficult points.”</p> <p>INT7: “Switch to other tasks. Because each time you need to go back to the location and determine the location of the task in a way.”</p>	Manually Difficulties Determine Find from table	6
Table of Contents	<p>INT4: “Finding the task from the contents was very difficult.”</p> <p>INT8: “I think it's necessary to keep in mind the page numbers in the table of contents. Otherwise, the wrong procedure may be performed.”</p>	Table of contents Page numbers Too long time	5

Table 4.2. continued

Physical Problems (Ring binder form)	<p>INT1: “The book is definitely harder because it takes so long time really.”</p> <p>INT4: “Turn the pages to go there to find the task and then find the preliminary step, and if it is in a place behind it, it is necessary to constantly turn the book to the right and to the left. The folder is also not very comfortable. It's not like turning a normal book page. It's so hard to get through those ring binder etc.”</p> <p>INT8: “Constantly turning pages and access to information is one of the points I have difficulty.”</p>	<p>Turning pages</p> <p>Not comfortable</p> <p>Hard</p> <p>Ring binder</p> <p>Difficult</p>	3
Theme - Process/ Steps			
Categories	Participants Quotations	Codes	Frequency
Search Option	<p>INT2: “I had no difficulty accessing or browsing information thanks to search option.”</p> <p>INT8: “The search option automatically performs our manual process in IETM.”</p>	<p>Search option</p> <p>Automatic</p> <p>Search key</p> <p>Search engine</p>	7

Table 4.2. continued

Links- Hypertext	<p>INT1: “When you write the related task in the search engine in IETM, it goes directly to it and if it has a preliminary step, they can be accessed much faster because they are linked.”</p> <p>INT2: “IETM is much more useful because IETM doesn't leave me any manual labor on where the information is, i.e. I can access it directly from the link.”</p>	<p>Linked Links Click Directly</p>	6
Technical Problems (Touchscreen)	<p>INT1: “Links are not activated immediately but that is probably related to the tablet's feature”</p> <p>INT3: “The touchpad seemed to have had some trouble touching it. It's also a computer-generated problem, I think.”</p> <p>INT4: “A little late detection when I touch the screen in IETM. Because of the touch. Other than that, I had no difficulty.”</p>	<p>Touchscreen Touching Touch Difficult Hard</p>	6
Back Option	<p>INT2: “In IETM, it was much easier and more convenient to go back and forth between the related tasks as there was linking.”</p> <p>INT7: “When I click the backspace to get back, it brought me back to where I started directly.”</p>	<p>Back Option Directly Back and forth</p>	4

4.3. Participants' Opinions about the Rate of Reaching the Accurate Information

The participants were asked their opinions about the rate of reaching the accurate information. The participants stated that they found IETM more useful for accessing information. They emphasized that IETM is more practical and faster. On the other hand, while searching through the book, they stated that they had difficulty in progress because there was no linking or interactivity. They learned the page number from the table of contents in the book and after reaching the page, they repeated the process because of the content in it. This makes it difficult for them to follow the steps in the book. Details are shown in Table 4.3

Table 4.3. *Reaching the Accurate Information*

Theme - Reaching the accurate information			
Categories	Participants Quotations	Codes	Frequency
Usability	INT1: "IETM is certainly more useful if there is no error in the IETM linking."	Useful Faster Accurate No error	8
	INT3: "Since IETM is more practical, I was provided information at a faster time."		
	INT7: "I found the information I was looking for much faster and accurate at once in IETM"		
	INT8: "I was able to reach the information I was looking for faster and with more accurate results in IETM."		

Table 4.3. continued

Difficulty	INT1: “The book is definitely more difficult because it takes so long really.”	Hard Difficult Complex Wrong	8
	INT4: “I think it happened when I was looking for a task in the book. I went to a wrong title. Then I came back again. I had to search the table of contents. How many times have I gone to the contents?”		
	INT8: “It created confusion, so I couldn't go to the right post after a certain place.”		

4.4. Participants’ Opinions about the Duration to Reach the Accurate Information

The participants were asked their opinions about the duration to reach the accurate information. The participants stated that IETM was faster by comparing the time spent on accessing the books and information to the IETM. They compared the time spent to achieve the same task and made a proportion. Based on these ideas, they compared two materials in terms of ease and difficulty. They stressed that the book was quite a waste of time in response to IETMs practicality. Details are shown in Table 4.4

Table 4.4. *Reaching the Accurate Information*

Theme - Searching from the book			
Categories	Participants Quotations	Codes	Frequency

Table 4.4. continued

Time Spent	INT1: "The book is definitely more difficult because it takes so long really."	Long time Difficult	8
	INT8: "I had to come to almost everything in each procedure. This took a long time."		
	INT4: "But it takes too long in the book. It takes a long time to find a task in the book."		
Speed	INT2: "In the book, this was not a structure like a traditional book, but it was more time consuming to go back and forth because of constant references."		5
Difficulties	INT1: "The book covers a lot of space. Other than that, turning pages, for example, turning pages are not very useful. Some of them are already tearing."	Not useful Not clear Complicated Difficulties Negativity	4
	INT2: "There was not a very clear structure as to where the relevant task or reference was located and how to reach it."		
	INT8: "The book makes the transition between the information difficult and you are very likely to forget a few steps before the book. This is also a negative thing."		
Theme - IETM			
Categories	Participants Quotations	Codes	Frequency

Table 4.4. continued

Speed	<p>INT3: “With IETM we can do this with more practical touches on the screen. IETM is undoubtedly faster in this regard.”</p> <p>INT6: “You get much faster information. You spend energy not to reach information, but to perceive and understand information.”</p>	<p>Faster Easily</p>	7
Time Spent	<p>INT1: “When I compare the two in the book, of course IETM was done in a 1/3 period of the book. But normally it probably increased 5-6 times.”</p> <p>INT2: “In IETM, I can say that this part does not take much time and it is almost halfway to go directly to the link, the time spent.”</p> <p>INT6: “Probably one-fifth or something. We can reach much faster at IETM. And we get the accurate information.”</p>	<p>5-6 times 1/3 period Halfway One-fifth</p>	5

Table 4.4. continued

Facilities	<p>INT1: "I certainly found IETM more useful. It was easier to find when the time spent accessing information was shorter."</p> <p>INT1: "IETM done in 1/3 the time of the book."</p> <p>INT3: "IETM is definitely more useful. Both to find what you're looking for and to have animation support."</p> <p>INT6: "It does not leave the user a chance to make mistakes. The frame is clear."</p>	<p>Support</p> <p>Easier</p> <p>Shorter</p> <p>Clear</p>	5
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4.5. Participants' Opinions about the Quality of the Images/Animations

Participants were asked their general opinion about the quality of the images/animations. In order to provide visual support for the completion of the task steps in the study, the participants stated that the importance of the visuals which are plain, simple. All participants agreed that animations were more effective than static visuals. Details are shown in Table 4.5

Table 4.5. *The Quality of the Images/Animations*

Theme - Visuals			
Categories	Participants Quotations	Codes	Frequency

Table 4.5. continued

Visuals' Roles	<p>INT1: "Visuals must show exactly the right place and right angle."</p> <p>INT2: "The visual warning is always stronger than the text."</p> <p>INT3: "If the person we are going to talk about does not have any knowledge about this subject, we can easily explain this with visuals. I think the effect of the visuals in this regard too."</p>	<p>Right Stronger Easy</p>	7
Clear and Understandable Visuals	<p>INT1: "In terms of intelligibility, the angle and content they are taken from are important."</p> <p>INT2: "The visual must be extremely clear and simple, in a way to directly explain the information that is to be explained directly. I think there should be simplicity."</p> <p>INT3: "The visual comprehension and simplicity make it more understandable to the reader."</p>	<p>Clear Understandable Directly Simple</p>	5
Impacts of Visuals	<p>INT1: "It is very important to remove the right part in the right place."</p> <p>INT2: "I think it visually shows both the place and the relevant part in a much simpler and easier way. We may try to describe a piece in a paragraph, but it is much easier to explain it in a much simpler way with the visual."</p>	<p>Relevant Describe Easier Simpler</p>	4

Table 4.5. continued

Difficulties	<p>INT1: “In the visual, there is often a comeback at every step, something that makes this process a little longer and more difficult.”</p> <p>INT2: “The visuals in the book are static and do not have much interactive structure.”</p> <p>INT8: “The visuals have a structure that is only from a single angle and without any interactivity.”</p>	Longer Not interactivity	3
Theme - Animations			
Categories	Participants Quotations	Codes	Frequency
Animations’ Role	<p>INT3: “Having animation will of course be arguably more efficient.”</p> <p>INT8: “Because the animation shows the whole process, it is much more effective and much more accurate than opening the cover.”</p>	<p>Animations</p> <p>Effective</p> <p>Accuracy</p>	8

Table 4.5. continued

Impacts of Animations	<p>INT1: "IETM came closer to there, and it was easier for me to find its location more clearly."</p> <p>INT3: "I think it would be more effective to use IETM. Because it is more practical for some subjects more understandable, supports with animations and videos because it provides this subject easier"</p> <p>INT6: "After watching the animation in IETM, the comprehension time decreases a task, that process, and that step. You can understand more easily."</p>	<p>Easily Practical Easier Comphersion time</p>	7
Facilities	<p>INT2: "I think that animation reflects much more requested information because animation tells more step by step. And I think it's much more understandable in animations because it follows a step that focuses on the system at work."</p> <p>INT7: "The animations in IETM bring together a large number of images and show them very easily. So IETM support animation. I think a thousand-page book in a few hours, I think will give the opportunity to very comfortable user."</p> <p>INT8: "I think that following the animation will be much more successful."</p>	<p>Step by step Large number of images Comfortable Successful</p>	4

4.6. Participants' Opinions about the IETM System

Participants were asked about their general opinions on the IETM system. Five of the participants stated that IETM had difficulties due to “touch” features. It was also stated that it is difficult to click on the link from the options that are opened when the search is done, because the text is small in size. On the other hand, all of the participants expressed a positive opinion on IETM and they mentioned the conveniences it provides. Details are shown in Table 4.6

Table 4.6. *The IETM System in General*

Theme - Positive opinions about IETM			
Categories	Participants Quotations	Codes	Frequency
3D Animations	<p>INT3: “In terms of visual IETM also have visuals like in the book, but IETM has an animations and videos, so IETM is more useful.”</p> <p>INT4: “Very good to have animations.”</p> <p>INT5: “This technology will be much more developed by reducing the file size and making animations much faster.”</p> <p>“For example, I think it is very useful to sharpen the tool in the eyes of the user as if it were working with a three-dimensional model.”</p>	<p>3D animations</p> <p>Useful</p> <p>Good to have</p>	5

Table 4.6. continued

Mobility	INT3: "Portability, for example, rather than carrying a pound of weight because of a book; with IETM, you can only do this with a tablet that you can take at work."	Portability Carrying Take with Not heavy	2
	INT4: "Easy to carry. You can take it anywhere. Not as heavy as a book."		
Navigation	INT1: "Now we live in the age of technology. It makes more sense to use IETM than to deal with books."	Navigate More easily Useful	2
	INT4: "IETM is definitely more useful than this book in this respect."		
Theme - Negative opinions about IETM			
Categories	Participants Quotations		Frequency
Touchscreen	INT1: "Tablet's sensitivity difficulties were problem that affect the application."	Sensitivity Touchscreen Touching	5
	INT2: "Because the tablet is using the pen while clicking on the links."	Keyboard	
	INT3: "I think it would be beneficial to have a good tablet. Because I think it's easier to use the touch feature or something better."		
	INT5: "I didn't have a problem other than just touching."		
	INT7: "Depending on the platform, I had some difficulties using the keyboard or typing in some of the entries."		

Table 4.6. continued

Font Size	INT1: “We couldn't change the size, for example, we couldn't change that size, so we clicked on the wrong link.” INT5: “I told that to stay small because there was no optimization in the interface” INT7: “The user interface of the device used can be distressed while type depending on the feature of the platform. Size of the keyboard depending on the smallness. Clicked places need to be better designed in this case.”	Size Keyboard Optimization	5
Battery / Usage Time	INT5: “Charging problem may create some drawbacks” INT7: “One of the possible problems that may occur is the battery. Depending on the battery life will be available at that moment.” INT8: “There may be charging problems in the field.”	Battery life Charging	3

In addition, participants expressed their general opinion about IETM and stated that its interface is user-friendly but there are some points that need improvement. Sample quotations of participants are as below:

INT2: “Can be made more user friendly as interface.”

INT3: “I think it's more useful because transitions in IETM are easier and the user interface is simpler.

INT6: “Thanks to the user-friendly interface, I can easily reach the steps. Links are very important.”

4.7. Summary

In this chapter, participants' viewpoints about the IETM and printed book were elaborated for each specific research question. The participants' overall views on IETM are very positive. Especially the search option has been found to be very positive and useful compared to the book. All participants agree that the three-dimensional animations in the IETM make the content more understandable compared to the static visuals in the book. On the other hand, there was some difficulty with the sensitivity of the touch screen, and it was emphasized that this was more tablet-based than the IETM application by the participants.

CHAPTER 5

DISCUSSION AND CONCLUSION

In this chapter, concluding remarks and their discussion with the prior studies are presented with parallel to the research questions. Following the discussions, overall significance of the study was summarized. Lastly, recommendations for future research and limitations were presented.

5.1. Major Findings and Discussion

This section, within the framework of the six main questions, focused on the results and discussion of the study.

5.1.1. Follow the Task Steps

Participants stated that the use of IETM is more efficient in obtaining the necessary information than traditional books, and therefore, they prefer it. The IETM search option allows users to perform manual operations with a single keystroke, thus preventing time loss. Users have argued that this feature makes IETM more favorable. They mentioned that hypertexts in IETM are easy to navigate through the data and provide access to preliminary conditions in almost every task with a single click. Participants stated that these links save time and speed up the learning process. As the content of technical training books is very intensive and modular, the number of related tasks is also high, which requires the user to complete at least two different tasks in order to complete a main task. Therefore, the steps that are tried to be followed through the traditional book are constantly going through the table of contents, which causes loss of time. All participants argued that IETM makes this process much more useful and efficient thanks to linking.

Similarly, in this study, the images in the traditional book generally consist of frames taken from the system model and have a static structure. For example, the visuals in

the printed book may not be able to represent the location of the system accurately. When working with expensive systems where the user does not have the luxury of making mistakes, the single image may not be able to fully express the information that needs to be given, which may cause errors. The participants stated that this situation can be prevented by the animations in IETM. The results of the study reveal that the visuals, which should be clear and understandable, can be confused because they are shaped from the perspective of the author, while the animations are much more helpful. The findings show that the animations can show a system from any angle and highlight important points in a remarkable way. One of the studies underlined the significance of supporting learning environments with interactive books that contain multimedia components (Kılıç Türel & Özer, 2015). The results of the said study show that participants produce positive metaphors for interactive books. Due to interactive e-books' ability to provide more than just text function, participants regarded it more appealing than books. Interactive books can contain elements such as video, audio, animation and interaction and support written content. Due to these characteristics, it is seen as favorable by users and preferred to printed books (Abdullah & Gibb, 2008; Schwartzman & Tuttle, 2002; Soules, 2008).

5.1.2. Search the Required Information

As mentioned earlier in this study, IETM uses compilation and storage techniques in text, graphics and images, replacing the paper-based manual in terms of functions and services. The findings show that they preferred IETM because of some properties such as search options, hypertext and back options.

According to the results obtained in a study, when the users are given adequate and appropriate training, they are more familiar with the tablets and then gain better understanding by using tablets (Chen, 2013). With the usage of IETM, the interaction feature that is not found in traditional books has become available. Due to the lack of interaction in books, the participants stated that they lost a lot of time during the practice. For example, when they wanted to find a task from the book, they said it was

the most difficult step to find from the table of contents. On the other hand, the search option, one of the advantages of interaction in IETM, helped to overcome this problem. In addition, thanks to mobile devices, a learning model is obtained in which the user is not dependent on time and space conditions (Chen, 2013). The participants have made some negative comments regarding traditional printed books. For example, one of the problems with searching the book (except for the loss of time) is that repeatedly turning the book pages back and forth tore the book and even caused some pages to tear apart. The fact that these books, which were planned to be used for a long time, were tearable even in one application, affected the participants negatively.

5.1.3. Rate of Reaching the Accurate Information

When participants were asked about the rates of access to accurate information, most of the participants stated that IETM accelerated the process unless there was an error in the linking. In the book, they stated that due to navigation problems during the task steps, they had gone to the wrong task and had to repeat the process. This confusion made it difficult to follow the contents of the book, and also wasted time. Users have stated that IETM is more practical, faster and often provides access to related information at once. According to the literature, the search feature that is not found in printed books gives effective utilization of time, and is preferred by the users (Bodomo, Lam & Lee, 2003; Chu, 2003; Chen, Li & Jia, 2005; Gunter, 2005). IETM provides users with an opportunity to access the information they want immediately. The table of contents page of the technical training book used in this study consists of content and page numbers. However, this is not always the case. In the absence of the page number, a data module code generated for each task is given and these codes need to be followed. The aforementioned codes have 18 digits and are very difficult to follow.

The modular structure within the book stems from the fact that many tasks are interrelated. For these reasons, it is necessary to read more than one task in order to complete a task as mentioned earlier. To complete a task from the book, the most

repeated operation is to turn the page and find the relevant place from the table of contents. Due to the modular content, task tracking from the book has challenged users. In IETM, which has the same content, the greatest convenience is that linking can be made and thus saving time for its users. The findings indicate that the participants were not confused by going back and forth in the content in that it was easier for them to track where they were at because they did not need to keep in mind the page number, thanks to IETM.

5.1.4. Time for Reach the Accurate Information

When participants were asked to evaluate the time spent during the practices, all of them stated that IETM accelerated the process. When they rate this speed and duration between IETM and the book, they emphasize that they do the same process in IETM five or six times quicker. Many research results show that the interactive e-books in the learning-teaching process help students to facilitate the learning process by improving understanding in the process. (Aedo, Díaz, Fernández, Martin & Berlanga, 2009; DeFrance, Khasnabis & Palincsar, 2010; Grimshaw, Dungworth, McKnight & Morris, 2007; Korat, 2010; Öztürk & Can, 2013). The IETM displays interact with users (as a result of the user's request and input) to provide procedural guidance, navigation instructions and additional information, thus saving users' time.

IETM provides users with a faster and more convenient learning environment, thanks to its low error rate. The low error rate features of the IETM allow the users to focus on understanding information without spending a lot of time and energy searching for information. Results point out that it is very easy to reach the required task of IETM. After clicking on the search option, users can list the content of the entire book by clicking on a single icon on the tablet. The search feature, which is not available in the printed book, ensures that the time is spent efficiently. Thanks to the search features, users prefer tablets and e-books because they save time of users in the process (Bodomo, Lam & Lee, 2003; Chu, 2003; Chen, Li & Jia, 2005; Gunter, 2005). Participants stated that interactive routing in IETM reduces the risk of user error. They

also stressed that the only direction in the book is the page number or data module number, which is insufficient and very susceptible to error.

5.1.5. Quality of the Images/Animations

When participants were asked about the quality of the visuals in the book and the quality of the animations in IETM, they all stated that the animations were more effective than static visuals. The IETM refers to learning materials that compress text to pages containing animation and enable readers to find the necessary information. According to previous studies on this matter, interactive books can provide users with elements such as video, audio, animation, and interaction. Because of these features, it is considered suitable for users and is preferred to printed books (Abdullah and Gibb, 2008; Schwartzman and Tuttle, 2002; Soules, 2008). These visual and e-book contents will contribute to the learning process for users to provide visual elements (Kaysı & Aydın, 2014). According to research results, participants were more favorable to e-books in a format that could accommodate multimedia materials than printed books (Özer and Kılıç Türel, 2015).

The results of this study show that the participants perceive that the animations consist of thousands of images and that they can transfer the content that can be explained with thousands of images in a few seconds. According to the results, the participants say that the direction messages that are tried to be given in the visuals can be given very successfully and conveniently, thanks to the animations.

5.1.6. IETM System

When the participants were asked their general opinions and suggestions about IETM, they mentioned that they had some positive as well as negative comments not withholding the fact that positive ones outweighed negatives. First of all, all participants expressed positive views about the use of three-dimensional animations and stated that it improves intelligibility, increases efficiency and enhances usefulness. As a second positive opinion, the participants said that a tablet PC with IETM was

portable and that they could carry dozens of books and thousands of pages with a single tablet. When Tablet PCs are used as a mobile learning environment, more content becomes portable and training can happen at any time and place. IETM can also be used in this way. Finally, IETM content allows users to navigate between pages with a single click, thanks to the index structure and hypertexts. The majority of the participants expressed their satisfaction with this feature. The participants stated that this feature makes navigation very easy. It is enough to click the relevant button or link in IETM whereas hundreds of pages need to be turned back and forth in the printed book.

They mentioned the touch screen sensitivity as a negative aspect because there were a number of problems with the tablet pen during the application. For example, although they clicked the links with the tip of the pen, they could not go to the required screen due to the weak touch feature. For this reason, they said that the touch screen sensitivity should be higher. The second problem was that the size of the text on the screens was a bit small, making it difficult to determine the area to click. Coupled with the touch screen problem, they mentioned that they had to click 3-4 times to go to some links. As in this study, the literature mentions some technical problems such as device size that might affect the efficiency of IETM use (Ebied & Rahman, 2015). To solve these two problems the tablets with proper touch sensitivity and adjustments should be preferred, and the user interface should be improved by increasing the font size.

The last problem is about the battery or usage time of the tablets. The findings show that the charge of IETM tablets used in the field cannot last for a sufficient time period. The battery problem can be solved by arranging some features of the tablets as in e-books. Since e-readers do not reflect the light of outdoors like the screens of tablet computers—additionally, screen refreshment is not done continuously as in tablet computers—they provide a long usage time—one month—without recharging the batteries. If these features can be incorporated into IETM tablets, the charging problem might be minimized (Harris 2010, p. 748).

5.2. Features and Functions of the IETM

The participants' views on the IETM system were very positive because they thought that the features the printed book does not have were present in IETM. Since there is not much study done in this field, it is significant to reveal the opinions of the users. In order to emphasize the importance of the study, it should be noted that each answer given to the questions is capable of opening a door to further studies. Any positive or negative opinion about the use of IETM might be valuable enough to design a new study. When explaining the features and functions of the study, the answers that were given by the participants within the scope of the interview questions are summarized according to some categories as follows:

5.2.1. 3D Animations

The first one was a comparison of animation and visuals. In general, the participants emphasized a few points when evaluating the IETM and the books. For example, they emphasized that static visuals are not as effective as animations because a static image has a single angle and two dimensions, the users may sometimes not be able to perceive it correctly. However, it was emphasized that the animations had many visuals from every angle and the steps to be shown could be highlighted with effects. Some participants emphasized that it is very difficult to visualize the guiding steps in the task. For example, if users are instructed to rotate clockwise to perform an operation, it is necessary to add extra arrow marks, etc., to visualize it while the animation may show a moving rotation. Overall, the findings show that the participants found the animations effective and efficient. The animations were emphasized by all participants as one of the strengths of IETM. However, 3D material and animation preparation processes are very time consuming and costly compared to static visuals.

5.2.2. Mobility

The manual used in technical training is in the form of a printed book and consists of thousands of pages. The dimensions of the content that need to be transported for technical training consist of thousands of pages, and this is a very challenging process. Interviewees, who learned that they could solve this problem through IETM, emphasized the fact that the tablets were portable in size, which is a positive feature. For these reasons, thanks to the IETM, the technical training processes in the field are made easier in terms of logistics. In addition, the availability of training content at the desired place and time stems from the fact that IETM is a mobile training tool.

5.2.3. Navigations

Users stated that they had difficulty with the book when they wanted to reach the content and preliminary conditions of a task during the application. The main reason for their difficulties is that the content of the book is followed by page numbers and data module codes. To learn the page numbers or codes, users need to look at the table of contents and then turn back and forth in the book, which consists of thousands of pages. Seeing that they can do this challenging process with the search option in IETM, the participants found IETM quite successful because of this feature. Unlike books produced in the form of basic text and static visual, IETM offers users an interactive learning environment. Similar to the search option, the back option or the links within the page provide users with great ease of navigation.

5.2.4. Time Spent

The features mentioned in the previous sections, such as 3D animations, mobility and navigation allow users to perform the operations they do in the book in a much shorter time. For these reasons, the participants stated that IETM saves time for users.

5.2.5. In General

The IETM technology does not find much usage in our country in that it is currently being used by a limited number of companies as materials for technical training. One of the main reasons why it is being used by a limited number of companies is the

concerns about the views of its target audience. In order to overcome this concern, IETM has been used for the same task steps on different dates. The strengths and weaknesses of IETM were determined in the comparisons made by the participants on two materials. In line with these results, it was seen that their strengths had positive contributions compared to the book, while their weaknesses were generally related to the tablets that were used. The results obtained in this study might help to eliminate the question marks about the use of IETM in technical training and especially affect the determination of the materials used in the field of education.

5.3. Limitations

It should be borne in mind that this study has limitations as listed below:

- In this study, it is assumed that ILS department employees are in close relationship with technology. If the study was conducted with participants who are less familiar with technology, the results may change.
- Working with end users rather than departmental employees during implementation could have provided results that are more reasonable.
- With respect to the data analysis, subject matter experts checked and affirmed the codes, the outcomes rely upon the scientist's interpretations. Results of this study are largely self-reported.
- Participants' perceptions are limited to the content of the research. The learning atmosphere, which consists of time and position may have affected the participants' perceptions.
- One-to-one talks characterized by synchronous communication in time and space have many advantages and disadvantages. These disadvantages may affect the study:
 - *Data quality* relies upon the interviewer's capacity. A few people have the characteristic capacity to interview and gather great data. Not all interviewers are likely to have these skills. A few interviewers may

likewise have their very own biases that may influence the manner in which they enter the appropriate responses.

- *The moderator bias* might be a problem while interpreting results. The moderator's body language, facial expressions, tone, and style of language may introduce bias. Similarly, the moderator's age can produce bias.
- *The open-ended type responses.* This may become a problem to interpret them for researcher.

5.4. Recommendations for Future Research

According to the information obtained from the participants, it is necessary to investigate the missing points in the study while also emphasizing important ones. For this purpose, some recommendations have been made for future studies in line with the results of the interviews conducted in this study.

Based on the results of this study, the following points are suggested for future research:

- Further studies ought to explore the impacts of various types of annotations (for example graphics and/or videos) with regards to the IETM (mobile) environment,
- In addition, a study can be conducted to compare the effects of desktop and mobile platforms on technical training,
- It is suggested that the same concept can be generalized by experimenting with more people,
- It is also suggested that the same concept can be generalized by experimenting with end users of the IETM technology,
- In addition, experimental and causal-comparative studies may be required in this point,

- The effects of IETM use on learning process can be studied by working with two groups which are technology-prone and non-technology-prone,
- In this study, positive characteristics of IETM such as interactivity, mobility, speed rate can be analyzed and investigated separately,
- Reconstruction of the application with a new interface to be created by combining IETM and AR technologies,
- There are not enough studies on the use of IETM in technical training; therefore, further research is needed to investigate the effect of such an application.

5.5. Summary

According to the results, the participants evaluated the IETM and the printed book form according to certain criteria and stated that many of the features of IETM provide advantages over the printed book. The most prominent features were interaction, speed and animation. In addition, IETM's ease of use compared to a book is also mentioned since IETM includes qualities such as being portable, not sizeable and rich in volume; in other words, it can contain many book contents at the same time. On the other hand, features of the printed book forms are evaluated based on their disadvantages such as lack of interaction, being hard to find a required information, and static visuals that are causing problems in unclear situations. According to the study results, all of the participants have expressed positive opinion about the use of IETM. They emphasized that the use of IETM shortens the process of achieving remove-install task steps, which is an important part of technical training. It also makes the steps-process more convenient and understandable. The participants stated that the books used in technical trainings are inadequate in learning steps from time to time, and this negativity could be solved by IETM. When the IETM is preferred in technical training on the field, there are some important points that need to be taken into consideration. Firstly, it should be considered that charging problems may be experienced, and measures should be taken in this regard. The other point is that the use of highly efficient

touchscreen tablets might be more appropriate. Participants emphasized this issue because they often had problems with the touch feature not responding immediately.

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APPENDICES

A. Interview Protocol

Merhaba, ben Ceylin Böğürücü, ODTÜ Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümünde master öğrencisiyim. Katılımcıların IETM ve geleneksel basılı kitap formunu kullanmalarını sağladıktan sonra tecrübelerine ilişkin görüşleri üzerine araştırma yapmaktayım. Bu görüşmenin amacı teknik eğitimlerde geleneksel basılı formda kitapları kullanan çalışanların IETM teknolojisiyle hazırlanmış etkileşimli elektronik formdaki materyalleri kullanmalarını sağlayıp bu tecrübelerine ilişkin görüş, yorum ve değerlendirmelerini -iki formun kullanımı yönünden karşılaştırarak- araştırmaktır. Bu araştırmada ortaya çıkacak sonuçların sonraki çalışmaların niteliğini artırmada kullanılacağını umuyorum. Bu nedenle, katıldığınız bu çalışmada kullandığınız IETM uygulamasına ilişkin düşüncelerinizi ve önerilerinizi bizimle paylaşır mısınız?

Görüşme esnasında paylaşacağınız yorumlarınızı izninizle kaydetmek istiyorum. Bu bilgileri araştırmacı dışında bir kimse görmeyecektir. Sonuçlarda da her türlü kişisel bilgileriniz kesinlikle gizli tutulacaktır. Görüşmeye katılım gönüllülük esasına dayalıdır. Çalışma, genel olarak kişisel rahatsızlık verecek sorular içermemektedir. Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakıp çıkmakta serbestsiniz.

- Görüşmeye başlamadan önce söylediklerimle ilgili olarak belirtmek istediğiniz düşünce ya da sormak istediğiniz soru var mı?
- Görüşmeyi izniniz olursa kaydetmek istiyorum, sakıncası var mıdır?

Görüşmemiz yaklaşık 10 dakika sürecektir. İzninizle sorulara geçmek istiyorum.

B. Interview Questions

1. Bilgiye ulaşma kolaylığı bakımından IETM ve kitabı değerlendirir misiniz?
2. Aradığınız görevin adımlarına ulaşmak için yaptığınız işlemler nelerdir? Açıklar mısınız?
3. IETM ve kitaptan bilgiye ulaşırken harcanan süreleri karşılaştırır mısınız?
4. Hangi aracı daha kullanışlı buldunuz? Nedenlerini açıkla mısınız?
5. Kitaptan arama yaparken zorlandığınız noktalar nelerdir?
6. IETM’den arama yaparken zorlandığınız noktalar nelerdir?
7. Aradığınız bilgiye doğru şekilde ulaşma konusunda hangi aracı daha kullanışlı buldunuz? Nedenlerini açıkla mısınız?
8. Doğru bilgiye ulaşma oranınız hakkındaki görüşleriniz nelerdir?

Örneğin;

- Kitapta görevi ararken 3 farklı göreve bakmak gerekti 4. de buldum.
 - IETM’de görevi ararken 1 farklı göreve bakmak gerekti 2. de buldum.
9. Metin içinde geçen görsellerin görev adımlarını anlaşılır hale getirmedeki rollerini değerlendirir misiniz?
 10. Görsellerin açık ve anlaşılır olması bir görevi tamamlamayı nasıl etkiler? Açıklar mısınız?
 11. Size göre açık ve anlaşılır görsel nasıl olmalıdır? Açıklar mısınız?
 12. Kitapta geçen görselleri ve IETM’de geçen animasyonları karşılaştırarak değerlendirir misiniz?
 13. Görev adımlarını uygulama sürecinde, sağladıkları kolaylıklar bakımından görsellerin ve animasyonların etkisini değerlendirir misiniz?

14. IETM’i kullanırken yaşıadığınız problemler (varsa) nelerdir? Açıklar mısınız?
15. IETM sistemine ilişkin görüş ve önerileriniz nelerdir?