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Click, Explore, and Learn: Graduate Students' Experiences and Attitudes Toward Using E-Books for College-Level Courses

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CLICK, EXPLORE, AND LEARN: GRADUATE STUDENTS'
EXPERIENCES AND ATTITUDES TOWARD USING
E-BOOKS FOR COLLEGE-LEVEL COURSES

A Dissertation Submitted in Partial Fulfillment
of the Requirements of the Degree of
Doctor of Philosophy

Rasha Abdulrahman Alhammad

College of Education and Behavioral Sciences
School of Educational Research, Leadership, and Technology
Educational Technology

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ABSTRACT

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2017.

The main purpose of this qualitative research was to explore graduate students':
(a) interpretations of their experiences with the use of e-books for learning; (b) reasons
that influence their preference to use e-books or printed books when they learn; (c)
perceptions toward e-books impact on learning; (d) perceptions toward the influence of
prior technological experience, knowledge, and confidence on opinions and decision-
making associated with e-books; (e) interpretations of their experiences with the use of a
given e-book; and (f) recommendations of changes to e-books to better supporting their
learning. Participants were 20 graduate students at one of the midsize universities in the
Western United States. Purposeful sampling was applied to the selection of participants
along with the proposed selection criteria. The data collection procedure was comprised
of three phases and three data collection methods (interviews, observations, and artifacts).
Interview transcripts were the main data source in this research. Observational data and
artifacts were considered as supplementary data.

In this phenomenological research, the trustworthiness was examined through the
consideration of three criteria (credibility, transferability, and dependability). A
phenomenological data analysis was employed to analyze the data. A theoretical lens
comprised of several supporting learning theories to the constructivism learning approach

was utilized to analyze the results and provide insight on students' learning experiences with e-books. Such learning theories include behaviorist learning theory (self-testing), cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning.

Five major themes and 16 sub themes emerged fromparticipants' interpretations of their experiences with the use of e-books for learning. The five major themes were: (a) all students valued e-books, but nearly all students still prefer printed books; (b) e-books can enhance learning, but can hinder learning as well; (c) the impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books; (d) students preferred to use the given e-book to the given printed book; and (e) change to e-books recommended by students to better support learning. Research implications were drawn from the research findings for educators, students, developers of e-book readers, e-book authors, e-book publishers, and technology production companies. Implications could contribute to stakeholders' understanding towards the root causes for students' preference and reluctance to the use of e-books and the changes they need to see in e-books in order to use them more when they aim to learn. Finally, recommendations for future research were provided.

ACKNOWLEDGEMENTS

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INTRODUCTION

It is challenging to identify an immutable definition of an electronic book (e-book) due to the fact that perceptions and realities associated with e-books have been changing. However, the term, e-book, is an umbrella word that conveys numerous meanings depending on various concepts: context, characteristics, dynamic nature, and type of technologies. The majority of these concepts are very different from the ordinary printed books. E-books have the potential to change how people search, read, and learn. In today's information rich age, exploring people's perceptions toward using e-books to learn as an activity of everyday life is critical (Manley & Holley, 2012; Vassiliou & Rowley, 2008).

An e-book is not a digital format of a traditional printed textbook placed on the web or in a reader device as many people believe (Abram, 2010). In fact, an e-book is developed by comprising text, still images, animated images, videos, audios, and various features for the propose of information development and online delivery. We cannot consider a digitized printed book as an e-book due to the fact that ordinary printed books are limited to only text, or text and still images. On the other end of the spectrum, the majority of e-books offer their readers a multiple representations of information (vocal, visual, and textual), various features (glossary, key words search capability, highlighting, notes adding, word definition, visual searching, bookmarks, etc.), social interaction opportunities, and interactive self-testing opportunities along with prompt feedback. The

unique structure of e-books provides multiple opportunities to improve learning experiences not only to students in face-to-face classes, but also to online students as well. Such opportunities cannot be neglected. As indicated by Abram (2010), "If we were to not take advantage of the many opportunities to improve the learning experience and add additional elearning experiences in the shift to ebooks, then that would be another missed opportunity" (p. 19). However, in order to augment the chances of offering improved learning experiences, it is essential to consider exploring students' interpretations of their prior experiences with the use of e-books and how they perceive e-books utilization and impact on learning through these experiences. The results of such an investigation would provide critical facts to boost learning and improve technology production in term of e-book device.

Statement of the Problem

In contrast to ordinary printed books, e-books provide distinctive interactive features and opportunities that fulfill students' learning needs and optimize learning process. The numerous advantages available in e-books increase the prediction that students would prefer to read e-books. Visual and audial characteristics available in e-books are the most distinguishable features advocated by many learning theories (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Mayer, 2001; Norman & Bobrow, 1975; Paivio, 1990; Sweller, 1988; Waugh & Norman, 1965). E-books reader devices comprised of software that offer students opportunities to learn new knowledge through web-based contexts and provide features (e.g., glossary, animated images, key words search capability, highlighting, notes adding, word definition,

bookmarks) that would augment functions performed along with traditional reading (Lam, Lam, Lam, & McNaught, 2009; Mock, 2004; Tosun, 2014). In addition, a research study reported that after using e-books, students expressed feelings of competence, believed their learning was enhanced, exposed high self-efficacy feelings, and valued the use of e-books (Kissinger, 2013).

The numerous advantages offered by e-books raise the expectation that reading e-books fosters meaningful learning experiences. Such advantages lead students to feel more motivated to read e-books than ordinary printed books. However, while there are readers who prefer reading e-books to printed books, there are readers who hold negative opinions toward e-books. According to a number of research studies, despite the advantages features offered by e-books, students' negative opinions toward e-books have been increasing and yet students still prefer reading printed textbooks (Gregory, 2008; Pledger, 2010; Woody, Daniel, & Baker, 2010). Unfortunately, researchers did not indicate further investigation about possible influences of such results.

Almost all prior studies on e-books were conducted quantitatively to investigate readers' preferences about reading e-books or printed books. In addition, researchers have not yet explored the root causes of readers' preferences, which indicate the criticality of conducting this research. The findings of previous researches confirm the intelligibility of qualitatively exploring the root causes of readers' positive and negative attitudes toward the use of e-books and developing appropriate strategies to overcome the negative stances. Based on the available literature and previous research, this research explored, in depth, graduate students' interpretations of their experiences with the use of e-books for learning, reasons that influence their preference to use e-books or printed

books when they learn, perceptions toward e-books impact on learning, perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, and their interpretations of their experiences with the use of a given e-book. Furthermore, drawn from the results, this research aimed to develop appropriate recommendations that would help overcome negative stances. Finally, a theoretical lens comprised of several supporting learning theories to the constructivism learning approach was utilized to analyze the results and provide insight on students' learning experiences with e-books. Such learning theories include behaviorist learning theory (self-testing), cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning.

Purpose of the Study

Although the production and sales of e-books, in terms of e-books materials and e-books reader devices, are increasing, students still hold negative stances toward them. Furthermore, despite the unique structures, affective visuals, and interactive elements available in e-books from which students should obtain meaningful learning experiences, they do not prefer reading e-books to printed textbooks (Woody et al., 2010). As stated previously, prior literature research quantitatively investigated readers' preferences about reading e-books or printed books without addressing the root causes of the reported results. Hence, the root causes of preferring and rejecting the use of e-books are not yet identified, which indicates the criticality of conducting this research. Moreover, there has been limited evidence about how students actually interpret their experiences with the use of e-books and how they perceive e-books impact on their learning.

Previous studies focused on answering the question: Do students prefer to read e-books or printed textbooks? From my point of view, our responsibility as researchers is situated beyond such a point. As a qualitative researcher, I aimed to explore and understand graduate students' feelings toward e-books, then provide recommendations and suggestions that could help them overcome negative feelings they hold. The goal of this research was to help students successfully take an advantage of the multiple features and opportunities available in e-books that would effectively and meaningfully contribute to their learning experience. The main purpose of this phenomenological research was to describe and understand how graduate students interpret their experiences with the use of e-books. In addition, this research aimed to explain, in depth, the reasons influence graduate students' decision to use e-books or printed books, how they perceive e-books impact on their learning, how they perceive the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, and how they interpret their experiences with the use of a given e-book that contains demonstrative media, embedded features, and tests. The root causes of graduate students' negative and positive interpretations, perceptions, and attitudes were identified.

Moreover, this research offered graduate students opportunities to recommend changes to e-books and to e-books reader devices to better supporting their learning. In order to obtain more insight on the data of this research, the data were analyzed through a theoretical lens incorporating several learning theories and pertains to the constructivist learning approach. The theoretical lens includes behaviorist learning theory (self-testing), cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning. In

addition, the results would contribute to the field of educational technology by providing a conclusion that is comprised of critical facts that support education and technology production. Based on the research findings and discussion, implications were structured and suggestions were shared with educators, students, developers of e-book readers, e-book authors, e-book publishers, and technology production companies. Implications and recommendations provided in this research would augment stakeholders understanding of the root causes of students' preference and reluctance to the use of e-books, of e-books impact on learning, and of changes to e-books to which we should increase attention in order to offer e-books that better support learning.

Research Questions

The primary research question that guided the study was:

How do students describe the use of e-books through their experiences?

There were five subsidiary research questions to which assist answering the primary research question:

Q1   What format, e-books or printed books, do students prefer to use when they learn?

Q2   How do students describe the use of e-books in terms of learning enhancement and hindrance?

Q3   How do students describe the impact of prior technological experience, knowledge, and confidence on perceptions and decision-making associated with e-books?

Q4   How would students describe the use of the given e-book that contains demonstrative media, embedded features, and tests compared to the given printed book?

Q5   What changes to e-books do students recommend to better supporting their learning?

The first, second, and third supportive questions (What format, e-books or printed books, do students prefer to use when they learn? How do students describe the use of e-books in terms of learning enhancement and hindrance? and How do students describe the impact of prior technological experience, knowledge, and confidence on perceptions and decision-making associated with e-books?) were explored through conducting interviews. The fourth supportive question (How would students describe the use of the given e-book that contains demonstrative media, embedded features, and tests compared to the given printed book?) was explored through conducting interviews and observation. Finally, the fifth supportive question (What changes to e-books do students recommend to better supporting their learning?) was explored through conducting interviews, and collecting artifacts.

Significance of the Study

A number of prior research studies have been quantitatively conducted on students' preferences of reading e-books or printed books. Based on the available literature and previous research, the majority of the reported results indicated that students do not prefer reading e-books to printed textbooks. However, the root causes of the reported results have not yet been explored. As a qualitative researcher, by conducting this phenomenological research, I aimed to contribute to the field of education by providing detailed evidence about how graduate students interpret their experiences with the use of e-books and how they perceive e-books impact on their learning.

As stated previously, the purpose of this research was to explore graduate students' interpretations of their experiences with the use of e-books for learning, reasons

that influence their preference to use e-books or printed books when they learn, perceptions toward e-books impact on learning, perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, interpretations of their experiences with the use of a given e-book, and recommendations of changes to e-books to better supporting their learning. This research would contribute to educators, students, developers of e-book readers, e-book authors, e-book publishers, and technology production companies and their understanding towards the root causes of students' preference and reluctance to the use of e-books. Exploring the essence of the phenomenon would contribute to the field of educational technology and, largely, promote education by fulfilling students' needs in term of learning.

This research provided critical facts and evidence that could be considered when choosing, designing, developing, or publishing e-books. In addition, developers of e-book reader devices could take an advantage of the results. Furthermore, the developers could consider applying modifications to their technological devices according to students' reported perceptions and recommendations. Drawing upon the results, discussion on the findings of this research included appropriate recommendations and suggestions that may be implemented by stakeholders to facilitate e-books adaption and utilization.

Limitations of the Study

It is undeniable that limitations exist in any research enquiry. A qualitative research method was applied in this phenomenological research. In pursuing to the design of this research and the nature of qualitative research methods, there were several limitations:

1 . Due to the nature of qualitative research methods, the sample size in this research was small.

2 . The sample selection was limited to graduate students at one of the midsize universities in the Western United States. This limitation was caused by accessibility and convenience of time, location, and availability when conducting this research.

3 . Participants in this study were from eight different nationalities and data were limited by their native languages and their own way of verbalization.

4 . The findings in this research were limited by my personal uninspected biases, interpretation, and qualitative research experiences.

5 . The materials of the e-book and printed book that were used in this study were limited to topics regarding the functionality of organs and blood in human body. Even though participants were asked not to comprehend the content, but to skim through, they may already hold negative perceptions toward the topics chosen where they end up providing inaccurate data regarding the use of both the e-book and printed book.

6 . Data were limited by several aspects related to participants' personal factors. These aspects were: participants' prior experiences with the use of e-books and printed books, emotional situations, cultures, time constraints, settings, and other personal factors.

Definitions of Terms

Animation. Materials provided through simple moving drawings that represent important elements to explain a process, action, event, etc. (Mayer, 2001).

Behaviorist learning theory. Focuses on human's behavior and conditions that would change or reinforce desired behavior (Harasim, 2012).

Characteristics of e-books. E-book's qualities (obtainable, accessible, composed of multimedia materials, etc.) and features (e.g., glossary, still images, animated images, multimedia objects, key words search capability, highlighting, notes adding, word definition, etc.), which make e-book distinctive from ordinary printed books (Vassiliou & Rowley, 2008; Velagic, 2014).

Cognitive load theory. Describes humans' mental energy used when processing information and its response to different loads (intrinsic, extrinsic, and germane load; Lohr, 2007).

Cognitive theory of multimedia learning. Emphasizes on the value of learning from words and visuals instead of learning from words alone in order to extend memory and create meaningful learning (Mayer, 2001).

Constructivism theory. Focuses on how humans construct their understanding of new knowledge based on their prior knowledge and experiences (Piaget, 1973).

Dual coding theory. Proposes that there are two separate memory systems (verbal and visual) for different types of information along with the three types of memories (sensory, short-term, and long-term memories; Paivio, 1990).

E-book. An e-book is not a digital format of a printed book positioned on the web. It is a digital object with textual, vocal, and visual representations, which is developed to meet the familiar concept of an ordinary book but with distinctive features. These features include but are not limited to: hyperlinks, glossary, still images, animated images, videos, audios, key words search capability, highlighting, notes

adding, word definition, external resources, multimedia objects (videos, audios, and images), simulations, and bookmarks (Abram, 2010; Vassiliou & Rowley, 2008)

E-books reader device. It is a reader hardware, such as iPad, Kindle, and Nook, which downloads, saves, and displays e-books content. It has text software that provides various features, such as glossary, still images, animated images, videos, audios, key words searching, highlighting, notes adding, word definition, visual searching, bookmarks, etc., in order to augment functions executed along with traditional reading (Tosun, 2014).

Information processing theory. Focuses on how humans mentally process the information they receive and how information moves through short-term memory including sensory and working memory, and long-term memory (Lohr, 2007).

Interactive elements. Elements available in e-books that respond to readers' actions (e.g., the feedback provided in the embedded tests; Woody et al., 2010).

Interpretations. Participants' actions of describing the meaning of their previous experiences with the use of e-books and explaining the meaning of e-books impact on learning (Crotty, 1998; Merriam, 2009).

Learning styles. Human's matchless characteristics and approaches to understand new information. Learning styles are associated with five elements: environmental (sound, light, temperatures, design), emotional (motivation, persistence, responsibility), physical (perception, intake, time, mobility), sociological (self, partner, team, mentor, varied), and psychological elements (global/analytical, impulsive/reflective; Kang, 1999; Reid, 1995; Reiff, 1992).

Meaningful learning. Relies on learners' cognitive activity through learning and occurs when learners receive information through multimedia presentations and being able to transfer, save, and retrieve the information whenever they need it (Mayer, 2001).

Narrated animation. Materials provided through simple line drawings that represent important elements to explain a process, an action, an event, etc. along with a narration of brief important information (Mayer, 2001).

Perceptions. Participants' actions of perceiving, capturing, or understanding the meaning of their previous experiences with the use of e-books and the meaning of e-books impact on learning through their senses (Crotty, 1998; Merriam, 2009).

Printed book. An ordinary book that illustrates the content through the use of only text, or text and still images on paper and can be accessed through publisher, printing presses and libraries (Ebied & Rahman, 2015).

Self-efficacy theory. Focuses on the influence of humans' feelings and beliefs about their own capabilities on their actions and perceptions (Bandura, 1997).

Self-testing. The opportunity from which students can test their own comprehension of provided materials along with prompt feedback (Harasim, 2012).

Social constructivism. Focuses on how social interaction influences the process of constructing understanding of knowledge and experiences (Vygotsky, 1978).

Textual presentation. Materials provided through text (Mayer, 2001).

Visual presentation. Materials provided through videos, animations, still images, and moving images (Mayer, 2001).

Vocal presentation. Auditory materials provided as spoken words and sounds (Mayer, 2001).

<p style="text-align:center">**Summary**</p>

In this chapter, an overview through relevant research literature on the value of e-books and issues related to e-books use for learning was provided. This chapter also discussed the rationale, problem statement, purpose, questions, significance, and limitations associated with the processes of conducting this research. Compared to printed textbooks, e-books have unique structures, affective visuals, and interactive elements that foster students' learning (Anuradha & Usha, 2006; Buckley & Tritt, 2011; Ebied & Rahman, 2015; Hwang, Wu, Zhuang, & Huang, 2013; Kissinger, 2013; Lam et al., 2009; Mock, 2004; Roschelle et al., 2007; Rupley, Paige, Rasinski, and Slough, 2015; Zurita & Nussbaum, 2004). However, prior research indicated that students do not prefer reading e-books over printed textbooks (Gregory, 2008; Gürcan, 2005; Pledger, 2010; Tosun, 2014; Woody et al., 2010). The root causes of preferring and avoiding the use of e-books are not yet qualitatively explored and identified, which shows the criticality of conducting this research. In addition, there has been limited evidence about how students actually interpret their experiences with the use of e-books and how they perceive e-books impact on their learning.

In order to address the root causes of positive and negative attitudes toward e-books, this research explored, in depth, graduate students' interpretations of their experiences with the use of e-books for learning. Furthermore, this research explained the reasons influence graduate students' decision to use e-books or printed books, how they perceive e-books impact on their learning, how they perceive the influence of prior

technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, and how they interpret their experiences with the use of a given e-book that contains demonstrative media, embedded features, and tests. Based on the results, this research also developed appropriate recommendations that would help overcome negative stances. A theoretical lens comprised of several supporting learning theories (i.e., behaviorist learning theory [self-testing], cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning) to the constructivism learning approach was utilized to analyze the results and provide insight on students' learning experiences with e-books. In Chapter II, a detailed literature supporting this research was provided. Detailed information on methodology and research design utilized when conducing this study was explained in Chapter III. The results of this research were demonstrated in Chapter IV. Finally, the findings, implications, and recommendations for future research were discussed in Chapter V.

CHAPTER II

REVIEW OF LITERATURE

This chapter provides a general overview on e-books, and discusses related topics and theories contributing to the exploration of graduate students' perceptions toward e-books use and impact on their learning for college-level courses. The organization of this chapter is: (a) the electronic books (e-books), which covers the history of e-books, definition of e-books, characteristics of e-books, and previous literature on e-books use and impact on learning; and (b) learning theories and e-books, which contribute to research questions proposed in this research by exploring prior literature related to the topic and discussing the use and impact of e-books on learning through a theoretical lens pertains to the constructivist learning approach and comprised of several learning theories: (a) behaviorist learning theory, which explains self-testing approach associated with behaviorist learning technology and e-books; (b) cognitive load theory, which depicts the criticality of providing information that fits learner's way of thinking and cognitive structure and how e-books support its proposition; (c) information processing theory, which explains human's basic memory structure and how e-books facilitate processing the information through them; (d) constructivism theory, which covers social constructivism and the role of the learner; (e) dual coding theory, which explains humans' two separate memory systems along with the three types of memories and how e-books contribute to its proposition; (f) self-efficacy theory, which explains the impact of prior experiences, knowledge, and confidence on perceptions and decision making

associated with e-books; and (g) cognitive theory of multimedia learning, which covers the view of multimedia design, goals of multimedia learning, the influence of animation, and cognitive theory of multimedia learning and e-books.

<div align="center">**The Electronic Books (E-books)**</div>

History of E-books

Before conducting any discussion regarding e-books and their related topics, it is fundamental to understand what an e-book is. In 1971, Project Gutenberg, a digital library had presented the first e-book to its readers. Since then, the book has not been limited to what it used to be. E-books, today, are nearly 50 years old. Yet, printed books have been presented to the market for five centuries. In 1974, Vinton Cerf and Bob Kahn had developed the Internet protocol to connect billions of devices around the world. In 1983, the protocol became popular among universities, researchers, and research centers as a network for research. Since 1994, the Internet has been exponentially expanding (Lebert, 2009).

The growth of the Internet increases the opportunities of obtaining information, accessing contents, widening our knowledge, and communicating worldwide. Booksellers started selling books online on their websites in order to reach readers around the world. Magazines and Newspapers are also available online. Digital libraries have become more interested in digital documents and less interested in the printed format. Libraries started developing virtual websites where an individual is able to access libraries online and conduct online search and reading. In addition, some journals only considered electronic publishing to overcome the expenses of print publishing. In fact, there are a number of journals, newsletters, and magazines that can only be accessible

online. Moreover, most of the newly established bookstores are accessible online and sells only e-books (Lebert, 2009).

Book authors also develop their own websites for the purpose of either seeking a publisher or self-publishing. The number of books published in both formats, printed and electronic, has been expanding. Some printed books are converted into a digital format whereas other books are only published electronically. The fact that e-books provide easy and fast accessibility makes individuals more conscious about how information is easily obtained with one simple click. In fact, nowadays, the process of writing, developing, and publishing e-books is not limited to authors. In 2012, Apple Inc. had released the iBook Author application that allows anyone to create an e-book using many features (i.e., texts, video, interactive diagrams, 3D objects, etc.), and then get it published (Apple, 2016). Today, the majority of us, students and educators have perceived connecting through the Internet to obtain electronic information that is often available in e-books as a critical practice to search, study, and learn (Lebert, 2009).

Definition of E-books

Due to the fact that both technology and e-books are continuously changing, identifying a sustainable and permanently reliable definition of e-books is unattainable. The majority of e-books definitions reflect the existing evolving phase of the phenomenon. Velagic (2014) believed that e-book definitions often include: associating to printed books, emphasizing the characteristics of e-books (obtainable, accessible, composed of multimedia materials, etc.), and comparing and contrasting these characteristics to the characteristics of printed book (Velagic, 2014).

Many definitions described the electronic and digital nature of e-books as a representation of a printed book. According to Lee (2002), an e-book could be defined as, "An electronic representation of a book, usually a parallel publication of print copy, but occasionally born digital" (p. 43). Almost a similar definition was identified by Stevenson and Waite (2011), "An e-book is an electronic version of a printed book which can be read on a computer or special handheld device" (p. 452). Moreover, Feather and Sturges (2003) proposed that an e-book could be defined as the result of integrating printed book structure with electronic environment features. According to Armstrong (2008), an e-book is, "Any content that is recognizably 'book-like,' regardless of size, origin or composition . . . made available electronically for reference or reading on any device (handheld or deskbound) that includes a screen" (p. 199). The Electronic Book Exchange System (EBX; EBX Working Group, 2000), also provided the following definition:

> A digital object that is an electronic representation of a book. While an e-book can consist of a single page, it is normally thought of as an electronic analog of a multipage hardcover or paperback book. . . . An e-book may come in a variety of formats, including, but not limited to, PDF, Open eBook Publication Structure 1.0, and various other textual and multimedia formats. (p. 6)

There are some points of view bounding the advantages of e-books only to the ability to be read on an electronic device. As stated by Reitz (2004), an e-book is, "A digital version of a traditional print book designed to be read on a personal computer or an e-book reader (a software application for use on a standard sized computer or a book-sized computer used solely as a reading device)" (p. 243). Secker's (2004) definition reflected a similar perspective as to Reitz's (2004), "The term e-book has a variety of meanings, but generally it applies to published materials, such as reference books or

monographs, that have been converted to digital format for electronic distribution" (p. 17).

Furthermore, a number of definitions referenced the broad components of an e-book: hardware, software, and content. R. Wilson and Landoni (2001) explained, "The term 'electronic book' is used throughout professional literature and popular culture to refer variously to hardware, software and content" (p. 2). As also clearly stated in Borchers's (1999) definition of an e-book, "A portable hardware and software system that can display large quantities of readable textual information to the user, and that lets the user navigate through this information" (p. 1).

Vassiliou and Rowley (2008) indicated how the term e-book has been obscurely used in the literature and yet has been confusing "Even at the level of basic definition of what an e-book is" (p. 355). However, they provide their own definition of an e-book in their paper, *Progressing the Definition of 'E-book',* following their consideration of 37 definitions of e-books released between 2000 and 2008. They found that previous attempts to define e-books in the literature often pertained to four aspects: (a) media, (b) content/file format, (c) device, and (d) delivery. In addition, their analysis revealed that the most common themes for the considered definitions were: (a) digital/electronic forms of e-books, (b) printed book analogy, (c) basic components of e-books including content, and (d) e-book technologies used to view or read e-book content. Vassiliou and Rowley (2008) further indicated that the key terms used, to represent e-books content, among all analyzed definitions were: book, multimedia features, text, file, object, content, material, and document (see Table 1).

Table 1

E-book Content and Its Key Terms

Key Terms	Times Mentioned
Book	18
Multimedia	12
Text	9
File	7
Object	5
Content	5
Material	4
Document	3

Note. From "Progressing the definition of 'e-book'" by M. Vassiliou and J. Rowley, 2008, *Library Hi Tech, 26*(3), p. 355-368. Copyright © 2008 by Emerald Group Publishing Limited all rights reserved. Adapted with permission.

In addition, Vassiliou and Rowley (2008) proposed a worthwhile definition of an e-book that comprised of two-part. First, an e-book is a digital object with textual and/or other content, which arises as a result of integrating the familiar concept of a book with features that can be provided in an electronic environment. Second, e-books typically have in-use features such search and cross reference functions, hypertext links, bookmarks, annotations, highlights, multimedia objects and interactive tools. According to Vassiliou and Rowley (2008), this two-part definition is essential to represent the characteristics of e-books and their dynamic nature modified and guided by the inconstant technologies.

Characteristics of E-books

Unlike printed books, e-books are more flexible, searchable, and accessible. They can be immediately accessed through any standard web browser during anytime of the day. E-books also have the potential to provide their users with a number of purposive features. E-books features include but not limited to: glossary, still images, animated images, videos, audios, key words searching, highlighting, notes adding, word definition, visual searching, and bookmarks. Students often perceive these features as important aspect in an e-book.

Simon (2001) reported in his study on university students who used e-books for a semester in a college-level course, they perceived the ability to look up words, bookmarking, highlighting, and annotation as important features in e-books. In addition, Turner (2005) highlighted the value and importance of e-books features for students (e.g., embedded definitions, highlight text, jot notes, search for specific terms or pages, use a bookmark, and copy material) when the researcher addressed 11 advantages available in e-books. Furthermore, Simon (2001) believed that e-books users would use e-books more when they have familiar features to the ones they expect from the printed medium. The researcher further indicated the production of e-books that include easy-to-use features would lead to widespread acceptance for e-books as supportive tools in the educational field.

E-books could also integrate hyperlinks that link users to other parts of the book, external resources, external multimedia objects (videos, audios, and images), and simulations. In fact, users could easily shift from the e-book they are reading to the web browser available in the e-book reader device, such as Safari in the iPad, in order to

search for additional resources or demonstrative videos and images that would facilitate learning. Thus, it was anticipated that students feel motivated and interested to explore additional information while reading e-books more than when reading printed books. Moreover, the content of an e-book could be conveniently copied, cut, pasted, or printed. In addition to the previously addressed features, e-books provide social features as well. With the improvement of social interaction tools, such as commenting and chatting, meaningful interaction among users could be easily accomplished (Vassiliou & Rowley, 2008).

Furthermore, e-books are mostly more cost effective than their printed copies. The fact that e-books are more affordable than printed books could be an influencing factor for e-book adoption by students. As reported by DeNoyelles, Raible, and Seilhamer (2015). Researchers found that e-books' lower costs was the top factor motivating graduate students to e-books use adoption followed by the ability to access e-books anywhere, to access e-books offline, and to store many e-books on one device. Alhammad and Ku (2016) also reported that graduate students favored the immediate accessibility often e-books offer. The researchers also found that when e-books are more cost effective students tend to feel more motivated to use them. According to Li (2013), because e-books are more cost effective and more convenient to read, they may cannibalize print book sales. Similar to Li (2013), Annand (2008) reported, a number of researchers pointed out that when e-books costs are lower than other print-based learning resources, they become more accepted.

E-books Use and Its Impact on Learning

Information provided in printed textbooks used to be the single element that supports students' learning experiences. When e-books were presented to the market, a number of information technology experts have anticipated that printed books will be alternated by e-books. Today, e-books are slowly superseding the ordinary printed textbooks. The majority of book publishers for higher education produce e-books as alternatives or as additional options to printed textbooks. E-books have supportive readers because of the distinctive visual, social, and audial features provided from which students fulfill their educational needs. In *The Social & Mobile Learning Experiences of Students Using Mobile E-books* study, Kissinger (2013) reported that after using e-books, students expressed feelings of competence, believed their learning was enhanced, exposed high self-efficacy feelings, and valued the use of e-books (Alhammad & Ku, 2016).

Moreover, e-books allow users to have convenient, immediate, and effective access to specific materials where authoritative information in digital libraries has become 24-hours a day and 7-days a week globally accessible (Anuradha & Usha, 2006; Buckley & Tritt, 2011). In addition, researchers indicated that students could learn new knowledge through web-based contexts that are provided in e-books (Lam et al., 2009; Mock, 2004). Compared to printed textbooks, e-books provide numerous advantages to users. E-books reader hardware, such as iPad, Kindle, and Nook, has text software that provides various features, such as glossary, still images, animated images, videos, audios, key words searching, highlighting, notes adding, word definition, visual searching, bookmarks, etc., in order to augment functions executed along with traditional reading

(Tosun, 2014). It was reported by Roschelle et al. (2007), that tablets, such as e-books reader hardware, offer features that support users' communication, instruction, active engagement, and feedback.

Furthermore, e-books reader device offer Internet accessibility where students can access additional information (e.g., other e-books, articles, videos, images) to facilitate their understanding and ultimately obtain successful learning. These advantages could facilitate learning and optimize learning process, which would influence readers to value the use of e-books more than printed books. However, it is important to denote that when students access the Internet for academic purposes, they sometimes feel distracted from studying by displacing time that would have been consumed on academics (O'Brien, 2011).

Furthermore, e-books' visual and audial characteristics are the most distinguishable advantages advocated by information processing theory (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Norman & Bobrow, 1975; Waugh & Norman, 1965). In addition, e-books are paperless, easier to carry, easier for note-taking, faster and easier for purchase, take up less space, and can be printed and published in a variety of file formats (HTML, PDF, LIT, PDB, etc.; Tosun, 2014).

The numerous advantages available in e-books increase the prediction that reading e-books are advantageous learning tools that foster fruitful learning experiences. However, while there are readers who prefer reading e-books to printed books, there are readers who hold negative opinions toward e-books. Woody et al. (2010) conducted a study to investigate what factors influence students' preference to e-books and they found that despite the affective visual and interactive elements in e-books, students do not

prefer reading e-books to printed textbooks. Woody e al. (2010) did not provide further analyses of possible causes of such results but they highlighted the prominence to evaluate e-books as learning tools before substituting the printed textbooks (Alhammad & Ku, 2016).

A number of research studies concluded that students prefer reading printed books to e-books (Annand, 2008; Pledger, 2010; Woody et al., 2010). According to Gregory (2008), students' negative opinions toward e-books were increasing along with the growing number of e-books usage and productivity. In Pledger's (2010) study, 53% of participated students conveyed their preference to read printed books to e-books. According to the responses of 307 participants in a study investigated the rate of e-books reading; 22% of participates indicated they read e-books while 77% of participants indicated they do not (Gürcan, 2005). From my point of view, printed books have their unique characteristics and offer various advantages that make it challenging for some students to shift their reading to e-books. Some of the advantages could be that students perceive:

- The tactile sensibility of printed books in hand and its feedback as important. In other words, the thickness of the pages read versus the thickness of the pages yet to read helps with making a track of one's location in the book better than just seeing a single flat page in an e-book reader device.
- Smelling and feeling the texture of the papers in printed books as pleasing.
- Recalling information read in printed books as easier than in e-books.

- The experience of browsing for books in libraries and bookstores as better than doing it online.

- Browsing through the pages in a print book as easier than browsing through e-books. In fact, it feels very easy to get lost in an e-book.

- Finding written notes in printed books as easier than in e-books.

- Reading printed pages in printed books as less harmful in terms of one's eye strain, compared to e-books electronic pages.

- Reading printed books as more secure. In other words, e-books are easier to loose and e-book reader device must be charged.

Moreover, Tosun (2014) conducted a study on reading printed books or e-books. The findings revealed that a greater part of participants does not read e-books. When answering the question, "Do you read e-books?," more than 79% of 258 university students answered "No." In addition, the most given answers by participants to the question, "What are the reasons you prefer reading printed books to e-books?" were "To protect my eye health," "I like holding the book in my hands," and "It is portable and easier to read" (Tosun, 2014). Similar to Tosun's (2014) findings, Annand (2008) also found that students had difficulties reading e-books due to eye strain incidents which negatively affected their experiences and drove them to prefer print-based materials. The majority of previous studies examined readers' preferences of reading e-books or printed books through quantitative inquiries. However, such studies have not yet considered exploring the root causes of readers' preferences, which indicate the criticality of conducting this research.

Finally, I organized e-book readers' and students' positive and negative attitudes toward the use of e-books affirmed through this review of literatures (see Table 2). Theses findings confirm the intelligibility of exploring students' perception toward the use of e-books for learning. Conducting a qualitative research to explore the topic in depth would assist with addressing the root causes of these negative attitudes and developing appropriate strategies to overcome them.

Learning Theories and E-books

The term, *theory*, refers to generated information that reflects a response to humans' curiosity or a proposed question. According to Harasim (2012), "A theory is an explanation that has been scientifically developed by scientists and scholars using state-of-the-art research methods and information of the day." (p. 4). Brent Wilson (1997) stated when explaining how a theory could influence new concepts and vise versa,

> Theory helps us formulate ideas; it informs the creative process. When we see the world differently, we act to make things different via the relationship between theory and design or between science and technology. Such relationships allow for new technology or conversely . . . a new technology spawns new theory. (p. 23)

The main intention of *learning theories* is to help people to understand how actually humans learn. Contributing to the purpose of this research and to the research questions proposed, this section explored prior literatures related to the topic and discussed the use and impact of e-books on learning through a theoretical lens pertains to the constructivist learning approach: (a) self-testing and e-books, (b) cognitive load theory, (c) information processing theory, (d) social constructivism theory, (e) dual coding theory, (f) self-efficacy theory, and (g) cognitive theory of multimedia learning.

Table 2

Attitudes Toward the Use of E-books Inferred From the Review of Literature

Positive	Negative
1. Convenient, immediate, and effective access	1. Solving problems related to using e-books is challenging
2. Support learning by providing still and moving graphics, video clips, audio collections, and links to activities and websites, etc.	2. Time issues
3. Offer immediate accessibility to external resources (other e-books, articles, videos, images, etc.)	3. Lack of school funding and training hinders educators from using e-books
4. Paperless and take up less space	4. Eye health protection
5. Easier to carry	5. More used to printed books, (like holding the book in hands, and the believe that it is easier to read)
6. Easier for note-taking	6. The strong visuals and interactive elements do not increase the preference to e-books
7. Faster and easier in purchase	7. Internet accessibility could be distracting
8. Mostly more cost-effective than printed books	8. Un-explained negative opinions
9. Can be printed and published in a variety of file formats (HTML, PDF, LIT, PDB, etc.)	9. Existed limitations
10. Offer various features (adding book mark, key words search, highlight, note taking, etc.)	
11. Offer meaningful interaction among educators and students	
12. Parallel different learning styles	
13. Facilitate the understanding of abstract concepts	
14. Promote motivation	

Behaviorist Learning Theory
(Self-testing)

Behaviorist learning theory is interested in human's behavior and conditions that would change or elicit appointed behavior. Ivan Pavlov (1849-1936) was well-known for his theory of classical conditions. He conducted his classical conditions experiment on dog salivation comprising a bell and food. He associated the bell with the food and found that even if the food was not provided, the dog salivated to the sound of the bell. Another physiologist who contributed to the field of behaviorist learning is Burrhus Fredric Skinner (1904-1990). Skinner proposed his voluntary or operant conditioning as an alternative to Pavlov's classical conditioning. Skinner's operant conditioning view considers both positive and negative reinforcements to infuse desired behavior. He conducted his well known laboratory rat experiment and concluded that simply rewarding small acts could condition complex behavior. In his experiment, the rat went through three phases. In the first phase, Skinner placed the rat in a maze with a cheese located close. When the rat made its first turn, it was rewarded with the cheese. In the second phase, the rat was not rewarded until it made the second turn. Finally, in the third phase the rat had to reach the end of the maze in order to get the reward (Harasim, 2012).

Behaviorist learning technology. In the 1920s, teaching machines were first introduced as self-scoring testing method. The teaching machine provides learners with a list of questions and gives them an opportunity to answer. Ultimately, learners are rewarded when conveying the correct respond. In the 1950s, Skinner updated the teaching machine and developed the programmed instruction. His programmed instruction approach was driven by associating self-instruction of the content with self-testing. The programmed instruction fosters answer/behavior that was correct. Through

successive approximations, learners try to obtain the demanded behavior and prevent wrong responses (Harasim, 2012).

In the 1950s, computer-assisted instruction was introduced for teaching and training purposes. Basically, computer-assisted instruction is a drill and practice approach to promote learning. In the drill and practice approach, the control is mostly with the designer of the program (Harasim, 2012). According to Kamarulzaman and Shaari (2015), drill and practice learning technique is well-associated with the behaviorist learning theory where learners are only allowed to drill on items developed by content experts. The most prominent advantages of the drill and practice and the self-testing approaches are offering learners with opportunities to absorb provided materials through repetitive activities along with prompt feedback. These are beneficial approaches for learners and content developers as developers can focus learners' attention on the most important concepts through attentively developed items (Kamarulzaman & Shaari, 2015).

Self-testing and e-books. The main advantage of the self-testing approach is offering learners opportunities to obtain meaningful learning by testing their own comprehension of provided materials along with immediate feedback. Content developers (such as book authors) have also perceived self-testing approach as an advantage method of teaching. Self-testing offer content developers a chance to focus audience's attention to the most important concepts through carefully developed content (Kamarulzaman & Shaari, 2015). Unlike printed textbooks, some e-books offer interactive self-testing opportunities by providing multiple-choice questions at the end of each chapter along with immediate feedback that explains what the correct answer is. The multiple-choice questions often cover the most important concepts in a chapter. Therefore, when learners

read e-books that offer easy to use self-tests with immediate feedback, they get an opportunity to test their comprehension and understanding of the most important concepts in the content. In fact, Hecking, Ziebarth, and Hoppe's (2014) considered online self-tests that could be automatically evaluated as a strategy to motivate students for participating in learning. Hence, it was predicted that the ease of such a learning opportunity could motivate students to check their understanding, and yet increase their preference to e-books more than printed books.

The results from their study, Griffin, MacKewn, Moser, and VanVuren (2012) reported that self-testing, as one of the learning and studying strategies, was correlated positively (with statistical significance) with students' GPA. In addition, Dunlosky (2013) listed self-testing on to be learned materials as one of the effective learning strategies that would boost learning. Graduate students' perceptions on the use and impact of self-testing approach provided in e-books on their learning were explored in this research.

Cognitive Load Theory

By the early of the 1920s, existing limitations in the behaviorism learning theory started to be identified. The major limitation was that behaviorist scientists could not explain the most of social behaviors activities. They did not consider what they could not observe or measure. Thus, behaviorists' interest was only in measuring what they could observe. However, the power of the mind, where the influence of extrinsic stimulus does not take a part in decision-making, was distinguished by psychologists. Behaviorism theory considers the mind as a black box. On the other hand, cognitive theory is interested in what is inside the black box and how the mind constructs sense of the world.

The development of cognitivist learning theory considered as a reaction and an extension to behaviorism learning theory. Cognitivism was interested in understanding the processes of the mind and what happens between the stimulus (input) and the response (output; Harasim, 2012). Lohr (2007) defined cognitive load theory as, "A theory that describes mental energy and its reaction to various loads, including intrinsic, extrinsic, and germane load" (p. 46). In addition, according to Harasim (2012),

> In cognitivesm, the mind is primarily represented by computational metaphors such as a cognitive information processing unit or mind as computer. The pedagogies and technologies associated with cognitivesm emphasize the nature of cognition in order to be able to transfer or transmit the message accurately. (p.77)

Cognitive load theorists believe that considering human cognitive system's architecture could reinforce the occurrence of effective learning. Specifically, in the information processing theory (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Norman & Bobrow, 1975; Waugh & Norman, 1965), the working memory is often limited to a certain amount of elements and it may lose important elements of perceived knowledge. Paying attention to the mental efforts caused by received elements and how to facilitate optimal learner load was the focus of Sweller's (1988) cognitive load theory. Since working memory is limited, cognitive load theory explained that cognitive overload might occur when learners are exposed to complex materials where they feel overwhelmed. The cognitive overload diminishes learners' performance and ability to successfully complete a task or fully comprehend the information (Sweller, 1988).

Cognitive load depicts the mental energy consumed when human's mind processes the information. The main goal of cognitive load theory is to facilitate learning and to recognize the value of delivering information that fits as much as possible the

learner's way of thinking (schema) or cognitive structure. The term, schema, refers to knowledge representation in memory. Cognitive load theory value information developed in a way to diminish working memory load, save perceived elements of information in long-term memory, and foster the ability to retrieve it (Lohr, 2007).

Types of cognitive load. Cognitivists describe three types of cognitive loads: (a) intrinsic load, (b) extraneous load, and (c) germane load.

Intrinsic load. Intrinsic load represents the nature of the content and its level of complexity. R. C. Clark, Nguyen, and Swelller (2006) define intrinsic cognitive load as, "The mental work imposed by the complexity of the content" (p. 9). In this case, complexity could be identified in element interactivity. According to Paas, Tuovinen, Tabbers, and Van Gerven (2003), intrinsic load could be described as learners' extent to recognize content of information that interacts with other content of information. Lohr (2007) explained that high content interactivity could be identified in the content that could be understood only when considering and understanding many different factors. Low content interactivity could be identified in content that necessitates an understanding of fewer elements (Lohr, 2007).

Extraneous load. Lewis (2008) describes extraneous load as the load that is not essential within the content and should be eliminated. Lohr (2007) explained that extraneous load represents obstacles existing during a learning process due to an increase in the load placed on memory. Paas et al. (2003), consider the extraneous load as a result of poorly developed information.

Germane load. Germane cognitive load is related to the developments of constructing schemas (Paas et al., 2003). It represented the remaining free capacity in

working memory (Lewis, 2008). According to Lohr (2007), germane load could be augmented by developing information in such a way to facilitate optimal learner load "For example . . . providing analogies can help people understand new information more quickly" (p. 52).

Effective learning could not be accomplished if learners' cognitive load is too high. High cognitive load exist in information that is complex, irrelevant, or excessive. Human's mind is not able to absorb complex content where a learner ended up receiving too little information and, mostly, will not be able to retrieve. The memory holds the information only for seconds and then either passes it and saves it in long-term memory or loses it (Lohr, 2007). When intrinsic cognitive load is high, extraneous cognitive load becomes a concern due to the fact that intrinsic and extraneous loads are additive. However, when intrinsic load is low, the learner would have less difficulty with content understanding. Depending on the content, there are some strategies should be considered and applied when developing information in order to create information as meaningful as possible. For example, giving a chance to get feedback or providing demonstrative media (videos, images, audios, etc.) would reinforce individuals' optimal load (Fleming & Levie, 1993).

Cognitive load theory and e-books. Cognitive load theory proposes that when learners receive complex materials, they feel overwhelmed and then cognitive overload occurs. Cognitive overload reduces learners' ability to fully comprehend and processes the information. According to cognitive load theory, considering learner's way of thinking (schema) and cognitive structure are essential concepts in any process that

includes a development of information in order to create information that is meaningful as possible.

Since working memory is limited, information should be developed in such a way to increase the germane cognitive load. Germane load represents free capacity in working memory (Lewis, 2008). Helping learners to easily understand new information would increase germane load. For example, combining verbal and pictorial information would increase the chance of retrieval. Considering the fact that humans have two separate memory systems, visual information traveling from sensory memory to a visual processor, and verbal information traveling from sensory memory to a verbal processor, would optimize learners' cognitive load. Fleming and Levie (1993) stated a strategy that could be considered to develop meaningful information. They believed providing demonstrative media would influence learners' optimal load. E-books often incorporate demonstrative videos, still images, animated images, audios, and more. The use of the demonstrative media provided in e-books parallels learners' different ways of thinking and helps them understand complex materials. Another strategy Fleming and Levie (1993) highlighted is providing feedback to learners. Some e-books provide multiple-choice questions at the end of each chapter along with immediate feedback that explains what the correct answers are. The multiple-choice questions often cover the most important concepts in a chapter. Thus, when learners read e-books that offer multiple-choice questions, they get a chance to test their comprehension and understanding of the content.

Sweller's (2010) modality effect explained how using both modes (auditory and visual) processors instead of one can expand the capacity of working memory. In

addition, Hwang et al. (2013) considered efficient access to information as an opportunity to optimize learning and reduce intrinsic cognitive load. From my point of view, since e-books provide both auditory and visual information and has efficient accessibility to additional materials, it is equitable to say reading e-books can reduce cognitive overload and expand the capacity of working memory. Graduate students' perceptions toward the use of e-books' demonstrative media (videos, still images, animated images, audios, etc.), e-books' feedback (multiple-choice questions tests), and e-books' efficient accessibility and their impact on students' cognitive load and learning were explored in this research.

Information Processing Theory

Information processing theory could be defined as "A theoretical perspective that focuses on the specific ways in which individuals mentally think about and 'process' the information they receive" (Lohr, 2007, p. 46). Information processing theory focuses on basic memory structure that explains how information travels through short-term memory including sensory and working memory, and long-term memory (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Norman & Bobrow, 1975; Waugh & Norman, 1965). Figure 1 is a demonstrative model developed by Lohr (2007) to explain the process of information processing theory.

The term Short-term memory is used to characterize sensory memory and working memory. Sensory memory is a memory that conserves received information as it is for a short period of time (approximately less than 1 second for a visual input and 2 or 3 seconds for auditory input). Working memory processes confined amount of information and stores it for about 5 to 20 seconds. Finally, long-term memory is the

memory that saves information, knowledge, and skills for a long period of time (Lohr,

2007).
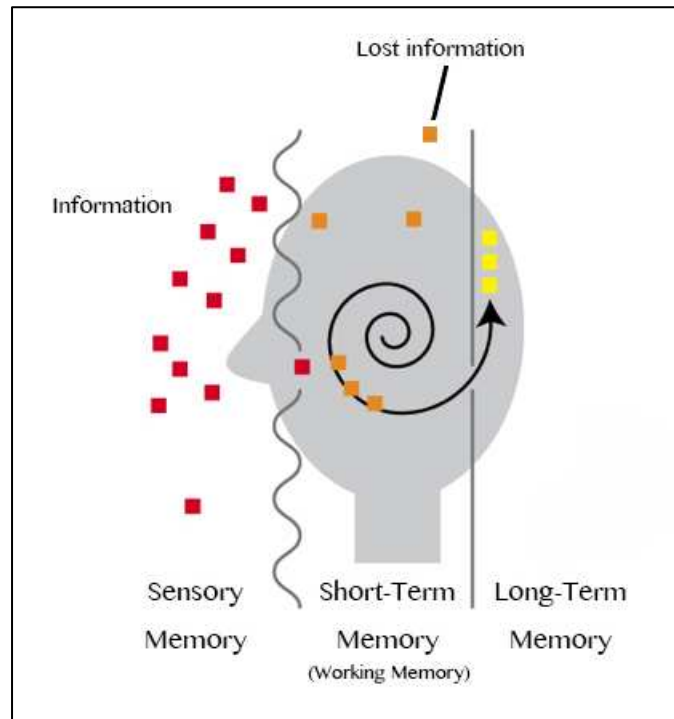
Figure 1. Information processing model. Adapted from *Creating Visuals for Learning and Performance: Lessons in Visual Literacy,* by L. Lohr, 2007, Cleveland, OH: Prentice-Hall, p. 54. Copyright © 2008, 2003, by Pearson Education, Inc. Adapted with permission.

Effective learning is the result of a successful transfer of important information

from a memory to the other. As shown in Figure 1, some of the information is considered

lost when it could not be moved through sensory, working, and long-term memory.

Information processing theory starts with sensory memory, which is the process of

selecting specific information and filtering out unnecessary information. Unfortunately, a

human's mind does not filter out a lot of unnecessary information. A part of short-term

memory is the working memory where information gets organized in such a way to be

successfully moved to the long-term memory. Working memory has a limited capacity where information cannot be saved for a long period of time. According to Miller (1956), working memory could only hold five to nine units of information. Cowan's (2001) researches concluded that working memory could only hold four units of information. The term, *unit*, refers to chunked information that represents meaning (Lohr, 2007).

Finally, the long-term memory is the last phase of information processing theory. Once information successfully transferred to long-term memory, it will be saved forever because of the fact that long-term memory is indefinite and able to save an unlimited amount of information for a long period of time. The long-term memory is where information is stored and recalled when individuals need this information. Recalling information depends on how it had been stored. Storing information depends on how it had been received (Lohr, 2007).

Information processing theory and e-books. As stated previously, information processing theory focuses on basic memory structure that explains how information travels through short-term memory including sensory and working memory, and long-term memory. The most important part in information processing theory, in terms of the use of provided multimedia in e-books, is working memory. The use of visuals, images, and videos embedded in a material increase learners' attention, influences their engagement, and foster their ability to successfully processes the information. Thus, learners have a greater chance to successfully transform the information to long-term memory and be able to retrieve it in the future (Fleck, Beckman, Sterns, & Hussey, 2014).

When reading an e-book that has text, still and moving graphics, video clips, and audio collections, learners aim to select, organize, integrate, and guide information to move from sensory memory to working memory and then to long-term memory. In addition, using technology devices to read e-books give readers a greater opportunity to search for graphics and visuals related to what they read and enhance their ability to facilitate information (Alhammad & Ku, 2016). According to Fleck et al. (2014), "Following the information processing approach, learning and memory is enhanced when the student is provided with multiple mediums for data input, thus creating more meaningful connections" (p. 32).

Hence, it is equitable to say using the web search available in most of e-books devices to search for (additional resources, images, videos, etc.) that better explain a concept can foster a successful processing of information. Furthermore, meaningful learning that conditions information passing across sensory memory and working memory and saves it in the long-term memory could be accomplished by using e-books that include (text, still images, animated images, videos, audios, etc.; Alhammad & Ku, 2016). In this research, the perceptions of graduate students on e-books use and impact on their learning, in terms of facilitating and processing the information, were explored.

Constructivism Theory

Constructivism learning theory could be defined as people's construction of new knowledge and understanding based on their previous knowledge and experiences (Piaget, 1973). The primary focus of the constructivism learning theory is on the role of the learner in making meaning of their experiences and constructing understanding. Constructivism refers to how people learn and what the nature of knowledge is. Jean

Piaget, who devoted his life to classify the stages of human development, claims that humans learn through the construction of one logical structure after another from infancy to adulthood. Constructivism, in his view, is more about how knowledge is internalized and how people learn. As Harasim (2012) stated, "Humans, according to Piaget, internalize knowledge through experience and make sense of these experiences through adaptation involving processes of: assimilation, accommodation and equilibration/disequilibration. It is through these three processes that we learn, outgrow some ideas and adopt new ones" (p. 63). These three concepts expounded Piaget's both theories of intellectual development and constructivism (Harasim, 2012).

Social constructivism. Constructivism learning theory is correlated with social interactions as well. Social constructivism emphasizes on the value of constructing understanding of knowledge and experiences, which may be influenced by social networks (Vygotsky, 1978). Vygotsky highlighted the value of social interaction when developing meaning or constructing understanding. According to Vygotsky, children's new concepts are developed through interacting with others and obtaining feedback on own hypotheses or a task they are trying to complete (Harasim, 2012). Several characteristics that identify a constructivism learning environment were addressed by Harasim (2012) as follows:

1. Provide multiple presentations of reality, to avoid oversimplification.
2. Represent the natural complexity of the real-world.
3. Emphasize knowledge construction instead of knowledge reproduction.
4. Emphasize authentic tasks in a meaningful context rather than abstract instruction out of context.
5. Provide learning environments such as real-world settings or case-based learning instead of predetermined sequences of instruction.
6. Foster thoughtful reflection on experiences.
7. Enable context-and content-dependent knowledge construction.

8 .   Support collaborative construction of knowledge through social negotiation, not competition among learners of recognition. (p. 73)

Constructivism theory and e-books. As stated previously, constructivism learning theory primarily focuses on the role of the learner in developing meaning for their experiences and constructing their own understanding. When reading an e-book, the readers often try to develop their own understanding of the content and the experience they had while reading it. E-books have flexible accessibility where students can access a great number of them through a reader device that usually easier to carry around, compared to printed books' heavy weight. Such a fact could motivate students to obtain more information and knowledge at their convenient time location. Thus, students are offered opportunities to construct their own meanings and understanding of their own experiences of reading e-books and of the information available in them. In their study, Ebied and Rahman (2015) reported that e-books easy accessibility where university students can upload e-books and read them during anytime and in anywhere has its role in influencing students to learn more and then obtain higher academic achievements. Annand (2008) also found in his study that university students valued the flexibility that e-books' accessibly offer and perceived e-books as extremely portable especially for students who frequently travel with laptops (Alhammad & Ku, 2016).

Social constructivism is a part of constructivism learning theory where the focus is on the influence of social networks on the constructed understanding of knowledge and experiences (Vygotsky, 1978). Roschelle et al. (2007) indicated that human communication, instruction, and active engagement could be fostered by using features embedded in tablets and e-books reader devices. According to Alhammad and Ku (2016), "Unlike printed books, e-books can be shared virtually with multiple users who desire to

exchange books and ideas. The convenience of sharing e-books immediately through the Internet motivates students to construct and gain knowledge whenever and wherever they can" (p. 3).

In their study, Ongoz and Baki (2010) concluded that students mostly like to purchase e-books over printed books because they are easier to share. In addition, some e-books offer instant social interaction opportunities for readers while they are reading the material. Khanna (2015) believed that e-books influence students to go beyond highlighting and adding notes. They can share e-books with their peers and educators. And educators can address students' queries through e-books. Other e-books, foster users to discuss the material in an associated forum or discussion board (e.g., Macmillan LaunchPad). Through these forums, e-books readers could help one another to construct knowledge by discussing ideas and asking questions. Such opportunities could be considered as additional resources for learning facilitation, especially for readers who are not feeling comfortable asking questions in person (Alhammad & Ku, 2016; Glazier, 2016).

Thus, along with social constructivism point of view, e-books offer a greater opportunity to easily share and exchange books, ideas, thoughts, comments, questions, and so forth through the Internet. In such a case, social interaction occurs when developing meaning of the content provided in e-books and of the experience of reading e-books while interacting with others (Alhammad & Ku, 2016). In this research, graduate students' perceptions on the impact of e-books flexible accessibility and online social interaction on their learning were explored.

Dual Coding Theory

Dual coding theory (Paivio, 1990) proposes that there are two separate memory systems for different categories of information (verbal and visual) along with the three memories indicated by information processing theory (sensory, short-term, and long-term memories). Considering dual coding theory could contribute with overcoming the existing limitations in the short-term memory. Allan Paivio (1990) defined verbal memory as information associated with language systems (auditory and speech). He further defines visual memory as information associated with pictures and non-verbal thoughts (imagination). Moreover, when magnifying Paivio's dual coding theory and its contribution to the assumption that humans have separate information processing channels, Mayer (2001) stated, "Dual-code theory presents the most coherent theoretical and empirical evidence for this idea" (p. 6). Paivio (1986) stated when explaining his theory of dual coding:

> Human cognition is unique in that it has become specialized for dealing simultaneously with language and with nonverbal objects and events. Moreover, the language system is peculiar in that it deals directly with linguistic input and output (in the form of speech or writing) while at the same time serving a symbolic function with respect to nonverbal objects, events, and behaviors. Any representational theory must accommodate this dual functionality. (p. 53)

Dual coding theory proposes that visual and verbal memories are different in terms of processing the information where each type of information could activate one another. In his book *Mind and Its Evolution,* Paivio (2007) provided the structural model of dual coding theory shown in Figure 2. This model demonstrates the representational units and their referential and associative interconnection (Paivio, 2007). The three types of processing Paivio (2007) identified in his dual Coding theory and modeled in Figure 2 were: (a) representational, the activation of verbal and non-verbal symbolic systems that

cut across sensorimotor; (b) referential, the activation of the verbal system by the nonverbal system, or the activation of the nonverbal system by the verbal system; and (c) associative processing, the activation of representations within the same verbal or nonverbal system. According to J. M. Clark and Paivio (2004), representational, referential, and associative levels of processing could be explained as follows:

1. "Representational processing involves the activation of internal verbal and imaginal representations by external stimuli, although similar processes may contribute to the end stages of internal activation via associative and referential processes" (p. 372). For example, if an individual reads the word *cat*, it triggers a verbal symbol *cat* in the brain.

2. "Referential processes involve activation of representations of the other type (e.g., verbal-imaginal and imaginal-verbal)" (p. 372). For example, when reading the word, *cat*,other associated subjects will be triggered (e.g., sounds of a cats and images of cats). In like manner when viewing a picture of a *cat*, other associated subjects will be triggered (e.g., the written word *cat* and sounds of a cats).

3. "Associative processes involve the activation of representations of the same type (e.g., verbal-verbal associations and imaginal-imaginal associations)" (p. 373). For example, the word, *cat*, triggers other associated words (e.g., pets, tomcats, animals, etc.).

Allan Paivio (2007)proposed that although the verbal (i.e., text, speech, audio) and non-verbal (i.e., visual, video, picture) information are processed through two separate systems, they are somewhat connected in a way they can activate one another. For instance, when an individual reads or hears the phrase, 'the last meal you had,' the brain would instantly retrieve and image of the last meal that individual had. Retrieving

information from memory is not limited to the information processed through verbal

system. Yet, non-verbal information, such as visual stimulus, could foster the ability of

recalling information from memory as well.
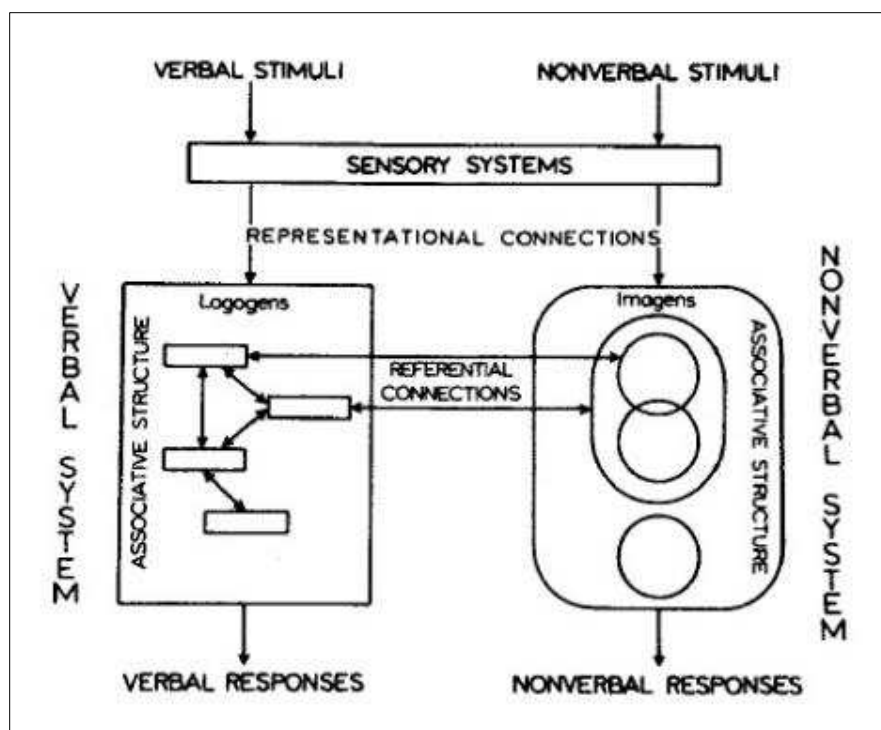
Figure 2. Structural model of dual coding theory. Adapted from *Mind and Its Evolution: A Dual Coding Theoretical Approach*, by A. Paivio, 2007, Mahwah, N.J.: L. Erlbaum Associates, p. 34. Copyright © 2007 by Lawrence Erlbaum Associates, Inc. Adapted with permission.

As stated previously, visual information travels from sensory memory to a visual

processor and verbal information travels from sensory memory to a verbal processor.

Thus, the advantages of these two separate memory systems could be considered in order

to optimize cognitive load. When two memories (verbal and non-verbal), instead of one,

are involved, the probability of obtaining meaningful learning is much higher. According

to Paivio (1990), learners could have greater opportunities to understand content that

combined verbal and visual information. In addition, learners are more able to retrieve verbal-visual content due to the fat that verbal and visual systems are connected.

Dual coding theory and e-books. Paivio's dual coding theory proposed that when both verbal and pictorial representations are processed in memory, the chances of understanding the content and retrieval are higher because of the fact that more than one way of representations is provided on the same information (Fleck et al., 2014). The existing limitations in the short-term memory could be managed by considering dual coding hypothesis. In addition, when two memories (verbal and non-verbal), instead of one, are engaged, meaningful learning could successfully occur. According to Rupley et al. (2015), dual coding theory and multimedia principle ". . . form the foundation for proposing a multi-coding theory centered around Multi-Touch Tablets and the newest generation of e-textbooks" (p. 1). In line with dual coding hypothesis, in their study, Schwamborn, Mayer, Tillmann, Leopold, and Leutner (2010) reported that ninth-grade students who only read a text explaining a scientific process marked lower scores on comprehension measurement than students who offered a drawing of the same process did.

Furthermore, some e-books comprise videos that often incorporate images/text and audios. As stated previously, by involving two encoding systems (vocal and visual/text), learners would have greater opportunities to facilitate and retrieve the content when they need it. This research explored the perceptions of graduate students on the use and impact of both vocal and visual information (videos, audios, and animated images) embedded in e-books on their learning.

Self-Efficacy Theory

Self-efficacy is a subset of social cognitive theory and explains how people take actions based on their feelings and beliefs of their abilities (Alhammad & Ku, 2016). According to Bandura (1997), "Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). R. M. Ryan and Deci (2009) stated when defining self-efficacy,

> Of all the beliefs that people hold about themselves and that affect their day-to-day functioning, and standing at the core of social cognitive theory, are self-efficacy beliefs, which can be defined as the judgments that individuals hold about their capabilities to learn or to perform courses of action at designated levels. In essence, self-efficacy beliefs are the self-perceptions that individuals hold about their capabilities. (p. 791)

Self-efficacy beliefs on reinforcing individuals' confidence on attaining anticipated outcomes. Therefore, confident individuals expect to successfully obtain desired outcomes and vise versa. For example, if one is confident in his own academic skills, he should expect high scores on exams; and if one is confident in his own social skills, he should expect successful social interaction. On the other hand, one's doubt on own academic skills should expect low scores on exams; and one's doubt on own social skills should expect poor social interaction. R. M. Ryan and Deci (2009) believed that people develop their self-efficacy beliefs through perceived information mainly from four sources: (a) mastery experience, (b) vicarious experience, (c) social persuasions, and (d) physiological reactions. Mastery experience is the most paramount resource of self-efficacy beliefs as people either successfully perform on a task where they believe on their capabilities, or poorly perform on a task where they doubt on their capabilities. Previous knowledge and experiences are also associated with self-efficacy beliefs. When an individual has successfully performed a task before, it is anticipated that he/she would

have high self-efficacy feelings on doing it again. Moreover, self-efficacy beliefs influence individuals' interest to be persistent when facing obstacles and flexible when fronting adverse situations. Individuals with high competence belief perceive complicated tasks as challenges rather than pressures that should be avoided. Furthermore, individuals with low competence belief perceive everything more complicated than they actually are (R. M. Ryan & Deci, 2009).

Self-efficacy theory and e-books. Self-efficacy focuses on people's actions and perceptions that are often based on their feelings and beliefs about their own capabilities. Human's feelings and beliefs about their own capabilities are influenced by several factors, such as mastery experience, vicarious experience, social persuasions, and physiological reactions (R. M. Ryan & Deci, 2009). Mastery experience is associated with one's previous knowledge and experiences. For example, when an individual has successfully used an e-book reader before, it is anticipated that he/she would have high self-efficacy feelings and confidence toward reading e-books. However, when an individual uses an e-book reader and faces difficulty with the technology, it is anticipated that he/she would have low self-efficacy feelings toward reading e-books. Self-efficacy beliefs on influencing individuals' interest to be more persistent when facing obstacles and more flexible when fronting adverse situations (R. M. Ryan & Deci, 2009).

Self-efficacy research considering learning and use of computers has revealed that students with high degrees of self-efficacy in relation to the use of e-books could obtain better outcomes and expose a higher degree of satisfaction (Campbell & Hackett, 1986; Compeau, & Higgins, 1995; Waycott, Jones, & Scanlon, 2005; Wood, & Locke, 1987). Kissinger (2013) indicated that students expressed feelings of high self-efficacy when

they expressed their beliefs regarding the use of mobile e-book technologies. Students'

prior knowledge and experiences with the usage of technology could foster them to feel

more comfortable and confident when using e-book readers' devices (Kissinger, 2013).

Yet, Woody et al. (2010) concluded that students' previous experiences with e-books do

not increase preference for them (Alhammad & Ku, 2016). In this research, the impact of

graduate students' prior technological experiences, knowledge, and confidence on their

perceptions toward e-books were explored.

Cognitive Theory of Multimedia
Learning

Richard Mayer (2001) defined multimedia learning as the alternative to purely

verbal presentations where individuals learn from both words and pictures instead of

learning from the words alone. He developed multimedia design principles that

emphasize on the value of combining words and visuals in order to extend memory and

create meaningful learning. Mayer's multimedia design principles are: coherence,

signaling, redundancy, spatial contiguity, temporal contiguity, segmenting, pre-training,

modality, multimedia, personalization, voice, and image. The proposed multimedia

design principles reinforce visual and verbal memories to meaningfully interact together

in order to extend memory and enhance learning. Mayer (2001) defined the term

multimedia as,

> The presentation of material using both words and pictures. By words, I mean the
> material is presented in *verbal form*, such as using printed or spoken text. By
> pictures, I mean that the material is presented in pictorial form, such as using
> static graphics, including illustrations, graphics, photos, or maps, or using
> dynamic graphics, including animation or video. (p. 2)

In his book *Multimedia Learning*, Mayer (2001) focused on the design of multimedia instructional massage; presentation includes words and pictures that indented to promote learning. He believed that multimedia learning is based on the concept that instructional massage should be designed based on our knowledge of how human's minds actually work. Mayer (2001) further explained:

> Let's assume that humans have two information processing systems--one for verbal material and one for visual material. Let's also acknowledge that the major format for presenting instructional martial is verbal. The rationale for multimedia presentations--that is, presenting material in words and pictures--is that it takes advantage of the full capacity of humans for processing information. When we present material only in the verbal mode, we are ignoring the potential contribution of our capacity to also process material in the visual mode. (p. 4)

Mayer's (2001) cognitive theory of multimedia suggested that visuals and words could improve learning when they are combined in such a way to facilitate the cognitive processes of selection, organization, and integration. These three processes are aligned with the structure of information processing theory: short-term memory (selection), working memory (organization), and long-term memory (integration; Alhammad & Ku, 2016). Mayer's theory also aligned with Paivio's (1986) dual coding theory, which proposed that humans have separate information processing channels (verbal and pictorial). Mayer provided the cognitive model of multimedia learning shown in Figure 3 in order to illustrate human information processing system. In the left side of the figure, there are two multimedia presentations that represent what individuals receive from the outside world (words and pictures).
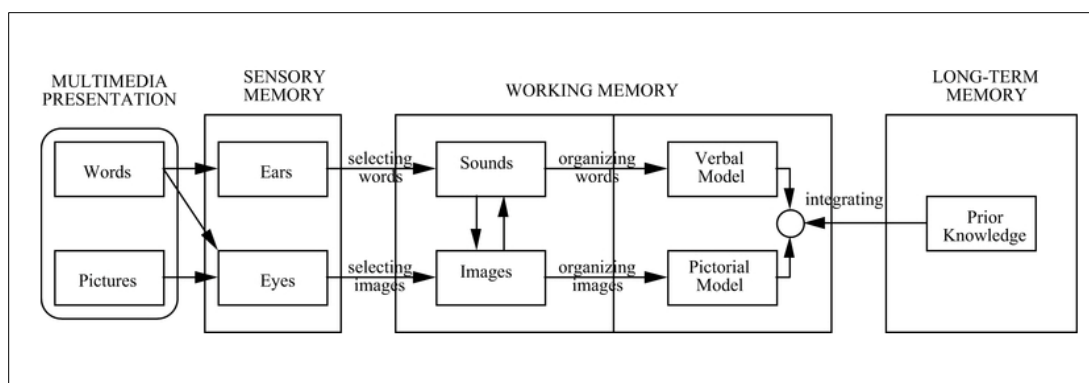
Figure 3. Cognitive theory of multimedia learning. Adapted from *Multimedia Learning*, by R. E. Mayer, 2001, New York, NY: Cambridge University Press, p. 34. Copyright © 2001 by Cambridge University Press. Adapted with permission.

The big frame boxes symbolize memory stores: sensory memory, working memory, and long-term memory. Words and pictures get inside sensory memory through the eyes and ears located inside sensory memory box. Pictures and printed text are usually held in the sensory memory as exact visual images for a very short period of time. The auditory sensory memory holds spoken words and sounds as exact auditory images for a very short period of time as well. The arrow from words to ears represents processing spoken text through the ears; the arrow from words to eyes represents processing printed text through the eyes; and the arrow from pictures to eyes represents processing pictures through the eyes (Mayer, 2001).

The major focus of multimedia learning is in the working memory. In the working memory box where knowledge is tentatively held and processed in active consciousness, there are two sides (left and right). The left side of the working memory box is where the raw materials (visual images of pictures and sound images of spoken words) are processed and transferred into working memory. The right side of the working memory

box is where the knowledge (visual and verbal models and links between them) is constructed in working memory. The arrows between sounds box and images box represent the processes of transforming spoken words or sounds into images and vice versa. The arrow from sounds box to images box symbolizes the mental transformation of sounds into visual images. For example, when you hear the word *dog*, your brain triggers a mental image of a *dog*. The arrow from images box to sounds box symbolizes the mental transformation of visual image into a sound image. For example, when you see a picture of a *dog*, you may mentally hear the word *dog*. The arrows (selecting images, selecting words, organizing images, organizing words, and integrating) represent the main cognitive processing essential for multimedia learning (Mayer, 2001).

Finally, in the right side of the figure there is the long-term memory box, where learners store knowledge. In contrast to working memory, long-term memory can hold a great amount of information for a long period of time. However, it is essential to bring information from long-term memory to working memory by recalling it and actively thinking about it (as demonstrated in the arrow from long-term memory to working memory). By considering the dual-channel assumptions, the sensory memory and working memory were split into two channels. The dual-channel assumption proposed that humans have two separate information processing channels to process: (a) visual information, and (b) audio information. As shown in Figure 3, the boxes across the top are for auditory sounds and verbal representations, and the ones across the bottom are for visual images and pictorial representations (Mayer, 2001).

The view of multimedia design: Learner-centered approaches. According to Mayer (2001), multimedia design has two views: technology-centered and learner-

centered approaches. The central focus of technology-centered approaches is on the functional capabilities of multimedia and how these capabilities can be used to design multimedia presentations. On the other hand, the learner-centered approaches centralize on how a human mind actually works and how multimedia can promote human cognition and learning. It mostly focuses on the relevance between design features and human information processing system. Mayer (2001) stated when highlighting the value of considering human mind functionality, "The premise underlying the learner-centered approach is that multimedia designs that are consistent with the way the human mind works are more effective in fostering learning than those that are not" (p. 10). Moreover, Norman (1993) stated when promoting the criticality of shifting the focus from machine-centered to person-centered, "Today we serve technology. We need to reverse the machine-centered point of view and turn it into person-centered point of view: Technology should serve us" (p. xi). Norman (1993) considered the tools developed to foster human mind (i.e., mental tools: language, and physical tools: paper and pencil) as cognitive artifacts, "Anything invented by humans for the purpose of improving thought or action counts as an artifact" (p. 5). Norman (1993) explained his point of view regarding learner-centered approach and technology design as technology "should complement human abilities, aid those activities for which we are poorly suited, and enhance and help develop those for which we are ideally suite" (p. 12). Unfortunately, mostly people focused their attention on the machine-centered point of view and on the design of the machine, where they ended up with a technology that is confusing (Mayer, 2001).

Goals of multimedia learning. Remembering and understanding are the two major goals of learning. Remembering is assessed by retention test and it could be defined as being able to create or identify the provided materials. Mayer (2001) defined retention as, "Being able to remember what was presented" (p. 26). Understanding is the ability to use the provided materials and construct a mental representation. Understanding could be assessed by transferring and requiring learners to apply what they have learned in new situations. Mayer (2001) proposed three different learning outcomes demonstrated in Table 3: no learning, rote learning, and meaningful learning.

Table 3

Three Kinds of Multimedia Learning Outcomes

Learning Outcomes	Cognitive Description	Test Performance	
		Retention	Transfer
No learning	No knowledge	Poor	Poor
Rote learning	Fragment knowledge	Good	Poor
Meaningful learning	Integrated knowledge	Good	Good

Note. Adapted from *Multimedia Learning*, by R. E. Mayer, 2001, New York, NY: Cambridge University Press, p. 34. Copyright © 2001 by Cambridge University Press. Adapted with permission.

When learners receive materials that impede the ability of focusing on the content, no learning occurs. Thus, learners would do poorly in test performance of both retention and transfer. Rote learning occurs when learners receive materials that impede the ability of focusing on the content but they try hard to learn. In this case, learners would perform good in the retention test, but they would perform poorly in the transfer

test. Finally, meaningful learning was what Richard Mayer focused on; integrating words and pictures to promote meaningful learning outcomes. Meaningful learning occurs when learners receive materials through multimedia presentations and being able to perform good in test performance of both retention and transfer. However, according to previous research on learning, meaningful learning does not rely on learners' behavioral activities through learning, yet it relies on learners' cognitive activity through learning (Mayer, 2001).

Animation. Mayer (2001) discussed the positive impact of animation on learning. Animation includes simple moving drawings that represent important elements to explain a process, action, event, etc. Narrated animation includes simple line drawings of few important elements and a narration of brief important information. Mayer further discussed the impact of narrated animation from three different perspectives: narration only, narrated animation, and narrated animation with redundant text. Information-delivery hypothesis proposes that combining animation, narration, and on screen text is more affected than presenting narration alone or combining animation with narration only. Narration only provides one delivery path for learners (spoken words) where they may feel incapable of processing the information. Narrated animation provides two delivery paths for learners (spoken words, and pictures) where more information can be passed to learners. Thus, the spoken words and pictures are processed through two paths (eyes and ears) where each one fosters the other and if there is a blockage in on path information can get through the other. Finally, narrated animation with redundant text provides three delivery paths for learners (spoken words, pictures, and printed words) where learners are able to receive information through either one or two paths. Therefore,

even if some of the paths are blocked, the information still can be processed through. For example, individuals who are not auditory learners, they still can process verbal information presented in printed words. Furthermore, individuals who are not visual learners still can process verbal information presented in spoken words (Mayer, 2001).

Cognitive theory of multimedia learning and e-books. Mayer's multimedia learning hypothesis states that the use of media could enhance learning when information presented in a way that is aligned with how human mind actually functions. As stated previously, people often focus their attention on the machine-centered point of view and the design of the machine, where they ended up with a technology that is confusing. Considering human mind functionality is essential when developing information that aims for meaningful learning. The multimedia learning design principles foster visual and verbal memories to meaningfully interact together to extend memory and enhance learning (Alhammad & Ku, 2016; Rupley et al., 2015).

According to Mayer (2001), "In the strictest interpretation of the delivery media view, a textbook does not constitute multimedia because the only presentation device is ink printed on a paper" (p. 5). On the other hand, e-books offer readers a multiple representations of information (vocal, visual, and textual) which is aligned with Mayer's multimedia learning and could foster one's construction of knowledge. When reading an e-book that has text, still and moving graphics, video clips, and audio collections, learners aim to select, organize, integrate, and guide information to move from sensory memory to working memory and then to long-term memory. Furthermore, using technology devices to read e-books gives readers greater opportunities to search for additional graphics and visuals related to what they read. In their study, Ebied and

Rahman (2015) examined the effect of using interactive e-books on academic achievement of university students, and the results indicated that learning using e-books reinforce students' superiority compared to those who were learning using printed books. Researchers further explained, the various advantages provided in e-books, such as the multimedia materials, fostered students' motivation to learn and thus increasing academic achievement. Azmi and Moradny (2010) also concluded that images provided in e-books (static and animated) have a positive constructivist effect on the achievement and the learning efficiency among graduate students (Alhammad & Ku, 2016).

In addition, Fleck et al. (2014), reported that 80% of college students participants find the use of multimedia helpful for academic purposes. When they were asked if the use of videos were beneficial for academic purposes, 80.7% of the students said they were. According to Mayer (2003), "When the media consists of spoken text and animation, there is a strong multimedia effect" (p. 132). In a study on how brakes work that involved two groups of students: (words-only group) received only a narration, (words-and-pictures group) received a narration along with animation, the words-and-picture group reported 97% more creative solutions than the words-only group (Mayer, 2003). In this research, the perceptions of graduate students on the use and impact of vocal, visual, and textual information (narration, animation, videos, and images) embedded in e-books on their learning were explored.

Summary

It is essential to understand what an e-book is prior to exploring, investigating, or discussing e-books and their related topics. Definitions of an e-book have varied over time due to the fact that perceptions and realities associated with e-books have been

rapidly changing. Many definitions described the electronic and digital nature of e-books as a representation of a printed book (Armstrong, 2008; Feather & Sturges, 2003; Lee, 2002; Reitz, 2004; Secker, 2004; Stevenson & Waite, 2011). However, in this research, numerous concepts of e-books were considered (e.g., context, characteristics, dynamic nature, and type of technologies). This research was mostly relying on Vassiliou and Rowley (2008) definition of an e-book that comprised of two-parts:

(1) An e-book is a digital object with textual and/or other content, which arises as a result of integrating the familiar concept of a book with features that can be provided in an electronic environment.

(2) E-books typically have in-use features such search and cross reference functions, hypertext links, bookmarks, annotations, highlights, multimedia objects and interactive tools. (p. 363)

Unlike printed books, e-books have unique characteristics that contribute to any learning process: more flexibility, easy accessibility, numerous features (e.g., glossary, key words searching, notes adding, word definition, visual searching, etc.), hyperlinks integration, simulations, and multimedia objects (e.g., still images, animated images, videos, and audios; Vassiliou & Rowley, 2008). Because of the distinctive visual, social, and audial features provided in e-books from which students fulfill their educational needs, e-books have supportive opinions (Anuradha & Usha, 2006; Buckley & Tritt, 2011; Ebied & Rahman, 2015; Hwang et al., 2013; Kissinger, 2013; Lam et al., 2009; Mock, 2004; Roschelle et al., 2007; Rupley et al., 2015; Zurita & Nussbaum, 2004). However, according to a number of research studies, students do not prefer reading e-books to printed textbooks (Gregory, 2008; Gürcan, 2005; Pledger, 2010; Tosun, 2014; Woody et al., 2010).

This research aimed to explore students' perception toward the use of e-books for learning. Contributing to the purpose of this research and to the research questions

proposed, this chapter explored prior literatures related to the topic and discussed the use and impact of e-books on learning. With the support of the literature discussed, this qualitative research explored the topic in depth, addressed the root causes of the negative attitudes toward e-books, and developed appropriate recommendations and suggestions to overcome these negative attitudes. Finally, this chapter discussed a supportive theoretical foundation to the constructivist approach (i.e., self-testing and e-books, cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning) that is associated with e-books use and impact on learning. The following chapter illustrated the methodology of this research in details.

CHAPTER III

METHODOLOGY

The purpose of this phenomenological research was to explore graduate students' interpretations of their experiences with the use of e-books for learning, reasons that influence their preference to use e-books or printed books when they learn, perceptions toward e-books impact on learning, perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, interpretations of their experiences with the use of a given e-book, and recommendations of changes to e-books to better supporting their learning. This chapter delivered detailed description regarding the methodology of this research, including: (a) research design; (b) qualitative research framework that is comprised of four elements (epistemology, theoretical perspective, methodology, and methods) proposed by Crotty (1998); (c) epistemology: constructionism; (d) theoretical perspective: interpretivism; (e) researcher's role; (f) methodology: phenomenology; (g) sampling and participants; (h) methods: interviews, observations, and artifacts; (i) materials, which explains materials provided in the utilized e-book and the printed book when conducting this research; (j) data analysis; and (k) qualitative research trustworthiness, which discusses the credibility (internal validity), the transferability (external validity), and the dependability (reliability) of this research.

Research Design

A *research design* could be defined as applying a systematic process in order to investigate something. According to Creswell (2012), research could be described as, "a process of steps used to collect and analyze information to increase our understanding of a topic or issue. At a general level, research consists of three steps: (1) pose a question (2) collect data to answer the question (3) present an answer to the question" (p. 3). Qualitative research is a general term that represents methodologies described as ethnographic, naturalistic, anthropological, field, or participant observer research. A qualitative approach emphasizes the value of considering variables in the natural setting in which they exist. Unlike quantitative research, qualitative research meaning is transferred through researcher's perceptions and understanding of the meaning people's constructed from their own experiences (Merriam, 1998). Merriam (2009) stated when comparing qualitative researches to quantitative research,

> Rather than determining cause and effect, predicting, or describing the distribution of some attribute among a population, we might be interested in uncovering the meaning of a phenomenon for those involved. Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences. (p. 5)

The aim of conducting a qualitative approach is more into exploring the meaning of a phenomenon from participants' point of views than determining cause and effect relationships. According to Schwandt (2001),

> To call a research activity qualitative inquiry may broadly mean that it aims at understanding the meaning of human action . . . qualitative methods are procedures including unstructured, open-ended interviews and participant observation that generate qualitative data, whereas so-called quantitative methods (e,g., structured questionnaires, psychometric measures, and tests) are means of generating quantitative data. (p. 213)

Understanding people's actions and the meaning they have constructed about their world and experiences they have had in, is usually the main goal of employing a qualitative approach. Van Maanen (1979) defined the term, qualitative research as "an umbrella term covering an array of interpretive techniques which seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world" (p. 520). Moreover, all forms of qualitative research consider the researcher as the main instrument for data collection and analyses. The human instrument is responsive and adaptive to surroundings, which is ideal for qualitative research.

Another common concept in the qualitative approach is that the process is inductive. In other words, researchers gather data to develop concepts, hypotheses, or theories instead of conducting a deductive approach where researchers test hypotheses that already exist. Therefore, theories would be developed from researchers' observations, interviews, the use of artifacts, and experiences from being in the field. In contrast to quantitative method, qualitative research requires rich description. Qualitative researchers provide words and pictures rather than numbers to convey what they have explored regarding a phenomenon (Merriam, 2009). The purpose of this research was to explore graduate students':

1. Interpretations of their experiences with the use of e-books for learning

2. Reasons that influence their preference to use e-books or printed books when they learn

3. Perceptions toward e-books impact on learning

4. Perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books

5. Interpretations of their experiences with the use of a given e-book

6. Recommendations of changes to e-books to better supporting their learning

Qualitative Research Framework

Qualitative researchers must identify the research framework within which they will work since it is the underlying structure that guides the processes of any research study. Crotty (1998) indicated that there were four essential elements to compose any social research process (epistemology, theoretical perspective, methodology, and methods). Figure 4 shows the framework of this research based on the four elements proposed by Crotty (1998). Crotty (1998) defined each element as following:

- *Epistemology:* the theory of knowledge embedded in the theoretical perspective and thereby in the methodology.
- *Theoretical Perspective:* the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.
- *Methodology:* the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.
- *Methods:* the techniques or procedures used to gather and analyze data related to some research question or hypothesis. (p. 3)
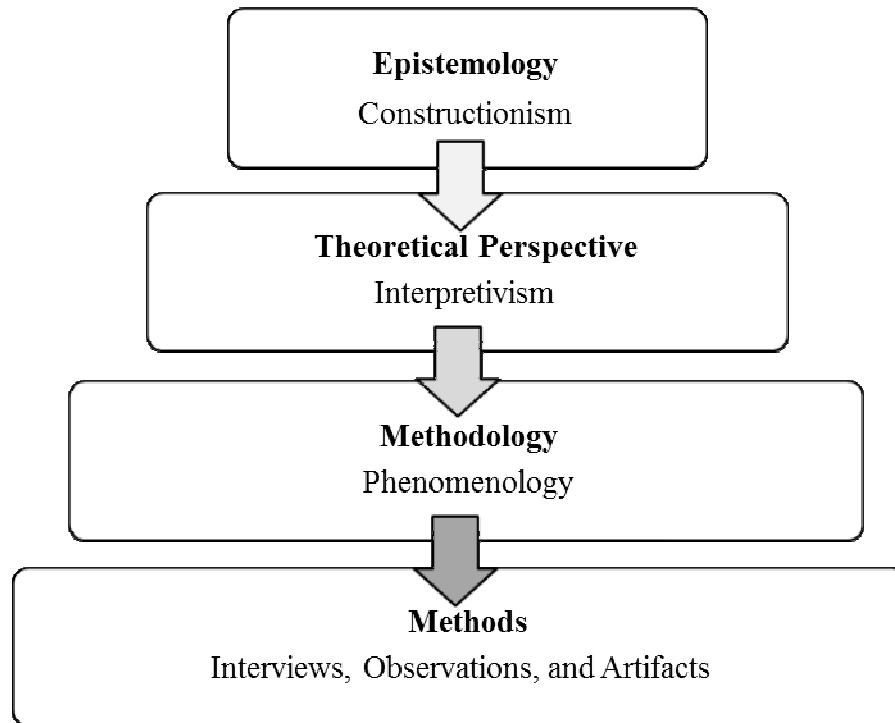
Figure 4. Research framework comprised of four elements proposed by Crotty (1998).

Epistemology: Constructionism

An epistemology helps researchers realize how they know what they already

know. Constructionism is an epistemological point of view that believes meaning is not

discovered yet constructed in humans' minds and there is no objective truth waiting to be

discovered. However, human minds may construct meanings differently even regarding

the same phenomenon or reality. Crotty (1998) described constructionism as, "all

knowledge, and therefore all meaningful realities as such, is contingent upon human

practices, being constructed in and out of interaction of human beings and their world,

and develop and transmitted an essentially social context" (p. 42). Thus, meaning or truth

is constructed in and out of humans' engagement with the world they live in and through

social interaction among themselves. Furthermore, a constructionist could practice being a researcher-as-bricoleur where the focus is drawn on individuals' ability to employ a multiple methods. In addition, a researcher-as-bricoleur requires practicing imaginativeness and being self-reflective where new meanings and point of views may develop (Crotty, 1998).

Constructionism is the epistemological guide to obtain knowledge. From my point of view as a constructionist researcher, I strived to explore participants' unique meanings they constructed from their own experiences. I believe people construct meanings from their social interaction between themselves and from their interaction with the world they live in. Furthermore, as a researcher, I believe that I constructed my own understanding of the topic through my personal involvement and interaction with the participants and my existing reality. My engagement, as a researcher, with the participants through the process of exploration was an essential aspect of constructing my understanding that contributed to this research.

In addition, constructionism allows researchers to reinterpret new meanings by exploring objects in a radical spirit of openness. As a constructionist, the researcher-as-bricoleur was practiced in this research. The researcher-as-bricoleur requires paying sustained attention to the objects of research. I strived to not limit myself to the conventional meanings I have been taught to relate to the object. Hence, I exercised imagination and creativity when musing over objects in order to see what possibilities the objects have to offer and to absorb new and richer meanings (Crotty, 1998).

Theoretical Perspective: Interpretivism

The theoretical perspective in this research was driven from interpretivism point of view where understanding social reality and human was the intention. According to Crotty (1998), interpretivism is often associated with Weber's (1864-1920) opinion that *Verstehen* (understanding), is what human sciences researchers are mostly concerned with. Crotty (1998) believed this theoretical perspective aim is to understand and explain social realities and human beings through social science by considering the unique development of a phenomenon. According to Crotty (1998), the interpretivist approach "looks for culturally derived and historically situated interpretation of the social world" (p. 67). Schwandt (2001) stated when explaining the term interpretivism,

> This term is occasionally used as a synonym for all qualitative inquiry, blurring important distinctions in intellectual traditions. More accurately, the term denotes those approaches to studying social life that accord a central place to *verstehen* as a method of human sciences, that assume that the meaning of human action is inherent in that action, and that the task of the inquirer is to unearth that meaning. (p. 134)

As an interpretivist, I believe going through individuals' personal experiences was a powerful approach that helped me to realize and explain humankind and their social realities. Appling interpretivism as the theoretical perspective in this research reinforced my ability to understand and explain the phenomenon. In this study, I aimed to understand and explain the phenomenon that how graduate students perceived e-books use and impact on learning through their experiences. In addition, based on students' personal experiences with the use of e-books for learning, they provided their recommendations to change e-books to better support their learning.

Researcher's Role

A qualitative researcher is the primary instrument of data collection and data analysis (Merriam, 1998). It is essential for researchers to understand the complexity ingrained in qualitative research and how their roles are dominant in generating and interpreting data (Xu, & Storr, 2012). As Chenail (2012) stated, "We as qualitative researchers spend intensive and/or extensive time in the field observing and asking participants what certain things mean and then ask follow up questions to help the participants bring forth into the public knowledge greater detail and perspectives" (p. 2). Accordingly, when conducting this qualitative research, I was aware that I was the exploratory and the substantial instrument of both data collection and data analysis.

Furthermore, I understood that I had a central role in examining the data gathered and delivering knowledgeable explanation of the analysis. As indicated by Xu and Storr (2012), "In qualitative research, the role of the researcher is not simply to collect data from a representative sample and provide a voice for the participants, but also to interrogate the data and provide informed commentary" (p. 6). However, biases or prejudices are often consequences of such a hefty role. Schwandt (2001) stated two senses of the term bias: (a) denotes a tendency in inquiries that prevents unprejudiced consideration or judgment and (b) individual preferences, predispositions, or predilections that prevent neutrality and objectivity. Schwandt (2001) further explained, "It is beyond dispute that sound inquiry practice requires critical reflection on one's actions and predispositions and awareness of the potential both of being deceived and of deceiving one's self" (p. 15). Due to the fact that bias and prejudice are essential aspects of knowing and understanding ourselves and the world we live in, they cannot be

eliminated or set aside. However, a researcher must reflect on personal biases and prejudices in order to recognize the differences between enabling and disabling them and then obtain understanding (Schwandt, 2001).

I am from Saudi Arabia. I was a pre-school teacher before my ambition brought me to the United Sates in 2010 to pursue my graduate studies. In 2012, I earned a Master's degree from Colorado State University in Education majoring in Organizational Performance and Change. In 2014, I earned another Master's degree from University of Northern Colorado in Education majoring in Educational Technology. Since then, I have been working on a doctoral degree in that same program. Since 2009, when I bought my first e-book, I realized that I prefer reading a printed book and I could easily not adapt to the use of e-books. Being an Educational Technology graduate student who has used e-books for college level courses, I understand firsthand the positive impact of technology on learning. I admire the fact that e-books facilitate many tasks for readers that cannot be accomplished when reading a printed book such as word searching, word defining, etc. On the other hand, I believe that technology could be a source of challenges that hinder learning.

A number of people whom I personally know (educators, students, family, friends, etc.) have also shared their preference for printed books even though they have e-books on hands. Many researches explored the topic (Anuradha & Usha, 2006; Buckley & Tritt, 2011; Ebied & Rahman, 2015; Gregory, 2008; Gürcan, 2005; Hwang et al., 2013; Kissinger, 2013; Lam et al., 2009; Mock, 2004; Pledger, 2010; Roschelle et al., 2007; Tosun, 2014; Woody et al., 2010; Zurita & Nussbaum, 2004), but did not provide deep analyses of the causes of such negative stances. The lack of research in this area fostered

my curiosity to qualitatively explore why, for many people including myself, reading printed books is more preferable than reading e-books. Going through the processes of conducting this research and through participants' experiences and perceptions increased my understanding about the root causes of people's preference, including myself, to printed books over e-books. However, in order to fully achieve such an outcome, I felt the necessity to explore what graduate students interpret from their experiences with the use of e-books for learning, what perceptions graduate students hold toward e-books impact on learning, and what changes would graduate students like to see in e-books to better support their learning.

The Master's degree I earned in Organizational Performance and Change has been influencing me to provide appropriate recommendations and suggestions to facilitate e-books adaption and utilization. I believe in the value of change that is promoted by facts and reliable data. The results of this research could help developing insights and strategies to facilitate the adaptation for readers to successfully use e-books. In addition, the results could contribute to the field of Educational Technology by providing a conclusion of critical facts that support education and technology production. I understood the criticality of being aware of my personal biases and prejudices during interviews and observations in ordered to obtain my goal. I attempted to explore the topic with openness where new meanings and point of views may develop. During interviews and observations, I aimed to isolate my perceptions about my previous experiences with e-books by not exposing my opinions and emotions to participants or prejudge their observed behaviors.

Methodology: Phenomenology

A phenomenologist strives to describe the meaning of a concept or a phenomenon explored through individuals' lived experiences. Phenomenologists try to understand the essence of the phenomenon under examination by focusing on what all participants have in common as they experience the phenomenon. According to Creswell (2013), "The basic purpose of phenomenology is to reduce individual experiences with a phenomenon to a description of the universal essence" (p. 76). A phenomenological research design was applied along with the epistemology (constructionism) and the theoretical perspective (interpretivism) in this research (Creswell, 2013).

In 1765, the term phenomenology was originally utilized by the school of philosophy (Kockelmans, 1967). From the philosophy of phenomenology, the main focus is on humans' direct experiences and how they transformed into consciousness. Phenomenologists are interested in human's conscious experience of their everyday life and of their social actions. Thus, a basic task of a phenomenologist would be depicting the basic structure of an experience (e.g., love, anger, hate, grief, like, dislike, betrayal). Creswell (2013) explained a role of a phenomenologist as describing what participants have experienced and how they experienced it by collecting data from all participants first, then composite description of the essence of the experience. In addition, in order to clearly conceive an essence and a structure of a phenomenon, it is critical to eliminate personal prior experiences, beliefs, and perceptions about the phenomenon of interest (Merriam, 2009). Moreover, Moustakas (1994) believed that the aim of conducting a phenomenological study is to,

Determine what an experience means for the persons who have had the experience and are able to provide a comprehensive description of it. From the individual descriptions, general or universal meanings are derived, in other words the essences of structures of the experience. (p. 13)

In this research, a transcendental phenomenological approach was applied. There are two broad types of phenomenological research: Hermeneutical and Transcendental. Hermeneutical phenomenology is oriented toward lived experiences (phenomenology) and interpreting the "texts" of life (hermeneutic). Transcendental phenomenology focuses more on the description of participants' experiences and less on researcher's interpretations (Creswell, 2013). According to Moustakas (1994) transcendental meant, "In which everything is perceived freshly, as if for the first time" (p. 34). Moustakas (1994) referred to such a point of view as *epoche*, which is a Greek term that means refraining from judgment. Moustakas (1994) further explained, "In the Epoche, the everyday understanding, judgments, and knowing are set a side, and the phenomenon are revisited" (p. 33).

According to Merriam (2009), in order to obtain the essence of an experience or to conceive the underling structure of it, it is essential to consider epoche along with the phenomenological interview as the main method of data collection. Merriam (2009) further explained,

Prior to interviewing those who have had direct experience with the phenomenon, the researcher usually explores his or her own experiences, in part to examine dimensions of the experience and in part to become aware of personal prejudices, viewpoints, and assumptions. . . . These prejudices and assumptions are then bracketed or temporarily set a side so that we can examine consciousness itself. (p. 25)

According to Ary, Jacobs, and Sorensen (2010), the general processes of conducting a phenomenological study starts with identifying a problem that required an

examination of sheared experiences. Second, broad philosophical assumptions must be identified and explored through interviews with those who directly experienced the phenomenon. Interview questions should mainly focus on what participants have experienced. Moreover, questions should focus on the contexts that influenced their experiences. Although conducting interviews is the main data collection method, other data sources could be applied (e.g., observation, art, artifacts, poetry, journals). Third, data analysis could be conducted by determining significant statements or quotes that would develop meaning and themes. Finally, after examining participants' experiences and researcher's own experiences, a composite description that conveys the real essence of the phenomenon could be written (Ary et al., 2010). As a phenomenological researcher, this general procedure was considered during the processes of conducting this research. Creswell (2013) also recommended very similar procedural steps that could be considered when conducting a phenomenological study:

1. Determine if the research problem is best examined by a phenomenological approach.

2. Specify the broad philosophical assumptions of phenomenology.

3. Data are collected from individuals who have experienced the phenomenon with in-depth interviews and multiple interviews.

4. Participants are asked two broad questions: (a) What have you experienced in terms of the phenomenon? and (b) What contexts or situations have typically influenced or affected your experiences of the phenomenon? Other open ended questions could be asked as necessarily.

5.   In the data analysis, a researcher reduces the data to end up with the most significant statements or quotes that are grouped into themes. Then the researcher provides a textural description of what participants experienced, and a structural description of how they experienced it. Combining both structural and textural descriptions develops the essence of the experiences.

6.   Significant statements and themes are then used to write up what participants experienced and how they experienced it.

7.   The researcher then writes a composite description that presents the essence of the phenomenon or he/she could write it from his/her stance.

Sampling and Participants

Sampling

After identifying the general problem, researchers need to determine what, whom, where, and when to observe or interview. According to Merriam (2009), probability and nonprobability sampling were the two basic types of sampling. In probability sampling, such as random sampling, a researcher got a chance to generalize the findings from the sample to the population. However, the majority of qualitative researchers would apply nonprobability sampling due to the fact that generalizing the findings in a statistical trend is not an aim in qualitative research. As Merriam (2009) stated, "Since generalization in a statistical sense is not a goal of qualitative research, probabilistic sampling is not necessary or even justifiable in qualitative research" (p. 77). Hence, nonprobability sampling is the method applied in the majority of qualitative researches and was applied in this research as well (Merriam, 2009).

In purposeful sampling, a researcher selects the best sample that could provide understanding and insight. As stated by Patton (2002), "The logic and power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry" (p. 230). In order to select the most appropriate participants or sites, a researcher must develop a selection criteria and identify why the criteria is important. In addition, several writers have provided various types of purposeful sampling. The most common types are: typical (average), unique (unique or rare attributes of the phenomenon), maximum variation (widely varying pattern of the phenomenon), convenience (based on money, time, location, availability, etc), and snowball sampling (seeking for referral; Merriam, 2009).

In terms of determining a sample size, there is no explicit answer. Unlike quantitative sampling that is mostly interested in representativeness, qualitative sampling aims for information-richness (Patton. 1990). According to Hatch (2002),

> Qualitative researchers argue that no direct relationship exists between the number of participants and the quality of a study; questions of number are answered in reference to research questions and levels of analysis; contexts are carefully described so that readers can make their own judgments about applicability to their contexts' and there are no extraneous variable--any element that is perceived to be important by participants is important to the study. (p. 48)

Therefore, sample size depends on multiple elements associated with the conduction of qualitative study (questions being asked, data being gathered, analysis in progress, etc.). Creswell (2013) believed that phenomenologists should aim to, "describe the meaning of the phenomenon for a small number of individuals who have experienced it" (p. 161). It is advised to continue the processes of sampling until researchers reach a point where they feel redundant or saturated (Merriam, 2009). However, due to time

limitations often associated with the process of research, it is reasonable to provide a range number of participants.

The purpose of this research was to explore graduate students' interpretations of their experiences with the use of e-books for learning, reasons that influence their preference to use e-books or printed books when they learn, perceptions toward e-books impact on learning, perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, interpretations of their experiences with the use of a given e-book, and recommendations of changes to e-books to better supporting their learning. The process of sampling was continued until I reached a point where I felt redundant and saturated. I continued the process of data collection until I obtained sufficient data from 20 participants in order to reinforce my ability to provide in-depth description and to fully understand participants' experiences.

Considering the purpose of this phenomenological research, purposeful sampling was applied to the selection of participants. When conducting purposeful sampling, a researcher must determine the selection criteria of selecting the participant and explain why the criteria are important (Merriam, 2009). The following criteria were utilized to select a convenient sample for the purpose of this research:

1. Must be graduate students currently studying at University of Northern Colorado (UNC).

2. Must be available in the semester of Fall 2016.

3. At least one e-book was used during the last 2 years.

4. The use of the e-books was for learning purposes for college-level course(s).

5. Must be able to see, hear, and communicate orally.

6. Must be willing to collaborate with the researcher (i.e., spend time with the researcher, answer questions, being comfortable with the interview being recorder, being comfortable with the sketch being preserved, and view the provided e-book and printed book).

The selection criteria were developed according to the purpose of this research and the access I have as a Ph.D. student at UNC. Moreover, in order to gather data that is deep, detailed, and related, students must have used at least one e-book for the purpose of learning during the last two years. When I obtained the Institutional Review Board (IRB) approval, a recruitment email (Appendix A) was sent to all participants who met all the previously addressed criteria and were asked to participate in this research.. Participants contacted me via contact information provided in the recruitment email. Times and locations that were convenient to participants were scheduled. Interviews were held in quiet places that reinforce open and continuous conversations. Consent forms (Appendix B) were distributed before interviews to give participants an opportunity to understand the procedure and then their signatures were obtained as an official approval for taking a part in this study until the end of data analysis phase.

Participants

Participants of this phenomenological study were graduate students who peruse graduate studies at the University of Northern Colorado (UNC) located in Greely, CO. They were purposefully selected in order to gain perceptions from particular and relevant resources (Merriam, 2009). The 20 participants consisted of 9 males and 11 females, from 8 different nationalities, and majored in 11 different programs (see Table 4). Table 4

illustrates more information regarding participants (e.g., demographic information, and e-book device reader used). Race was classified based on racial categories addressed by Grieco and Cassidy (2001),

> "White" refers to people having origins in any of the original peoples of Europe, the Middle East, or North Africa . . . . "Black or African American" refers to people having origins in any of the Black racial groups of Africa . . . . "American Indian and Alaska Native" refers to people having origins in any of the original peoples of North and South America (including Central America) . . . . "Asian" refers to people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent. (p. 2)

Methods: Interviews, Observations, and Artifacts

Along with the epistemology (constructionism), the theoretical perspective (interpretivism), and the methodology (phenomenology) of this research, I determined to employ interviews, observations, and artifacts as the data collection methods. Research methods represent the procedure and the activities a researcher aims to employ in order to collect and analyze data. As stated by Crotty (1998), "There will be certain activities we engage in so as to gather and analyze our data. These activities are our research methods" (p. 6).

Table 4

Demographics of Participants

Name	Age	Gender	Race	Nationality	Degree	Program of Study	Year of E-book Use	Technology Device
Ahmad	36	Male	White	Saudi Arabian	Ph.D.	Higher Education and Student Affairs Leadership	8	Dell computer, MacBook laptop, and iPad
Angela	31	Female	White	American	Ed.D.	Educational Studies	2	MacBook laptop with Kindle reader
Asya	31	Female	Black	Kenyan	Ph.D.	Educational Technology	7	Dell computer, Toshiba laptop, iPad, and Samsung smartphone
Benjamin	22	Male	White	American	MA	Biological Sciences	2	HP laptop and Android smartphone
Dana	35	Female	White	Libyan	Ph.D.	Educational Technology	3	Sony Vio laptop
Eric	25	Male	Asian	American	MA	Clinical Mental Health Counseling	4	Kindle, iPhone smartphone, and Android smartphone
Evelyn	32	Female	White	American	Ph.D.	Applied Statistics and Research Methods	5	Dell computer, iPad, Kindle Fire, Kindle Paperwhite, Nook, and Android smartphone

Table 4 (continued)

Name	Age	Gender	Race	Nationality	Degree	Program of Study	Year of E-book Use	Technology Device
Frances	38	Female	White	American	Ph.D.	Counseling Psychology	10	Acer computer, Dell computer, iPad, and iPhone smartphone
Isabella	27	Female	White	Canadian	MA	Clinical Mental Health Counseling	5	MacBook laptop and iPhone smartphone
Iman	31	Female	White	Iranian	Ph.D.	Applied Statistics and Research Methods	4	MacBook laptop and iPhone smartphone
Jamal	42	Male	White	Saudi Arabian	PhD	Educational Technology	3	MacBook laptop, iPad, and iPhone smartphone
Larry	24	Male	White	American	Ph.D.	Educational Psychology	2	Sony laptop with Kindle reader
Lisa	23	Female	White	American	Ph.D.	Counseling Psychology	6	Dell laptop
Maimunah	33	Female	Asian	Malaysian	Ph.D.	Applied Statistics and Research Methods	2	HP laptop, and Samsung Galaxy smartphone
Mishary	40	Male	White	Saudi Arabian	Ph.D.	Special Education	9	MacBook laptop, iPad, Samsung Galaxy note, and iPhone smartphone

Table 4 (continued)

Name	Age	Gender	Race	Nationality	Degree	Program of Study	Year of E-book Use	Technology Device
Nadin	31	Female	White	Libyan	Ph.D.	Chemical Education	5	MacBook laptop, and Dell computer
Ping	26	Female	Asian	Chinese	MA	Multilingual Education: World Languages Emphasis	5	MacBook laptop, iPad, and iPhone smartphone
Qiu	40	Male	Asian	Chinese	MA	Multilingual Education: World Languages Emphasis	4	HP laptop, iPad, Kindle, and iPhone smartphone
Talal	30	Male	White	Saudi Arabian	Ph.D.	Special Education	5	MacBook laptop, and iPhone smartphone
Wang	27	Male	Asian	Chinese	MA	Multilingual Education: World Languages Emphasis	6	MacBook laptop, iPad, Kindle, and iPhone smartphone

Merriam (2009) believed, "Data collection is about asking, watching, and reviewing" (p. 85). Hence, Merriam (2009) referred to interviews, observation, and documents as the common, everyday terms. In a qualitative research, a researcher uses interviews to collect data that include participants' direct quotations regarding their experiences, perceptions, and feelings. Observations are often conducted to obtain descriptions of participants' behaviors, activities, and actions. Finally, several types of documents could be considered to extract excerpts, quotations, or even full passages that represent participants' experiences, perceptions, and knowledge (Merriam 2009; Patton, 2002).

In this phenomenological study, I provided direct quotations from all participants' experiential data collected through in-depth interviews. However, it is important to note that some participants, like Wang and Ping, did not provide much information during the interviews compared to the rest of the participants. Consequently, I was not able to reflect on their inputs as much as I did with the others'. I also collected data that represents detailed description of participants' perceptions, feelings, and point of views through close observations and artifacts. Table 5 illustrates how the proposed research questions are parallel with data collection methods and interview questions (Appendix C).

Table 5

Illustration on the Alignment of Research Questions, Data Collection Methods, and Interview Questions

Research Questions	Data Collection Methods	Interview Questions
1. What format, e-books or printed books, do students prefer to use when they learn?	Interviews	(PART ONE) Interview questions
2. How do students describe the use of e-books in terms of learning enhancement and hindrance?	Interviews	(PART ONE) Interview questions
3. How do students describe the impact of prior technological experience, knowledge, and confidence on perceptions and decision-making associated with e-books?	Interviews	(PART ONE) Interview questions
4. How would students describe the use of the given e-book that contains demonstrative media, embedded features, and tests compared to the given printed book?	Interviews and observations	(PART TWO) Interview questions
5. What changes to e-books do students recommend to better supporting their learning?	Interviews and artifacts (sketches)	(PART THREE) Interview questions

The data collection procedure of this research was composed of several phases as shown in Figure 5. After obtaining IRB approval, times and locations that were convenient to participants were arranged. In order to collect rich data, each participant went through three phases, and then data were analyzed.

```
                        ┌─────────────────┐
                        │    Sampling     │
                        └─────────────────┘
                                 │
                                 ▼
              ┌──────────────────────────────────┐
              │ Arrange Interviews with Participants │
              └──────────────────────────────────┘
                                 │
                                 ▼
                      ┌──────────────────────┐
                      │  Phase 1: Interviews │
                      └──────────────────────┘
                                 │
                                 ▼
  ┌──────────────────────────┐  ┌──────────────────────┐
  │ Observations (field notes) │→│  Phase 2: Interviews │
  └──────────────────────────┘  └──────────────────────┘
                                 │
                                 ▼
  ┌──────────────────────────┐  ┌──────────────────────┐
  │     Artifacts (sketch)    │→│  Phase 3: Interviews │
  └──────────────────────────┘  └──────────────────────┘
                                 │
                                 ▼
                      ┌──────────────────────┐
                      │     Data Analysis     │
                      └──────────────────────┘
```
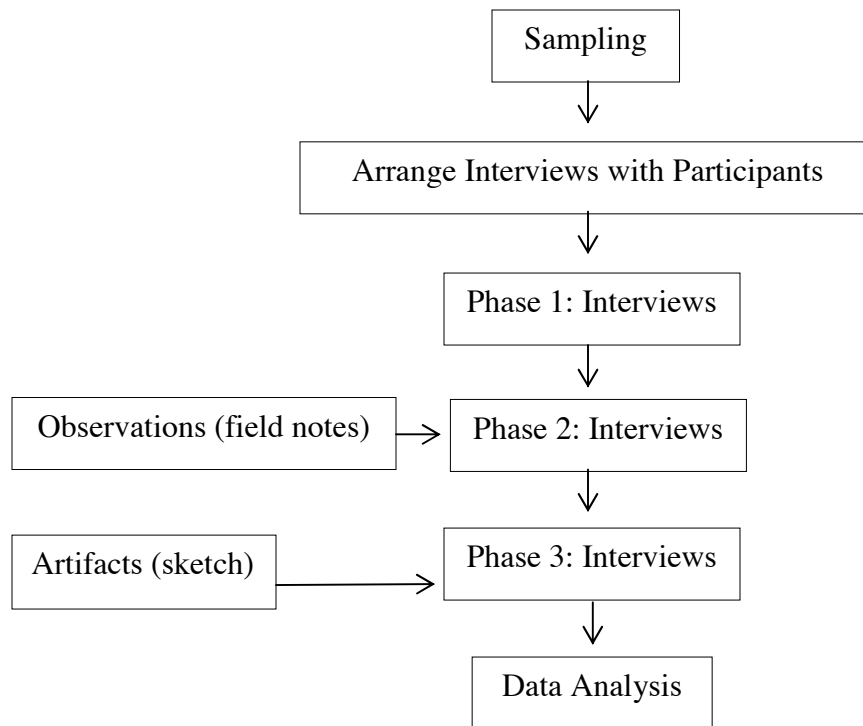
Figure 5. Data collection procedure flow chart.

In the first phase, participants were interviewed and asked questions to describe how they perceived the use of e-books. They were also asked to explain whether they believed e-books support or hinder their learning. In the second phase, participants were given a printed book to skim through. Then they were given an electronic version of the same content that includes features (still and moving images, videos, audios, tests, etc.) that were not available in the printed book. The exposure time of each book, printed book

and e-book, was no more than five minutes. Later, participants were interviewed to explore their opinions on the use and impact of the given e-book compared to the given printed book. Field notes were taken through the second phase interview to reinforce and expand the richness of data gathered regarding participants' perspectives toward the given e-book and the given printed book. Finally, in the third phase, participants were interviewed and asked about changes they would like to see in e-books to better support their learning. Furthermore, they were given a blank sheet of paper and a pen, and were asked to draw a sketch of the ideal e-book layout they believe will best support their goals. Participants' sketches were provided as artifacts to deliver an additional source of perceptions in order to better understand their point of views regarding changes they would like to see in e-books.

Interviews

In a qualitative research, an interview is often considered as the main method of data collection (Merriam, 2009). According to DeMarrais (2004), an interview could be defined as "A process in which a researcher and participant engage in a conversation focused on questions related to a research study" (p. 55). Interviews are employed by qualitative researchers to explore aspects that cannot be observed (Patton, 1990). By conducting interviews, a researcher enters into participants' perspectives by offering them opportunities to express their feelings, experiences, perceptions, opinions, attitudes, beliefs, etc. As indicated by Merriam (2009), "Interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them" (p. 88).

In qualitative research, conducting interviews could take several forms. In one-on-one interviews, a researcher could conduct a time consuming interviews and records data

from one participant at a time (Creswell, 2012). In this research, I conducted one-on-one

interviews with each participant to collect detailed data. In addition, one-on-one

interviews fit my aim to collect observational data (e.g., facial expressions and body

gestures) in order to include rich and in-depth data.

Interviews could take different types of structures. Semi-structured interviews

involve asking open-ended questions where participants can describe the world in

different unique ways. The questions are flexible, and allow the researcher to respond to

the situation at hand. According to Creswell (2012), "Have a plan but be flexible. During

the interview, stick with the questions, but be flexible enough to follow the conversation

of the interviewee" (p. 221). In this research, I conducted semi-structured interviews

comprised of flexible question that allowed me to follow the conversation of each

participant (Merriam, 2009).

I developed an interview guide (Appendix C) composed of 36 questions (8

demographic questions and 29 opened-ended questions) to direct the process of each

interview. Questions listed in the interview guide were carefully developed to provide

deep understandings of participants' perceptions and experiences that contributed to

answer the proposed questions in this research.

Observations

In qualitative research, interviews are considered a main method of data

collection, as are observations (Merriam, 2009). Observation involves observing

participants and places at a research location in order to collect open-ended and first hand

data (Creswell, 2012). Observation has offered researchers opportunities to collect

behavioral data that cannot be collected through other data collection methods to better

understand a culture, settings, facts, and roots of a phenomenon. In addition, observation could be the best method when participants are not able to discuss the topic, or when a researcher aims to collect an immediate perspective (Merriam, 2009). Merriam (2009) further explained that conducting observations could be, "to provide some knowledge of the context or to provide specific incidents, behaviors, and so on that can be used as a reference points for subsequent interviews" (p. 119).

During the processes of conducting observations, there are different relationships between the observer and the observed (Merriam, 2009). In terms of my relationship as the observer, I spent more time as an observer than as a participant. Participants were the only individuals who participated in the data collection sessions I developed. In essence, they were interviewed, given a printed book and an e-book and asked to compare, and asked to sketch the ideal e-book layout they believe will best support their goals. My role during the data collection sessions was only to guide the participants and the process.

In this research, observation was utilized to intensify and enrich interview data. During the second phase interview, I observed participants' behaviors and wrote field notes to record my observations. The aim of my observation was to collect as much detailed data as possible in order to fully understand participants' perceptions toward the given e-book and the given printed book. The field notes were incorporated with the interview transcripts (Merriam, 2009). According to Hatch (2002), "Raw field notes are usually descriptions of contexts, actions, and conversations written in as much detail as possible given the constraints of watching and writing in a rapidly changing social environment" (p. 77). It was essential to do complete recording of detailed notes during the observation, yet it was challenging.

Merriam (2009) suggested writing, typing, or dictating narrative full notes as soon after the observation is completed as possible. Merriam further provided several suggestions that would influence data recalling. These suggestions were: pay attention, shift from wide angle to a narrow angle lens, look for key words in participants' responses that would standout later, focus on the first and last remarks, and mentally play back remarks and scenes. I considered all Merriam's suggestion and I sat down and described what I observed immediately after each observation. I provided a detailed description of the events, participants' behaviors, and remarkable statements stood out during the interviews in my field notes.

Artifacts

Artifacts are a source of qualitative data that often are considered by researchers when they find interesting aspects related to the topic of the study or to the proposed questions in their research (Mason, 2002). Artifacts could be any physical data, perhaps not even easily noticed, or materials from the research site or records related to the phenomenon being examined. As indicated by Hatch (2002), "Interpreting meanings and significance of unobtrusive data is, therefore, heavily interferential, and it is incumbent on researchers to go about making interpretations carefully" (p. 120). Hatch (2002) further supposed that interpreting meanings would require a researcher to: recognize the contexts within which artifacts convey meaning, distinguish meaningful similarities and differences within texts, and judge the relevance of theories to the available data.

In this research, along with interview data, artifacts were collected as additional sources of data that would strengthen the overall research data. During the third phase, participants were asked to draw a sketch of the changes they would like to see in e-books

to deliver the ideal e-book they believe will best support their learning goals. The recommended changes were associated with e-book's layout, functionality, and reader hardware. Participants' drawings were considered artifacts data in this research. These artifacts provided additional source for insights in order to better understand participants' point of views regarding changes they would like to be considered when developing and offering e-book's software and hardware to the market.

Materials

The materials utilized in this research were comprised of an e-book and a printed book. Due to the fact that I could not find one book that meets the criteria and available in both formats, electronic and printed, I had to choose two different books. They were selected based on three criteria: (a) the content was regarding general topics that could be skimmed through without facing any complications; (b) the content was developed for reading for learning, as in textbooks, and not for leisure reading, as in novels; and (c) both formats (e-book and printed book) covered the same content. Both books, the electronic and printed, were reviewed, agreed up on, and confirmed by dissertation chair and educational technology professors to highly fit the purpose of this research.

The Electronic Book

The e-book utilized in this research was the *Life on Earth: Animal Physiology* book developed by M. Ryan, Macgill, Berry, Vavra, and Wilson (2010). Participants were asked to skim through three sections provided in this book that comprised of a total number of 15 pages (Appendix D, *The Physiology of Breathing, Reaching the Periphery, and How Hemoglobin Works*). This textbook was designed by using the iBook Author application. It is available from Apple for free downloading on iPad multi touch tablets

with iBooks application and on computers that include iTunes. This research used a version downloaded on January 23, 2016. This electronic textbook was developed to offer students an opportunity to obtain a deep understanding of the dominant topics of introductory biology. In addition, it included features such as videos, audios, photo galleries, tests, and multi touch images and illustrations that were designed to foster students' learning (Apple, 2016).

The sections chosen cover broad topics regarding the functionality of heart and lungs in human body. As stated previously, this e-book offered interactive features that were appropriate for my goal to seek an answer for the question: how would students describe the use of the given e-book that contains demonstrative media, embedded features, and tests compared to the given printed book? This e-book facilitated students' understanding by illustrating knowledge through text, videos, animation, narrated animation, audios, still and moving images (Appendix E), and tests for self-testing to demonstrate understanding (Appendix F). From this e-book, Figure 6 shows an example of an animation that combined texts, still and moving images, and audios together to facilitate understanding as indicated by dual coding theory and cognitive theory of multimedia learning (Mayer, 2001; Paivio, 1990).
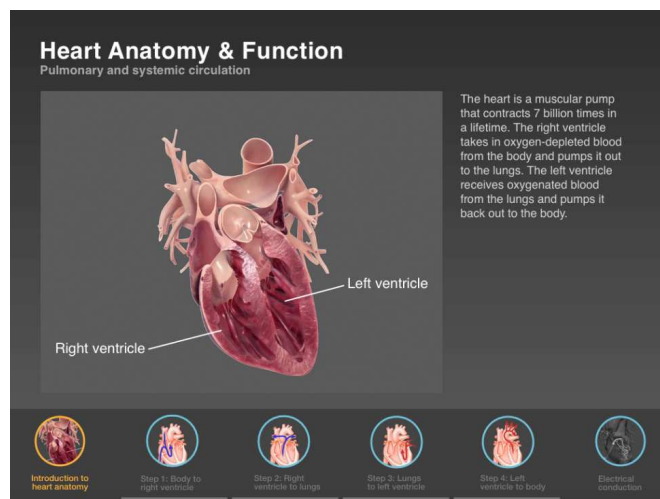
Figure 6. A screenshot of a heart anatomy and function animation. Adapted from *Life on Earth: Animal Physiology*, by M. Ryan et al., 2010, Watertown, MA: Digizyme, Inc., p. 34. Copyright © 2016 by Apple Inc. Adapted with permission.

While participants were skimming through the e-book, they clicked on images to view embedded animations as shown in Figure 6 and Appendix E. Furthermore, this e-book provided self-testing opportunities at the end of some sections (Appendix F). Figure 7 shows an example of a test provided in the chosen sections for this research. When participants completed skimming through the e-book, they were given an opportunity to try the tests provided at the very end of the final section and receive a prompt feedback. Such an opportunity helped participants to develop explicit perceptions on the impact of self-testing and how it influences learning through repetitive activities along with immediate feedback (Kamarulzaman & Shaari, 2015).
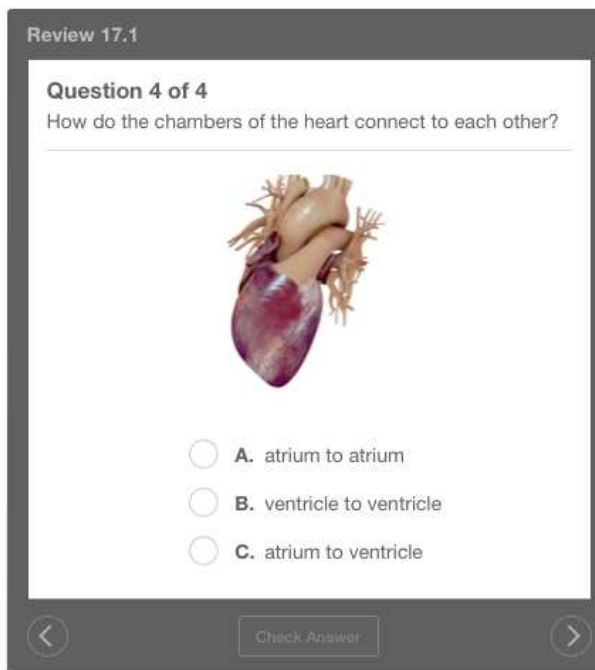
Figure 7. A screenshot of a self-testing approach. Adapted from *Life on Earth: Animal Physiology*, by M. Ryan et al., 2010, Watertown, MA: Digizyme, Inc., p. 99. Copyright © 2016 by Apple Inc. Adapted with permission.

The Printed Book

Similar to the e-book, the content of the utilized printed book in this research was developed for reading for learning about a general topic that could be skimmed through without facing any difficulties. In this research, the book written by Peter Abrahams (2007), *How the Body Works: A Comprehensive Illustrated Encyclopedia of Anatony*, was used as the printed book. Several sections in this book that covered topics regarding the lungs and heart, and comprised of a total number of 20 pages (pp. 188-207), were utilized since they covered the same content provided in the e-book. The content of the chosen sections were illustrated through the use of text and still images. When participants skimmed through this printed book, they were given an opportunity to have

clear perceptions on the use of printed books (comprised of text and still images) for

learning, compared to e-books (comprised of text, animations, still and moving images,

videos, audios, and tests with immediate feedback).

Data Analysis

Qualitative data analysis is the process of making sense of data. The process

involves structuring findings by identifying codes, patterns, and themes that depict the

data. The final findings would include these patterns and themes supported by evidence

from data gathered. Furthermore, the process of making meaning includes consolidating,

reducing, and interpreting what the researcher has observed and read and what

participants have stated. Making meaning refers to the process applied to answer the

research questions (Merriam, 2009). Hence, qualitative data analysis breaks down the

data to identify related codes that construct categories and themes to establish the

findings of a study. According to Merriam (2009),

> 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, between description and interpretation. These meanings or
> understandings or insights constitute the findings of a study. Findings can be in
> the form of organized descriptive accounts, themes, or categories that cut across
> the data, or in the form of models and theories that explain the data. (p. 176)

Creswell (2013) discussed the different types of qualitative approaches (Narrative,

Ethnography, Phenomenology, Grounded Theory, Case Study) and provided a different

data analysis procedure for each approach. As stated previously, Creswell (2013)

indicated that phenomenological data analysis require a researcher to: (a) reduce the data

to end up with the most significant statements or quotes that were grouped into themes

and then provide a textural description of what participants experienced and a structural

description of how they experienced it to develop the essence of the experiences, (b) use

significant statements and themes to write up what participants experienced and how they experienced it, and (c) write a composite description that presents the essence of the phenomenon or he/she could write it from his/her stance.

Creswell (2013) further provided a more detailed procedure when conducting phenomenological data analysis: (a) organize data, (b) read and take notes, (c) describe meaning of participants' experiences, (d) find and list statements, (e) group statements into meaning units, (f) construct description of experiences, (g) present the essence of experiences, and (h) make interpretations. Moustakas (1994) recommended almost similar procedure of analysis: (a) read the entire description of data in order to make sense of the whole, (b) read the same description but slowly to delineate units of meanings, (c) eliminate redundancies and explain the meaning of the units identified by connecting them to each other and to the sense of the whole, (d) reflect on the units identified and develop the essence of the situation for the subject, and (e) integrate the insights obtained into a description of the structure of learning. Based on my review of several phenomenological data analysis procedures, I developed the data analysis procedure shown in Figure 8 that was applied in this research.

Transcribing: transcribe recorded interviews as soon as possible after the completion of each interview.

Reading and Notes Taking: carefully read all transcripts, highlight keywords, write notes that will help with coding.

Organizing Data: apply open coding to organize interview data and compose units of meaning.

Constructing: construct sub themes based on units of meaning and participants' statements. Subsequently, common statements and related sub themes grouped together to construct major themes.

Analyzing: analyze and compare all themes (sub and major) to recognize similarity and differences through participants' responses. Integrate field notes from the observation in the process.

Interpreting: based on the analysis, interpret and describe participants' experiences and how they perceived those experiences. Integrate interview transcripts, observation field notes, and copies of artifacts to provide evidence.

Figure 8. Phenomenological data analysis procedure.

The data analysis procedure of this research was:

1. After conducting each interview, the recorded data were immediately transcribed.

2. Interview transcripts were carefully read multiple times in order to understand the essence of meaning. All key words were highlighted and notes were written to assist with the implementation of open coding.

3. Data were organized by applying open coding to compose units of meaning and identify segments that might be useful for answering the research questions. Open coding involves being open to anything possible at this stage (Merriam, 2009).

4. Sub themes were constructed based on units of meaning that composed of participants' statements. Subsequently, common statements and related sub themes were grouped together to construct major themes.

5. Constructed sub themes and major themes of each participant were analyzed and compared to identify similarity and differences through responses. Field notes from the observations were integrated in this process of comparison. A list of the final major and sub themes was provided.

6. From the analysis of the data (themes, observation field notes, and artifacts), a descriptive result regarding the phenomenon of how graduate students perceived the use and impact of e-books on learning through their experiences was reported.

Furthermore, reduction was applied where interpretations and descriptions of participants' experiences and how they perceived those experiences was provided. Reduction is considered as a thoughtful attentiveness that aims to convey aspects of meaning into researcher's focus (Ary et al., 2010). According to Ary et al. (2010), "From the analysis, the researcher derives an overall description of the general meaning of the experiences. This is done through a process called reduction. Think of reduction as way to reflect" (p. 473). In this research, quotes from participant interviews, observation field notes, and copies of artifacts were integrated to display evidence.

Qualitative Research Trustworthiness

In a qualitative research, trustworthiness is a general term referring to the validity and reliability of a qualitative inquiry. There are several techniques and criteria that could be considered to enhance and evaluate trustworthiness in a qualitative research. According to Cope (2014), trustworthiness in qualitative research referred to the degree where a person could trust the findings of a research study and believe that it could be applied to other settings or groups. Schwandt (2001) defined trustworthiness as, "The quality of an investigation (and its findings) that made it noteworthy to audiences" (p. 258).

In order to increase the possibility of trustworthiness in this research, three criteria were considered: credibility, transferability, and dependability. Schwandt (2001) listed credibility, transferability, and dependability as the criteria that served as the naturalist's equivalent to conventional criteria. Schwandt (2001) further explained,

> First, credibility (parallel to internal validity) addressed the issue of the inquirer providing assurances of the fit between respondents' views of their life ways and the inquirer's reconstruction and representation of same. Second, transferability (parallel to external validity) dealt with the issue of generalization in terms of case-to-case transfer. It concerned the inquirer's responsibility for providing readers with sufficient information on the case studied such that readers could establish the degree of similarity between the case studied and the case to which findings might be transferred. Third, dependability (parallel to reliability) focused on the process of the inquiry and the inquirer's responsibility for ensuring that the process was logical, traceable, and documented. (p. 258)

Credibility (Internal Validity)

The term, credibility, refers to the truth represented in researchers' interpretation and representation of data or participant views (Cope, 2014). Internal validity is mostly concerned with how the findings of a research inquiry match the truth or reality. Validity cannot be ensured since the truth or reality cannot be really captured. Thus, validity is a

goal not a product. It refers to researcher's confidence of his or her observations, interpretations, and conclusions and whether they are believable, in other words credible, or not (Ary et al., 2010; Merriam, 2009).

Although a qualitative researcher cannot provide an objective truth or reality, a number of strategies could be applied to enhance the credibility of one's findings. These strategies would increase the propinquity between the real world and research. Merriam (2009) recommended several strategies that could be considered to increase credibility (e.g., triangulation, member checks, peer examination, and clarification of researcher's biases. In this phenomenological research, triangulation, member checks, peer examination, and clarification of researcher's biases were applied.

One of the most well known strategies for trustworthiness is triangulation. According to Merriam (2009), a qualitative researcher could apply triangulation by using multiple methods to approve emerging findings. In this research, multiple methods (interviews, observation, and artifacts) were used to collect data and draw conclusions that were credible as possible. In addition, the utilization of multiple methods throughout this research process helped with obtaining a comprehensive view of the phenomenon. Another considered strategy was a member check that was applied by asking participants to review interview transcripts to ensure the plausibility and accuracy of the data. In addition, peer examination was applied by asking colleagues to review the findings as they emerged. Finally, in this chapter, I clarified possible biases I may have held when indicating my role as the researcher of this phenomenological research (Merriam, 2009).

Transferability (External Validity)

Transferability refers to the extent to which the findings of one study are generalizable in a way that can be applied to other situations or to other groups (Ary et al., 2010; Merriam, 2009). External validity is concerned with the generalizability of the findings in a quantitative inquiry. Schwandt (2001) described generalizability as, "The process involved in moving from the specification of patterns, relations, processes, conditions, and meanings . . . to a more general and abstract understanding of these aspects of human experiences" (p. 106). Unlike quantitative research, in qualitative research, generalizability is not a goal. Yet, qualitative researchers are responsible to apply descriptive adequacy where they deliver rich, detailed, and thick descriptions of the context so the potential readers can evaluate similarity and transferability. Researchers must provide accurate, detailed, and complete descriptions of both the context and participants in order to offer readers opportunities to determine transferability (Ary et al., 2010).

The most common view of generalizability in qualitative research considers reader generalizability that often includes the extent to which the findings of a study can be applied to other situations. In other words, the readers judge transferability by deciding whether the findings can be applied to their specific situations. Similar to the descriptive adequacy strategy, researchers could apply the thick description strategy that is considered as the best way to increase possibilities of transferring the findings of a study to other settings (Merriam, 2009). According to Merriam (2009),

> When rich, thick description used as strategy to enable transferability, it refers to a description of the setting and participants of the study, as well as a detailed description of the findings with adequate evidence presented in the form of quotes from participant interviews, field notes, and documents. (p. 227)

In this research, I intended to enhance the possibility of transferring the findings to other settings by delivering rich, thick description to the readers. The use of thick description strategy involved providing a description of the participants of this study. Moreover, I displayed evidence (quotes from interviews, observation field notes, and copies of artifacts) in order to report a detailed description of the findings.

Dependability (Reliability)

Dependability or reliability is mostly concerned with the degree to which data and findings of a research study would be similar if the study were replicated (Ary et al., 2010; Merriam, 2009). In a research design, reliability refers to the assumption that there is one reality and studying it repeatedly will report the same results. Yet, constancy of a phenomenon is never assured and human behavior is never static. Qualitative research aims to describe the world as the participants experienced it. Hence, replication of a qualitative research might not report the same findings (Merriam, 2009). However, Merriam (2009) indicated, "If the findings of a study are consistent with the data presented, the study can be considered dependable" (p. 222).

In qualitative research, strategies that could be utilized to ensure consistency and dependability or reliability are: triangulation, peer examination, investigators' position, code-recording, and audit trail (Ary et al., 2010; Merriam, 2009). As stated previously, in terms of triangulation, I utilized multiple methods (interviews, observation, and artifacts) to collect data and increase credibility and dependability of this research. As for peer examination in this research, I asked colleagues to review the findings as they emerged in order to ensure the consistency of the results. Moreover, my position as the investigator of this research was explained in the researcher's role sections in this chapter. In addition,

code-recording was applied in this research. Code-recording was explained by Ary et al. (2010) as the process of coding the data, leave the analysis for a period of time, come back to record the data one more time, and then compare the two sets of coded materials.

Finally, audit trail is the strategy of providing a detailed description of how data were collected, how categories were emerged, and how decisions were made through the study in order to facilitate other researchers' understanding of how exactly the findings were derived. In order to provide a detailed audit trail, Merriam (2009) recommended keeping a research journal along with the process of conducting a study. In this research, I explained the research procedure (data collection, data analysis, and report of findings) in details. Moreover, as soon as the research procedure started, I began writing entries as a research journal regarding the process of conducting this research and everything happened during the research period to clearly describe the research procedure and add more insight to it (Merriam, 2009).

Summary

In this chapter, detailed information regarding the methodology of this research was provided. This chapter delivered detailed description regarding research design, research framework, researcher's role, sampling, participants, materials, data analysis, and trustworthiness. This research was designed to explore graduate students' interpretations of their experiences with the use of e-books for learning, reasons that influence their preference to use e-books or printed books when they learn, perceptions toward e-books impact on learning, perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, interpretations of their experiences with the use of a given e-

book, and recommendations of changes to e-books to better supporting their learning. Hence, qualitative research method was considered most suitable with regards to this research design and its goals.

The research framework applied in this research was based on Crotty's (1998) proposed framework which was comprised of four elements: (a) epistemology: constructionism; (b) theoretical perspective: interpretivism; (c) methodology: phenomenology; and (d) methods: interviews, observations, and artifacts. Purposeful sampling was applied to the selection of the 20 graduate students as participants in this research. This chapter explained the data collection procedure of this research that was composed of three phases. Based on the review of several phenomenological data analysis procedures, the data analysis procedure of this research was developed. The procedures of the data analysis involved: transcribing, reading and notes taking, organizing data, constructing, analyzing, and interpreting. Finally, to increase the possibility of trustworthiness in this research, three strategies were applied: credibility, transferability, and dependability. The findings of this research were reported in Chapter IV, followed by Chapter V, which discusses the findings, implications, and recommendations for future research.

CHAPTER IV

RESEARCH FINDINGS

The purpose of this research was to explore graduate students' interpretations of their experiences with the use of e-books for learning, perceptions toward e-books impact on learning, and recommendations of changes to e-books to better supporting their learning. Twenty graduate students from 11 different majors (11 females and 9 males) participated in the research and went through a three-phase interview design (see Figure 5 in Chapter III). In-depth interview data (20 recorded interviews and transcripts), observation data, and artifacts were collected. In the first interview phase participants were asked questions to understand how they perceived the use of e-books and explored whether they believed that e-books support or hinder their learning. In the second phase, participants were given a printed book and an e-book that cover the same content to skim through. Then, participants were interviewed to explore their perceptions toward the given printed book and e-book. Field notes were taken through the second phase to expand the richness of data that provide an additional source of perceptions. In the third phase, participants were asked about changes they would like to see in e-books to better support their learning. Furthermore, in order to better understand participants' recommended changes, participants were asked to draw a sketch of the ideal e-book layout they believe would best support their goals and include their recommendations. Their sketches were provided as artifacts in this chapter.

Subsequently, phenomenological data analysis procedures (see Figure 8 in Chapter III) were applied to analyze the in-depth data collected from interviews. As a result, 5 major themes and 16 sub themes emerged. In order to answer the main research question (How do students describe the use of e-books through their experiences?), the analytical result of 20 interview transcripts and other supportive materials (i.e., observation field notes, artifacts, and researcher's journal) were integrated.

In this Chapter I reported the findings of this research that include direct quotes from interviews transcripts, field notes, artifacts, and research journals in a systematic approach with respect to the five major themes: (a) all students valued e-books, but nearly all students still prefer printed books; (b) e-books can enhance learning, but can hinder learning as well; (c) the impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books; (d) students preferred to use the given e-book to the given printed book; and (e) changes to e-books recommended by students to better support learning. Table 6 demonstrates the inductive relationship of the sub themes and major themes and their alignment with the five supporting research questions as well as the main research question.

Table 6

Inductive Relationship of Sub-themes and Major Themes

Sub-themes	Major Themes	Supporting Research Questions	Main Research Question
- Students valued the advantages offered by e-books	All students valued e-books, but nearly all students still prefer printed books	1- What format, e-books or printed books, do students prefer to use when they learn	How do students describe the use of e-books through their experiences?
- Students valued features provided in e-books			
- Students valued the ability to search for external resources through the Internet in e-books			

Table 6 (continued)

Sub-themes	Major Themes	Supporting Research Questions	Main Research Question
- Students valued the ability to easily share e-books and exchange their thoughts and opinions about e-books through the Internet			How do students describe the use of e-books through their experiences?
- Most students shifted their preference to printed books when learning mattered			
- Enhancement perceptions	E-books can enhance learning, but can hinder learning as well	2- How do students describe the use of e-books in terms of learning enhancement and hindrance?	

Table 6 (continued)

Sub-themes	Major Themes	Supporting Research Questions	Main Research Question
- Hindrance perceptions			How do students describe the use of e-books through their experiences?
- Students valued being comfortable and confident when using e-books	The impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books	3- How do students describe the impact of prior technological experience, knowledge, and confidence on perceptions and decision-making associated with e-books?	
- Negative experiences with e-books could alienate future uses			

Table 6 (continued)

Sub-themes	Major Themes	Supporting Research Questions	Main Research Question
- Use of the e-book for general reading and the printed book when learning mattered	Students preferred to use the given e-book to the given printed book	4- How would students describe the use of the given e-book that contains demonstrative media, embedded features, and tests compared to the given printed book?	How do students describe the use of e-books through their experiences?
- Use of the e-book even when learning mattered			
- Students valued demonstrative media provided in the e-book: 3D images, animations, and audio narrations			

Table 6 (continued)

Sub-themes	Major Themes	Supporting Research Questions	Main Research Question
- Students valued features provided in the e-book			How do students describe the use of e-books through their experiences?
- Students valued self-testing approach and its' immediate feedback provided in the e-book			
- Changes associated with e-book's layout and functionality	Change to e-books recommended by students to better support learning	5- What changes to e-books do students recommend to better supporting their learning?	
- Changes associated with e-book's reader hardware			

All Students Valued E-books, but Nearly All Students
Still Prefer Printed Books

E-books reinforce students' ability to process and understand information faster and better, which is discussed in more detail in the research literature in chapter two of this dissertation. In this research, 20 graduate students from 11 different majors expressed their perspectives toward the use of e-books through their previous experiences with regard to the advantages offered by e-books, the features provided in e-books, the ability to search for external resources through the Internet, the ability to easily share e-books and thoughts and opinions about them through the Internet, and the format they prefer to use (e-book or printed book) when they are required to comprehend the information. The findings in this section were collected from the first phase interview and were significant in answering the first supporting research question, as well as the main research question.

Students Valued the Advantages
Offered by E-books

All 20 participants valued the advantages offered by e-books. While 19 participants indicated that they preferred to use e-books to printed books when they study, only 1 participant preferred to use printed books despite the fact that he valued e-books' lower cost. According to Larry, "I think e-books are good for so many reasons. Probably the biggest reason would be the price because they are cheaper than printed books. But, for me personally, I don't like them." He was laughing, then continued saying, "I feel like I don't want to read them that much. I think the reason is that I like to have the printed book in my hands and be able to highlight and write on it. I know I can do that in e-books! But I like the feeling of having the book in my hands." When the 19 participants were asked to generally describe their experience with the use of e-books,

they expressed positive experiences by listing 16 advantages they valued in e-books.

Table 7 shows a list of e-books' advantages mentioned by the participants and the

corresponding number of frequency.

Table 7

List of E-books' Advantages Mentioned by Participants and the Corresponding Number of Frequency

Advantages	Frequency
Cheaper than printed books	14
Immediate accessibility	11
Easy to carry	9
Convenient	5
Interactive	4
Access to external resources	3
Visuals	3
Easy to manage	2
Efficient	1
Easy to organize	1
Recall last page viewed	1
Space saver	1
Time saver	1
Social interaction	1
Intuitive	1
Self-test	1

Ahmad's response to the question was, "I like e-books. They are easier to reach, more convenient, and way cheaper than printed books." Dana provided a very similar response to Ahmad's. She said, "I like to buy e-books because they are cheaper and easier to obtain compared to printed books." The lower price for which e-books often are offered is a major influence to Nadin. As she stated, "I usually buy e-books because they are cheaper than printed books. Sometimes I'm required to read books for classes that cost up to $300 each. I can't afford that as a student. In these cases, I end up buying the e-books version because it's cheaper." The convenience of carrying e-books influenced Nadin to plan to bring all of her e-books with her when she goes back to Libya. However, it is important to denote that she might exceed legality restrictions by printing all of the e-books she has. She explained,

> E-books are easier to carry. For me as an international student, I'm planning on bringing all of my books with me when I go back to Libya. If I'm going to do so with my printed books, it is going to be a very difficult and expensive. So, I decided to have an e-book format of every printed book I need in order to bring them with me when I go back home and then print them when I'm there.

Frances said, "E-books are the best way to go. I like the fact that they are cheaper than printed books or even free. I also like myself being able to interact with the books themselves. They are very efficient. I can highlight, write notes, and imitate what I can do in printed books." Frances also valued the ease of accessibility where she can obtain e-books in various locations. Table 8 shows the places where participants have read e-books and the corresponding number of students who mentioned them by frequency. Frances stated,

E-books are more efficient, more convenient, and easier to access compared to printed books. I can read e-books anywhere, i.e., in the class, at home, at my work, while sitting in my car waiting for something or someone, and even in the doctor's office. And as a student, I don't want to carry around all the heavy printed books wherever I go.

Table 8

List of Places Where Participants Have Read E-books and the Corresponding Number of Frequency

Locations	Frequency
Home	19
School	15
While traveling: airplane, car, train	6
Library	6
Coffee shop	6
While waiting: in the car, bus station, doctor's office, airport, grocery store	5
Office	4
Bus	3
Lab	2

Similar to Frances, Jamal said, "I like e-books. I think they save my time and money. I adore the ease of accessibility e-books have. I mostly read e-books at home. And sometimes I read them in the class, library, and in the coffee shop." Qiu said, "E-books are great! They are convenient and easy to access. I can read them anywhere and during anytime. I've read e-books in the class, at home, and while traveling, like in the plane and train." He added, "E-books are easier to obtain and to carry compared to printed books. And I can find as many e-books as I need online. And I can get them in

seconds." Evelyn pointed out several advantages, such as money saver, immediate

accessibility, interactivity, access to external resources and visuals. As she stated,

> E-books are really nice. I like them so much. They are money savers, so when I'm not sure about a class I can buy a chapter at a time. And one of the major draws for me is having access to web clouds so I can read my e-books wherever and whenever I want. I've read e-books pretty much everywhere other than driving, like at school, home, in the bus and while waiting for it to arrive, and when I'm standing in line at the grocery store because the person in front of me was taking forever. I also like interactive e-books. I mean in printed books you only read what is only available in that book. But some e-books include links for additional information, videos, and other stuff that provide good explanations of the material. They are like good supplements, but I don't think that a lot of students take advantage of them. Most of them buy e-books because they are cheaper.

Benjamin's response was, "I had good experiences with e-books. I found them

very intuitive. . . . I like the idea of having as many books as I want in my laptop and read

them wherever I'm. I've read e-books at school, home, and airport." Eric said, "I like e-

books. They are cheaper and easier to manage compared to printed books. It is definitely

nice to have one device that includes multiple books. Rather than carrying a bag full of

books." He also valued the immediate accessibility e-books offer. As he added,

> In fact, I don't regret carrying my Kindle with me if I did not read any books. But, if I carried my heavy books and I did not read them I feel so bad! I usually read e-books at the library, home, and coffee shops. And sometimes I carry my Kindle with me while I'm traveling in case I want to read some books. And I like the fact that when I buy an e-book I'm able to immediately download it instead of waiting for it to be sent to me through the mail and wondering the whole time whether I'm goanna get it before the class starts or not.

Asya listed many advantages that influenced her to buy e-books, such as the price,

space saving, easiness to carry, immediate accessibility, and provision of visuals and

social interaction. Asya stated, "I don't do e-books that much but I buy them when I

cannot afford the printed ones because e-books are cheaper. Also when I'm not sure if I

want to keep a certain book, I buy the electronic one so when I'm done I just delete it and

I don't have to deal with the book in my shelves." She added,

> Some textbooks are so heavy and difficult for me to carry wherever I go. But when it comes to e-books, I can just go online and read my book through any technological device that I have in hand. And I can read it wherever I'm, like at the school, home, bus, and while traveling. I like that about e-books. I also like the interaction aspects in e-books like when some e-books give links that take readers to videos and visuals related to the content. And there are some e-books that display peoples' opinions about each chapter on the side of the screen. In other words, it is like when I'm reading a chapter and I want to know what others think about it, I just click on a button to flip a page that takes me to reviews and opinions of people who've read the chapter. These reviews and comments make reading more interesting and often make me look at everything differently.

Iman, as an international student, valued e-books because she can carry them with her when she visits her home country. As she stated, "E-books are really great. They help me to study anytime and anywhere I want." Iman added, "And I travel all the time between the United States and Iran and I can't carry even one printed book with me. But I can carry as many e-books as I want in my laptop." Angela valued e-books because she can organize her study materials with e-books better than with printed books. As she said, "I love e-books! I'm not good with organizing papers. I don't like keeping printed books. I found myself much better with e-books because I'm more able to categorize and organize all of my study materials when they are electronic." Isabella preferred to read e-books because of their low prices and because she could recall the last page she was reading. She stated, "A lot of times I end up buying e-books because they are cheaper than their printed format. That's the big part of it for me." She added, "I also like e-books that can remember the last page I read. For example, if I was reading an e-book and I stopped for some reason, when I come back to resume my reading, it shows the same page that I was on the last time. I like that!" Lisa valued the use of e-books through

Macmillan Launchpad because of various aspects. Macmillan Launchpad is a resource

that aims to help students achieve better learning results by providing them a website

where they can read interactive e-books that include multimedia features, self-tests, and

social interactions features. As Lisa stated,

> I like to read e-books more because of Macmillan Launchpad. I use them when I study for an exam and when I teach classes for undergrads. I just love it! As a teacher assistant, I've never used printed books. The e-books I'm using when I teach are very interactive, can test you while you are reading, and have videos and extra resources. I really appreciate these things! And when I'm trying to figure out how to explain a concept or something to the students, I just bookmark it in the e-book and pull it up while I'm in the class. I also like the fact that I can carry my laptop that has my e-books instead of carrying a bunch of big and heavy books.

Students Valued Features Provided
in E-books

All 20 participants indicated their use of features available in e-books. When they

were asked to list the features they usually used when reading e-books and believed they

contributed to their learning, each participant provided one to five features. Figure 9

shows the features used by participants when they read e-books and the corresponding

number of participants mentioned them by frequency.
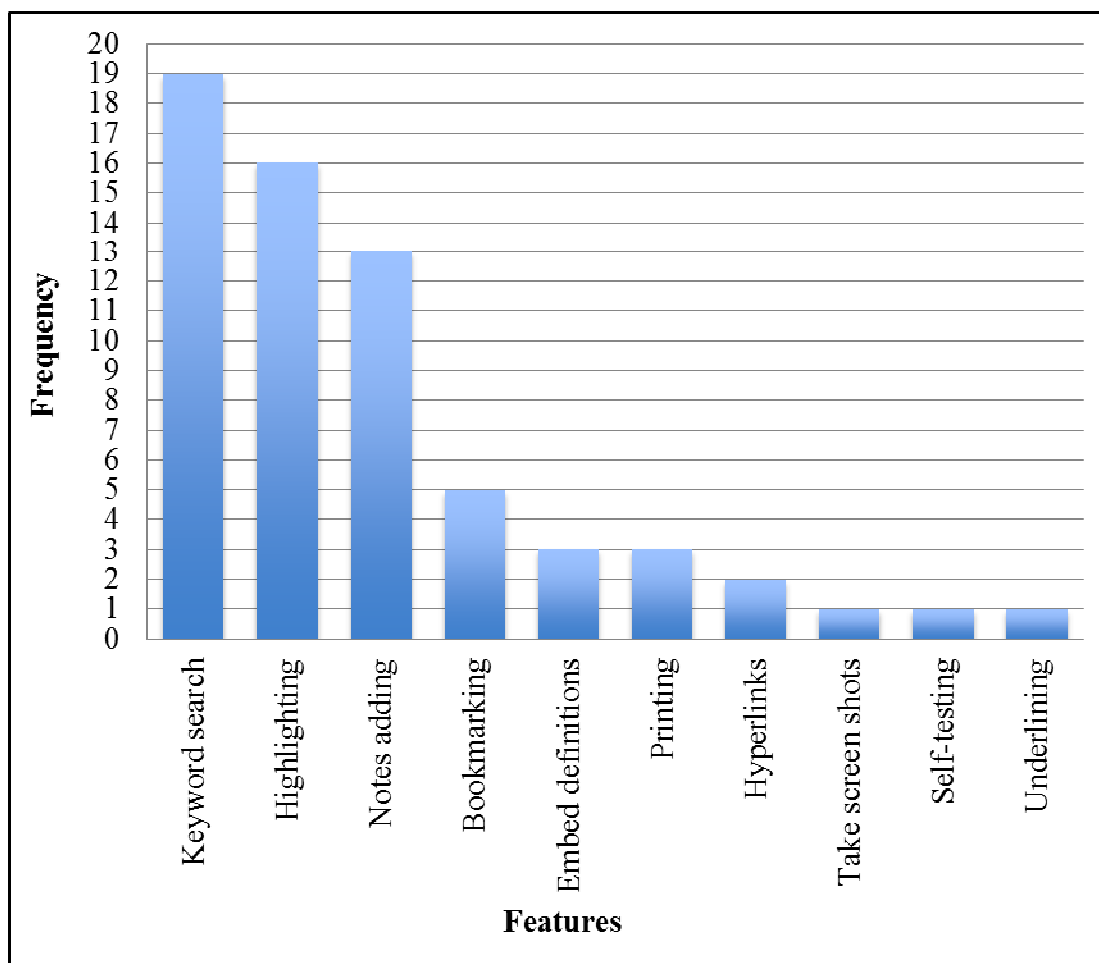
Figure 9. E-books' features used by participants while reading e-books and the corresponding number of frequency.

Participants listed the features they like to use when reading e-books, and referred to some of them as the ones with the most contribution to their learning. Jamal stated when indicating the value of using the keyword feature, "The best thing in e-books is the keyword search. So when I'm looking for something specific, I can find it in no time. If I do so in my printed books, it is going to take me forever." Similar to Jamal, Angela said,

"I like to highlight in four different colors. I add notes and comments. I bookmark the pages. I search for keywords." She further explained,

> A lot of times when I had a scientific lab and have to understand a diagram and then give a critical analysis for it, I search for keywords related to that diagram and then go back and reread and work on my processing skills to make sure I fully understand the information. So for me, the ability to search for specific words or terms really helped me to learn efficiently.

Ahmad listed a number of features, but he mostly valued the keyword search feature and the ability to take screen shots. As he explained, "I add notes, highlight important paragraphs, and use keyword search. I always need to search for certain acronyms, words, figures, or charts. And because it is easier to search through e-books, I have an electronic version of every printed textbook I bought." He added, "I mostly like capturing screenshots of figures and pictures in my e-books instead of scanning them from printed books where I often ended up with figures with low quality." Frances also listed a number of features, but she mostly valued the access to external resources through hyperlinks. As she stated, "I like to do highlighting, notes adding, and I really like having access to additional information through links. Like having links to videos, images, dictionary, or other websites that provide me with more information." Evelyn provided a very similar response to Frances's. As she stated,

> I mostly like to read additional references while I'm reading e-books. I like to click on the links available in the e-book and explore what other things I can get advantage of. I mean I can't search for what I don't know, because I don't know what I don't know! Like when I read a printed book I have to infer the meaning to be able to search for additional resources. But in e-books, I just click and BOOM it's there.

When participants were asked if they believed these features helped them to feel more confident and comfortable when they use e-books, all 20 participants provided positive responses. Larry indicated that the use of these features allowed him to do

activities he usually does when reading printed books. Thus, his comfort level increased

when reading e-books. Larry explained, "When I read an e-book that has no features, I

don't like it. These features make me feel more comfortable and open about reading e-

books. Because I want to do things that I like to do in my printed books." Iman also

provided a similar response to Larry's. As she stated, "These features allow me to do

some of the things that I like to do in my printed books. Such a thing makes me feel more

comfortable." She added, "The keyword search is very important feature. It makes

searching through the contents easier. When I use it, I feel more confident about myself

being able to find whatever I want." Lisa also said,

> I don't like e-books that don't have that much of features in them. To me that's frustrating. Because when I read my printed books I like to highlight and add my notes. I appreciate the fact that when e-books offer features that allow us to do things that we like to do, and to do things that we cannot do in our printed books. With these features e-books go above and beyond printed books.

> Maimunah limited her use to e-books to the ones that offer these features. She

pointed out that these features reinforced her adaptation to e-books. Maimunah explained,

> I like e-books when I can do some stuff like highlighting and keyword search. Unfortunately, some of them don't allow us to do anything expect reading because they are just electronic copies of their printed format. In that case I don't like to use e-books. These features help me to adapt to e-books. I mean when I use an e-book with these features, I feel like I can do everything I usually do when I read a printed book, and more.

Students Valued the Ability to Search for External Resources Through the Internet in E-books

Participants indicated that they liked to take an advantage of the ability to search

for external recourses (e.g., images, videos, additional information, and translations)

while reading e-books in order to obtain a better understanding. In addition, six

participants pointed out that the ability to access external information while reading

e-books motivated them to do so. On the other hand, they felt "lazy" and "less interested" to search for additional information on the Internet while reading printed books.

Table 9 lists the websites participants accessed to obtain additional information while reading e-books. It also shows the number of participants who mentioned such websites. Table 10 shows the type of information participants search for while reading e-books and the number of participants mentioned them. Finally, Table 11 lists the reasons for why participants search for external resources while reading e-books and the number of participants mentioned them by frequency.

Table 9

List of Websites Participants Accessed to Obtain Additional Information While Reading E-books and the Corresponding Number of Frequency

Websites	Frequency
YouTube	12
Google Images	10
Google	8
Google Translate	7
Google Scholar	1
School's library website	1

Table 10

Type of Information Participants Search for While Reading E-books and the Corresponding Number of Frequency

Type of Information	Frequency
Images	15
Videos	14
More information about specific topics	7
Translations	7
More resources	5
Animations	1
Charts, figures, and tables	1

Table 11

List of Reasons for Why Participants Search for External Resources While Reading E-books and The Corresponding Number of Frequency

Reason	Frequency
Help me to better understand the material	12
When the content is too complicated	6
When the e-book didn't provide enough information	5
Be more able to remember it	2
Visual / auditory learner	2
Give my brain a break	1
Reduce my cognitive overload	1
Scaffold my understanding	1
To widen my learning opportunities	1

When participants were asked: While reading e-books, have you ever searched for external resources (e.g., images, videos, etc.) that could explain the content? If yes, how and why? If no, why not? Eighteen participants provided positive responses. Larry, one of the two participants who said "no," explained,

> I've not searched for additional information while reading my e-books because I've never felt like I needed it . . . the e-books I've used were for developmental psychology that talk about the different stages people go through, and I didn't feel like I need more information on that. But if my e-books were about a neuropsychology class, for example, that talks about different structures of the brain, I bet I would need to search for more information on such a topic.

Asya responded, "Yes, I do it all the time. I'm a visual and auditory learner. When I'm reading something I give my brain a break by searching for images and videos that would make it easier for me to understand and, later, remember the content." She further explained,

> You know, doing such a thing reduces my cognitive overload. When I read something that is too complicated, I look for images or videos that can scaffold my understanding. And as an international student, I search online for the meanings of some words. . . . When I'm reading printed books I feel lazy to search online for additional information. Actually, when I stop my reading and move to a computer to search about something I might lose my concentration. So, I would just give assumptions, like assuming the meanings based on my understanding of the reading. But when I read e-book, it is easy for me to shift to any website and know what exactly I need to know.

Frances stated, "Yes. If images and videos are not available in the e-book, I search for images and videos in Google images and YouTube. And I like being able to go to Google and look up more information right then and there. It helps me to understand the material in depth." Nadin stated, "I've searched for videos in YouTube. I've also searched through Google Scholar for additional resources. And I always use Google Translate to translate some words while I'm reading e-books." Jamal also said, "Yes, I do that a lot! Oh my God, it is the best thing to do. . . . As a second language speaker, I like

to use e-books when I want to translate a word, sentence, or even a paragraph. I can just

copy it and paste it in Google Translate." Jamal also shared one of his own experiences

with searching for external resources as an example. He added,

> And when I don't understand a concept, or an idea, I just copy it and paste it in
> Google Images or YouTube. I end up with very helpful images and videos. For
> example, this semester I'm taking a class about the case study design. And a
> number of days ago, I wanted to understand what exactly a case study means and
> know its different types. So, I searched through YouTube and I found many good
> videos that explained exactly what I needed to understand. They were very
> helpful!

Wang also shared a very similar experience to Jamal's. As he said, "I like to copy

from e-books and paste it in Google Translate to translate words, or in Google to get

more information. And when I don't understand a theory or an idea that I'm reading

about, I search for a video that can explain it in YouTube." Benjamin stated, "Sometimes

when I read about scientific subjects, there are a lot of technical words that I may not be

able to understand. I've used Google many times to search for additional information,

images, and videos that can help me to understand the material." Dana responded,

> Yah! I've done it many times like when I read a term that is hard for me to
> understand. As an international student I like to type it in Google Translate to
> translate it to my native language. If that's not good enough, I go to Google
> Images and see what it means through pictures. I also like watching videos on
> YouTube. I'm a visual person, so when I watch a video or a picture about a topic,
> it sticks in my mind for really long time. And I feel like I can understand things
> more when they are explained in visuals, than in text only.

Similar to Asya, Nadin, Jamal, Wang, and Dana, Iman and Mishary valued the

ability to search for translations while reading e-books. Moreover, Iman and Mishary felt

too "lazy" to search for additional information through the Internet while reading printed

books. Iman indicated that she would mostly likely, "copy a word, or even a paragraph,

and paste it in Google Translate. And I've used Google Images and YouTube to find

some helpful images and videos. Especially when I'm reading about something new to me." She paused, and then added, "It's really helpful to see things explained in images or videos. I feel lazy to translate a word or look for visuals while I'm reading printed books. I usually do it only when I'm very curious or I must do it to be able to move forward with my readings." Mishary stated, "I've searched for images and videos in Google Images, and YouTube. I've also used Google Translate while reading e-books. When I read printed book I just use my assumption because I'm a very lazy person." He started laughing, and then continued, "But, when I read e-books, I feel like I want to explore the world and widen my learning opportunities. . . . Looking at images or watching videos are very helpful and better than just using your imagination or assumption."

In Lisa's response, she reflected on her perspective and experience of being able to access external information while reading e-books. She stated,

> I like it when I can watch videos right then and there while I'm reading e-books. Some printed books give links to videos and external stuff, but I usually don't feel that interested to turn my computer on, type the link, and watch whatever I need to watch. And sometimes, when I plan to see what this link is about when I'm done with the reading that I have in my hands, I just forget about it . . . I feel more motivated to search for external resources, images, and videos while I'm on my computer reading e-books, like, for example, today I was reading about Parenting Styles in my e-book reader device and the book was missing an image. So, I was able to find it in Google Images in seconds, and then went back to continue my reading. It is pretty easy to do that when I read e-books because of the ease of being on the Internet already. But when I read printed books, ugh! I must go through extra steps that I don't usually want to do.

As opposed to printed books, Ping believed that it is easy to, "switch to Google and look for images, videos, or additional resources while reading e-books. But, it is a complicated thing to do when I read printed books." She further explained, "I mean when you read your e-books, you are able to understand things better with one click. But when you read printed books, you learn only through what is in that book."

Isabella reflected on her own experiences with accessing external information while reading e-books. She stated, ". . . like when I'm reading about a theory in an e-book that did not explains it very well, I switch to Google and look for more helpful information. Or when an e-book mentions a study that seems interesting to me, I would go to the school's library website and look for it." Isabella also indicated that reading e-books motivated her to search for external information. As she explained, "I feel motivated to search through the Internet for additional information when I'm already on my computer reading an e-book. When I read a printed book and my computer is cross my house, I don't feel like I want do it."

Ahmad stated that while he was reading an e-book, "on the iPad or the computer, I switch to Safari and search for pictures, charts, figures, and tables through Google. Then, I go back to complete the e-book reading on the same screen." Ahmad believed reading printed books diminished the ability to widen learning opportunities. As he said,

> When I read printed books, there are no additional options to the materials offered by the book itself. I mean I usually feel lazy to turn my iPad or computer on just to search for a picture then turn it off . . . I like the fact that I can search for anything on the device while I'm reading an e-book. In fact, when I search for external resources while I'm reading an e-book, it could take me to another e-books, like when I search for a picture, and I click on it, it takes me to a copy of a page from another e-book that I often ended up reading.

According to Evelyn, it is easier to understand abstract concepts through animations. As she said, "I search for interactive graphics when I read about abstract concepts where I feel like I don't have any idea what the e-book is talking about. So, having an opportunity to see these abstract concepts explained in motion through these moving images is great!" She added, "and during the class when the instructor is trying to

draw a process or a procedure as a picture on the board. Most of my instructors are not

good artists!" She started laughing, and then continued on saying,

> It is hard for me to understand everything drawn on the boards. So, I check the
> chapter in my e-book hoping to find the same picture my instructor was trying to
> draw. If not, I just copy the name of the process or procedure and paste it in
> Google and search for the image and then say, "Oh, that's what this is about!
> That's not what I thought" . . . And if I were having a printed book at that time, I
> would not be able to search for that image through the Internet.

Students Valued the Ability to Easily
Share E-books and Exchange Their
Thoughts and Opinions about
E-books Through the Internet

The findings denoted that 16 participants have shared e-books, or parts from e-

books, online and 14 participants have shared thoughts and opinions about e-books

online. Conclusively, all 20 participants valued the ability to easily share e-books through

the Internet, and its positive impact on one's learning.

Students shared e-books online, even if it was illegal. When students were

asked whether they have ever shared e-books, or parts from them, with others through the

Internet, 16 students stated that they have shared e-books with friends, educators,

classmates, family members, and colleagues, via email, Google Drive, WhatsApp

application, Facebook, Twitter, AirDrop, and other sharing accounts. Dana said, "Yes

I've shared e-books! Like when some of my classmates and I planned to do the

comprehensive exam around the same period of time, we shared many useful e-books to

support each other." Ahmad also stated, "I've shared e-books via emails many times, like

when I work with a group on a project we share a lot of e-books. And when I find an

electronic version of a textbook that we use for a class, I usually share it with my close

peers." He added, "Sharing printed books is not that efficient or easy. Sharing printed

books is limited to a few number of books and also requires a face-to-face meeting in order to hand them over." Jamal's response was, "My friends and I, always share e-books via emails, WhatsApp messenger, Facebook, and Twitter. I like to share e-books, or pieces of information from e-books, with people whom I know they would benefit from them."

Saving money was one of the major influences that motivated students to share e-books, even if it was illegal. In fact, participants indicated they shared accounts in order to share e-books cost and save money. As Talal said, "I've shared my account with some of my classmates because we like to share the cost of e-books that we can not afford." Mishary and Frances also indicated that they shared accounts with others. Mishary stated, "I've sent some e-books to classmates. And one of my friends in a class gave me his username and password of his iBooks application. I was able to access his electronic library and read whatever I want for free." He paused, and then hesitantly added, "I know that it is illegal, but I don't have a lot of money to spend on books. And some of the textbooks are really expensive. I mean these books are meant to be for students! Why would they be offered in such high prices?." As for Frances, she said, "Yes, I've shared e-books even though it was illegal." She was laughing, then continued on saying,

> So, every time when I find or use e-books I share them with family members and friends. We share accounts too! So, I can log in with their information, and by that way we don't have to all buy the book again and again . . . I always share e-books with anyone needing it, especially for the expensive ones! We are students and we don't want to spend a lot of money!

Wang, Qiu, and Ping have shared e-books with their students. As Wang said, "I've shared e-books with my colleagues and students via emails and AirDrop." Qiu also said, "I always share e-books via emails with friends, classmates, my students and their

parents, colleague, and family members." Ping stated that she shared e-books, ". . . all the time. I share them with everyone I know through emails and AirDrop in my iPhone and iPad. I also used to share e-books with my students when I used to teach in China."

Students shared thought and opinions about e-books online. When students were asked, "Have you ever shared your thoughts and opinions, i.e., recommendations, complains, descriptions, about e-books with others via the Internet?," 14 students stated that they have shared their thoughts and opinions about e-books with advisors, friends, students, and classmates. According to Dana, she always discussed with her advisor, ". . . the e-books that I want to use in my research. So, I sent the e-book with my thoughts and questions. Then he would reply with answers and, sometimes, with other thoughts. . . . In many cases, his thoughts helped me to look at things differently." Asya reflected on her own experience and said,

> I remember one time I was reading something about HTML for a class and it was a very difficult topic. And I was supposed to build a website with one of my friends in the class. And I was using an e-book that shows the steps in details on how to build a website. So, I took a screenshot of these steps and sent it to my friend and we discussed them online while we were creating the website. . . . I know I can take a picture of a printed book and send it, but the quality won't be that good and honestly I would feel lazy to do it.

Jamal stated that he had taken, "a paragraph or a page from an e-book and sent it to a friend from a class to discuss it online and say, 'this is what the professor was talking about in the class', or 'what do you think of this part?'" Mishary provided a very similar response to Jamal's. He said, "I've took screenshots of some stuff I've read in e-books and sent them via email to some of my classmates. They are mostly related to assignments or something we've discussed before in the class." Lisa indicated that she usually, ". . . take copies of parts from e-books and publish them in the Blackboard in

order to discuss them with other students. I've done it as a student and as a teacher

assistant." Angela also stated, "I've taken screenshots of quotes, figures, and diagrams,

and shared them with other classmates when they ask questions on Blackboard."

Evelyn shared her experience with social interaction regarding e-books in details.

She stated,

> I had an e-book for a class and there was a forum at the end of each chapter. It was like a discussion board where the instructor could take an advantage of it. The forum was actually linked to the material and students were able to kind of semi-teach sections of each chapter. Each student picked a topic and then explained it and provided additional information about it in the forum. Students also were able to ask questions and other students were able to address them. I liked it! The class was a programing class and there were some topics that were hard to understand. We used the social interaction through that forum as a way to teach each other and explain complicated parts or why it's better to use that way over another one. It was not really similar to a class discussion, but beyond that. It was perfect for students who are not comfortable with asking questions in the class. Also, we were able to track each other's work because all the class was reading the same e-book online. All of our notes, comments, and questions were linked to our subscription of the e-book. So, I can ask a student, "why did you do this?" and say, "you should do that instead." We can't do such a thing in printed books because each one have his or her own ones. It was more like a community learning thing, instead of just reading an e-book.

Students believed on the positive impact of sharing e-books and thoughts about them through the Internet on learning. When participants were asked, "Do you believe that the ability to easily share thoughts and opinions regarding e-books and their content through the Internet contributes to individuals' learning?," all 20 participants provided positive responses. Isabella said, "I believe the increasing share-ability of e-books increases ones learning, like if you and I were in different countries and I want you to read an e-book today, I can send it online and have you read it right away. We can't do that with printed books." She added,

And it's easy to access e-books. I remember one time when I was at the middle of a discussion in a class, and I wanted to share something really good that I read on my e-book. So, I pulled it from my iPhone and read it to my classmates. I know I did not share it online, but I was able to pull it online and eventually share it with my classmates. If it was a printed book that was not with me. It is going to be impossible to do such a thing.

Asya reflected on her own experience and said, "One time I was in the bus and a friend sent me an e-book, and said, 'Hey this book talks about the same topic you're searching about.' And I was able to open it through my cell phone and read some of it." She also explained, "I didn't have to wait until I have the physical book in my hands to learn about something, or wait until I meet my friend to discuss the book face-to-face." Eric stated, "I've not shared e-books before because no body asked me to do it. But, I believe e-books add to students' knowledge in this case . . . I mean it is great that students can refer to some books through the Internet and read them online." He added, "Students can take parts from e-books and discuss them online instead of scanning the printed book or waiting until they meet in class, for example. I believe students would feel more motivated to discuss things that way." Benjamin provided a similar response to Eric. He stated, "I haven't shared e-books before because I don't use them that often. But, I think it is great to be able to identify certain subjects in e-books and allow students to discuss them and study with one another instead of waiting until they meet face-to-face."

Lisa, as a student and a teacher assistant, believed sharing e-books and thoughts and opinions about them can, "spread knowledge among students and help them to learn better. I wish all of my students help each other by sharing their ideas and thoughts about their required reading. I think that's why I like to share figures, videos, and images from e-books with my classmates and students." Frances's response was, "Yes, without a doubt. For example, if you can't understand a concept that you can address immediately,

someone can assist you with gaining that knowledge in a different way and change your

understanding of it." She further added,

> If you were reading a printed book on your own, then you have no other resources
> and miss out the whole other ability to gain more knowledge. If you are able to
> interact and share as you are processing the information, you are going to
> understand it better and keep it for so much longer. I mean when you have a
> conversation about a piece of information, it is going to have a value to you.
> Where as if you are reading a printed book by your own at your home, it would
> not be that meaningful. . . . You can communicate face-to-face with others while
> you are reading a printed book, but it's kind of complicated! I mean, when you
> read an e-book you can communicate whenever and wherever you want, right? I
> think being able to share thoughts or share the e-book itself through the Internet is
> a major enhancement.

According to Larry, providing people with accessibility to knowledge, ". . .

combined with other's opinions and different perspectives would solidify their existing

knowledge. Or it could add something new, like filling a missing link or something

through these different opinions and perspectives." He added, "I think these activities are

more supported by e-books than printed books. Because sharing and discussing printed

books are more complicated." Wang reflected on his observation on students' discussing

e-books online. As a teacher, he always requires the students to, "discuss their readings

through a system similar to Blackboard. I send them an e-book, they read it, and then

they share their thoughts and questions online. I've seen some of my students teach each

other. I like that!" Wang also reflected on his experience as an online student. He

explained,

> I've learned from my fellow students when I joined one of the International
> Baccalaureate online programs. So, in the program there were students from all
> over the world. The program instructors usually sent us materials from e-books
> online every week. So, we have to read them and then discuss them online as
> well. We were also required to read and comment on other comments. To be
> honest, I've learned a lot from other students' opinions and not only from the
> program instructors.

Ahmad stated, "I believe e-book expedites learning. I remember when my friend and I spent hours looking for a piece of information in one printed book. And there was another time when I was in my home searching through 10 to 15 e-books, and when I found what we needed I shared it with him via email." He added,

> The ability to share e-books and personal opinions about them through the Internet facilitates and eases the process of transferring knowledge. As a graduate student, I need to collaborate with my peers and share thoughts and talk about research stuff. Like when I read something that is related to what we study I like to share it and see what my peers think about it. To me, it is better and more motivating to do it electronically.

Mishary believed students, ". . . feel more motivated to share and discuss e-books because they are able to do it whenever they want and wherever they are. Unlike e-books, sharing and discussing printed books are limited." Jamal stated regarding sharing e-books, "with people around the world is a big deal. When I read an e-book that I know my friend will find it helpful, I want to be able to send it right away and so he can benefit from it as soon as possible no matter where he is." Jamal provided one of his own experiences as an example. He said, "I remember one time I had a discussion with a classmate and we had a difficult time trying to understand some concepts. After the class, he sent me some e-books via email. We discussed them online for days and helped each other to fully understand these concepts." Angela also reflected on her own experiences. She stated, ". . . like when I shared a scientific diagram with my classmates, I just copied the diagram and posted it in the Blackboard. It had the reference included along with the visual itself. It's great to be able to have discussions in such a higher level." She further added,

And the clarity of the diagrams taken from e-books allows others to process the information better. I can take a picture of a diagram in a printed book but it won't have the same resolution. And it will be kind of hard to understand it because the details won't be clear enough. It is also complicated to take a picture with my phone camera, download it to my computer, and then share it. I don't feel like I want to go through this whole process.

Most Students Shifted their Preference to Printed Books When Learning Mattered

When participants were asked if they still prefer to use e-books if they were required to fully comprehend the information, like studying for an exam, 13 participants from the 19, who preferred to use e-books, shifted their preference to printed books. Those 13 participants provided 21 reasons that could explain the alteration in their preferences. "I like the feeling of the printed book in my hand," "I like to handwrite write notes on printed books." "I'm more used to printed books," and "I feel more comfortable when I hold printed books" were the most common responses. Table 12 presents the reasons provided by participants along with the corresponding number of participants who mentioned them by frequency.

Table 12

Reasons for Why Participants Shifted Their Preferences to Printed Books and the Corresponding Number of Frequency

Reasons	Frequency
I like the feeling of the printed book in my hand	11
I like to handwrite write notes on printed books	9
I'm more used to printed books	8
I feel more comfortable when I hold printed books	8
I feel able to focus on the content	6
I can better locate the information in printed books	5
I like to draw on printed books	5
It feels more easier to use printed books	5
I can better locate myself in printed books	4
I like flipping the pages	4
I like to highlight on printed books	3
I feel I can better recall information	2
The light of the screen hurts my eyes	3
I like the smell of printed books	2
Feels more personal	1
I feel more confident about my ability to understand the content	1
E-books reader battery might go out of charge	1
The pages in e-books reader might freeze	1
Fits my studying style	1
I like to feel the texture of printed pages	1
Printed books make me feel more secure	1

Asya was sure about her preference, yet skeptical about the reason. As she stated, "I definitely prefer a printed book for that kind of studying. Maybe because I'm a librarian and I like flipping the pages of printed books." She was laughing then continued on saying, "Or because I can write on printed books and doodle myself on the side of the pages. And whenever I need a piece of information, I can pull it out faster. But I can do that in an e-book too!" She paused, then while looking hesitant she added,

> I don't know why! I mean, I can use the keyword search and add my notes electronically. But I like having the printed book in my hands. I like flipping the pages, writing my stuff on them, and it is more personal. The printed book feels like yours. Maybe because I'm more used to printed books! Because I just start using e-books about 7 years ago, which is not that long.

Ahmad's response to the question was, "When I do research, I like to go a cross multiple books that I would rather to read electronically. But when it comes to studying for a test, I need the printed book so I can put a lot of my focus on the content. I don't know why!" Ahmad further explained, "Maybe because I feel more comfortable when the physical book is in my hands." Jamal took a very deep breath and said, "OK, OK! I like to use e-books for skimming and general reading because it is easier to find things in e-books. But when I want to concentrate and make sure that I fully understood the content, I prefer printed books." While laughing, he continued,

> I don't know what the exact reason is! Maybe I'm an old fashion person or something. . . . When I hold the book in my hands and touch the papers, I feel I'm better able to understand the content. I feel more confident about my ability to understand the information. And I feel like I'm able to read every sentence. I think that I'm more used to printed books because I just start using e-books recently. Maybe what I need is to give myself sometime and force myself to patiently read more e-books.

Benjamin said while shaking his head, "No, no, no! In that case I need a printed book. I grew up reading printed books. So, it is easier for me to have a physical book in

my hands so I can flip the pages back and forth, and highlight." He paused, then added while staring at the ceiling, "Oh yeah! I can do that in e-books. Well, I think it is the physical aspect to it is what makes information sticks in my mind. And being able to write in it makes it more handy to me." Iman was mostly concerned about her comfort and eye strain. She indicated that she preferred printed books because, ". . . printed books make me feel more comfortable. And when I read e-books for a long time, the light of the screen hurts my eyes. The eye strain is a big deal for me." She also explained,

> I like e-books, but printed books make me feel more comfortable and feel like it is easy to do things that I like to do when I study, like highlighting for example! I highlight my e-books but I don't know why I like doing it more in my printed books. And when I study, I like to handwrite on my printed books, and draw circles on important stuff. I can't do these things with e-books! . . . It could be because I'm more used to printed books! I'm 31 year old and ten years ago I was not using any e-books. I just started using them like four years ago for my graduate studies.

Eric had a similar response to Iman's, as he said, "The printed books don't hurt my eyes. You know what I mean? Staring to the light of the screen for a long time really hurts." He further stated,

> I like the feeling of the printed book in my hands. It is easier for me to read printed books because I can easily flip through stuff and I like being able to physically flip pages. For me when I read my printed book and wrote a note somewhere, I can remember it and I can easily go back to it. But, it is hard for me to do so when I read an e-book. . . . When I read printed books I don't have to worry about charging the device. Or whether the page is going to freeze or not because I go back and forth so much! When I read e-books for a long time, the reader device freaks out and then I have to reset it.

Maimunah indicated that she liked to print pages from e-books to be able to comprehend the information. As she stated,

I prefer printed books. I feel more comfortable having physical papers in my hands, even if it's just few pages. Sometimes I have to print pages from e-books to be able to fully understand the content. I think I do that because I get tired easily from staring at the computer screen. And I guess having physical papers to write whatever I want on them is more convenient to me.

Similar to Maimunah, Nadin printed out the pages that she wanted to fully understand form her e-books. She said, "I usually read e-books when I want to skim through the material. But when I aim to study for an exam and try to understand everything, I prefer printed books. Sometimes when I read e-books and want to fully understand some pages, I print them out." She further explained,

> Because when I study, I like to do some stuff like highlighting or writing and drawing on my books. And I feel more comfortable when the book is in my hands because I can flip the pages and locate myself in the book while reading. On the other hand, when I read e-books through a single flat screen, it makes me feel unorganized. I believe that printed books fit my studying style more than e-books.

Ping stated, "When I study for an exam or something like that, I prefer to use printed books. Because . . . ." She paused, and then hesitantly continued, "I don't know how to explain it. Because when it comes to studying for something serious, I prefer to have the physical book in my hands and smell it." She started laughing, and then said,

> I like the smell of printed books. It makes me feel more comfortable and knowledgeable. I like to feel the texture of printed pages. And I like that I can flip between the pages and be able to locate my reading! I mean when I read printed books it is easier for me to switch between different pages and different information. Don't get me wrong, e-books are great I love them! I think I like to use e-books when I want to do general reading like preparing myself for a class. But not for an exam.

Dana stated, "I read e-books just when I want to do a general reading or a quick review on the content. And if I like the book I would buy the printed format. Because if I like it, I will keep it." She further said, "And when I study for an exam, I prefer printed books because it's who I am! I mean I like to smell the pages, hold my pen, write notes,

and even draw on my printed book when I study. I don't know why doing these things helps me to understand the content better." Dana also indicated that she felt more secure when she used printed books. As she explained, "I feel more secured when having the book on my shelves. I also feel secured when I have my notes written inside the printed book. When I write my notes in an e-book, I feel like I might lose them. In fact, sometimes I feel I might lose the whole e-book." Finally, I would like to include my thoughts and reflections I wrote in my journal. I wrote:

> It's interesting to see how students express comments that make feel like they will go with e-books all the way, and then suddenly, they don't want to use them. They express skeptical facial expressions and responses regarding e-books. A number of students did not know exactly why they don't want to use e-books. They pause, and take a fair period of time thinking about it. They keep saying, "I don't know," "It's embarrassing that I keep changing my mind," "I don't want to confuse you." To me, it seems they are confused about the real reasons why they don't like to use e-books.

<div align="center">

**E-books Can Enhance Learning, But
Can Hinder Learning As Well**

</div>

The findings denoted that participants believed e-books could enhance learning in various aspects, but they could hinder learning as well. The following paragraphs report students' descriptions of their perceptions toward the use of e-books in terms of supporting or hindering learning. This section of the findings was collected from the first phase interview and contributes to answer the second subsidiary research question, and the main research question.

Enhancement Perceptions

All 20 participants indicated that they believe e-books enhance learning. Two participants, Ahmad and Angela, associated learning enhancement with technological knowledge. Ahmad stated, "Yes, e-books enhance learning. Especially if the users know

how to use the e-book and leverage the benefits. Otherwise it will lead to the opposite."

Angela believed that it is essential for students to know how to utilize e-books in order to

be, ". . . more efficient with their studying habits. It is important to know how to properly

use the tools in e-books. So that being so, I believe e-books are extremely helpful for

academia and making the most out of one time." Participants listed 17 reasons that could

justify their enhancement perceptions. Figure 10 shows the reasons specified by

participants along with the number of participants who mentioned them by frequency.

When participants were asked: "Based on your experiences, do you believe that e-

books enhance learning?" Jamal responded, "Yes, a lot! I can easily find what I'm

looking for in an e-book through the keyword search. Even if I'm looking for a single

word through thousands of pages, I can found it in just like that." He snapped his fingers,

and then he further explained,

> But when I'm looking for a word in a printed book, I feel exhausted and then not
> that into understanding the information. It takes me a long time to find what I'm
> looking for. . . . And usually e-books are more interactive. They have more colors,
> animations, sounds, and audios. I believe this stuff helps students to be more
> engaged with the content and be able to understand it better. I personally found
> printed books boring, and e-books always grab my attention. And listening to the
> book is very important to me. Sometimes, while I'm driving, or just whenever I
> feel liking it, I highlight the content that I want to listen to and click a button in
> my iPhone or MacBook and it could read it for me. . . . And e-books help me to
> easily translate a word, a sentence, or even a paragraph. I can just copy whatever I
> want and paste it in Google Translate to have it translated to Arabic. And when I
> want to include a quote to my research paper, I can just copy it from the e-book
> and paste it. So I don't have to type anymore! I usually misspell everything.
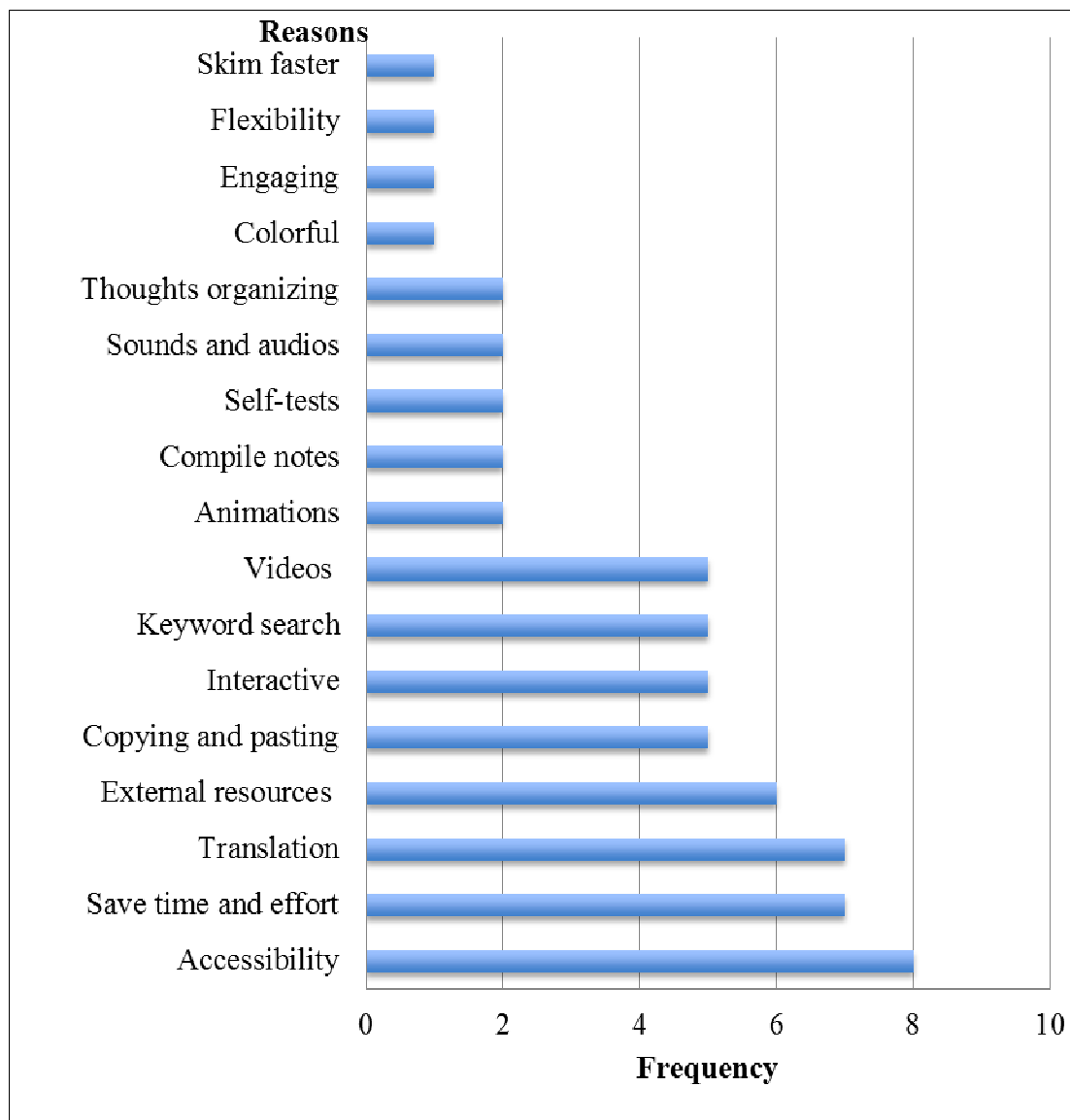
Figure 10. Reasons for why participants believe e-books enhance learning and the corresponding number of frequency.

Mishary also found copying, pasting, and translating when reading e-books beneficial. As he stated, "As an international student, I use Google Translate a lot! So, I can easily copy a word and paste it in the website. Or copy a quote and paste in in my assignment or research. I don't like to type because I'm very slow and I always misspell

words." In addition, in his response, Mishary pointed out that utilizing the keyword search feature helped him to organize his thoughts. He explained in an example, "When I want to read about something specific in a printed book, I have to go through many pages to find it, then I lose my thoughts. To me, that's distracting! But, I can immediately find what I'm looking for in e-books through the keyword search."

Maimunah indicated that the keyword search feature is the most helpful aspect in e-books when it comes to learning enhancement. She explained, "I lose my thoughts and learning motives when I spent so much time and effort looking for a piece of information in a printed book." Similar to Maimunah, Qiu also believed that the keyword search feature enhances his learning because, "it helps me to find what I'm looking for in seconds. If I'm looking for something specific in a printed book, it's going to take me forever. It saves my time and energy." Qiu added,

> Another thing that saves my time and energy is the word definition application. It's so helpful! So, whenever I read a word that I don't know what it means, I click on it and have the definition popped up while I'm reading. It's better than using external translator while I'm reading printed books. It could be distracting sometimes. And e-books offer anytime/anywhere accessibility. . . . And I don't know why I feel like I can skim through the content faster than when I'm reading e-books.

Wang, Talal, Nadin, and Ping also perceived the ability to translate words while reading e-books as helpful. Wang said, "I've downloaded an application that translates words for me. So, when I read e-books I can just click on a word and have the definition or translation immediately." He added, "And I like that I can access e-books whenever and wherever I want. I think the ease of accessibility e-books have can make a difference in one's learning." Talal had a similar perspective to Wang's. He stated, "E-books help us to learn better because of the ease of translation and accessibility." Nadin's response was,

"I like to copy a word that I don't know what it means, and paste it in Google Translate."

She further stated,

> I like to copy quotes from e-books and include them to my research papers. . . .
> As a teacher assistant, when I teach a class, I like to copy charts and figures and
> paste them in my PowerPoint slides. It is better than scanning them from printed
> books because I care about the resolution quality of my images.

> Ping said, "I like it when e-books translate words for me. I've downloaded a

dictionary in all of my devices and when I point or highlight a word in English, the

translation in Chinese would pop up. To me, it is better and easier than typing a word or

sentence from a printed book." As a second language speaker, Ping valued e-books that

included visuals and sounds. She explained,

> Some e-books include helpful animations, videos, and tests. Some e-books even
> have sounds! I just click a button to listen to an audio format of the book or an
> explanation of an image. I like it when I get a chance to listen to things and watch
> them at the same time especially for me as a second language speaker. Listening
> to spoken English and paying attention to how the words are pronounced is
> something meaningful to me.

> Lisa also believed on the positive impact of the external resources, visuals, and

self-tests embedded in e-books. She stated, "Yes. The Macmillan Launchpad provides

links for external resources, videos, and quizzes linked with your own learning curve. I

believe all of these interactive elements enhance one's learning." Moreover, Lisa

reflected on her own experiences with learning enhancements when she used e-books,

"When I study I like to incorporate my notes from classes with the book content to

organize everything I want to focus on. So, I like to copy texts, figures, and charts from

e-books and paste them in my notes to organize my thoughts." She further explained,

"When I use printed books, it's complicated to type all what I'm interested in into my

notes located in my laptop." Benjamin had a similar perspective to Lisa's. He believed e-

books enhance students learning, ". . . because of the interactive aspects that are available in them. And students can save their notes and compile them, which are easier to do electronically." Frances associated learning enhancement with the interactive aspects in e-books. As she said,

> For me, e-books definitely enhance my learning. Because of the ability to interact with the material, I understand it better that way. For example, e-books lead you to little videos where you can find more material on the topic. Even a lot of e-books have the ability to look up a word. So you just right click on a word and you can find out what it means or get more information about it. That to me is the best type of e-book where you can really interact with it. If the e-book is a truly interactive, then yes it enhances one's learning. If it's just a static book that you cannot click on, you can't use the additional features in it, then I don't know if it would make any difference.

Isabella also associated learning enhancement with e-books interactivity. As she responded, "I think it depends on the book. Some e-books have special features where you can view videos or go to virtual labs or something like that. That I think can really enhance learning. When it's just a copy of a printed book, I don't think it makes that much of a difference." Asya's reasons of learning enhancement were e-books' multi-modality, accessibility, and flexibility. As she explained, "E-books offer different avenues for learners that can't be offered in printed books to help them better understand the content. The multi-modality in e-books allows learners to explore "YouTube" videos and links that take them to external information." She also added, "Compared to printed books, I believe that e-books have easy accessibility and more flexibility that would be more beneficial to learners."

Evelyn perceived e-books' accessibility to additional information as a major influence on learning and understanding. She stated, "When you read an e-book and you say: OK! I do not understand this topic or this issue right here, you have access to

additional information. You can search for other resources that can help you get a better

understanding. To me, that's a big deal." Larry believed the immediate accessibility of e-

books helped him to obtain the information he needs and be able to learn as soon as he

desired. He described his point of view through his experience, "There was one time

when the book I'm looking for was not available in the school's library and it was going

to take a long time to get it from other libraries or even to buy it. I needed it like now! So,

I just bought it electronically and I was able to read it immediately." Dana's response to

the question was,

> Yes, because many e-books can be accessed at the same time, wherever you are
> and during anytime. When you go to the library, it is kind of challenging to find
> many good books in just one visit. But when it comes to e-books, you can access
> many books, read them, compare them, and buy or borrow the good ones in no
> time. . . . Also when doing research, e-books are better in terms of copying
> sentences, paragraphs, or pictures that you need to include.

Hindrance Perceptions

It was notable, while all participants said e-books supported learning 17

participants indicated that e-books could hinder learning. Participants listed 11 reasons

that could justify their hindrance perceptions. Figure 11 presents the reasons indicated by

participants along with the number of participants who mentioned them by frequency.
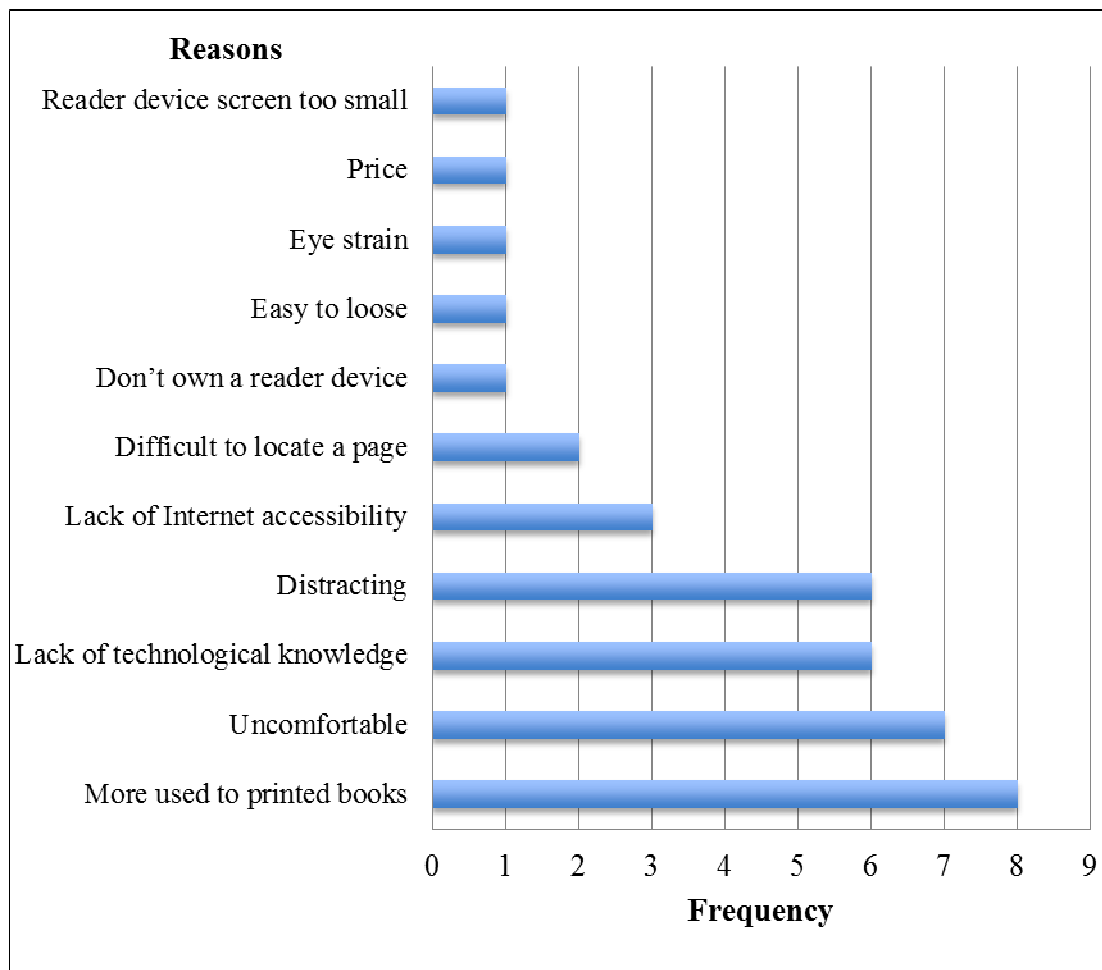
Figure 11. Reasons for why participants believe e-books hinder learning and the corresponding number of frequency.

When students were asked, "Based on your experiences, do you believe that e-books hinder learning?," Isabella responded, "E-books make me feel like it's hard to know where exactly I'm located in the book, like how many pages I read, and how many are left. I'll also admit, I don't really know how to use the features. I know these features are helpful, but most of the time I don't know how to use them." Isabella also believed that the high prices of e-books could hinder students' learning. She explained,

I feel very strongly that some students are crippled by textbooks fees. We already pay thousands and thousands of dollars on tuition and every class has a book that costs us $100 to $300 in addition to what we already paid. And I personally know some students who barely can afford to pay tuition here. They even get loans! And on the top of that, it is hard to be slapped with $500 just for textbooks fees. So students would be: I download the e-book because it's cheaper, or I don't have to have it. In that case, e-books' price may hinder students' learning. I even don't blame the students when they try to find an e-book that is available for free, whether it's legally or illegally. I wish teachers, authors, and e-book publishers consider the fact that textbooks are for student who are looking for resources that cost less money.

Ping explained how e-books could impede her learning,

Sometimes I feel lost when I read e-books. I don't know how to explain it! You know, when I read e-books I don't have a detailed sense of how thick the book is or where the page I'm reading is located in the book. For example, when I read a printed book and stopped for some reason, when I come back to continue my reading, I can easily find the last page I read. But complicated to find it in my e-book. And that makes me feel uncomfortable! And I always stop my reading when my eyes feel hurt because of the light of the screen.

Angela claimed that if students don't know how to use e-books, they would feel,

". . . uncomfortable and frustrated, and then will not be able to learn effectively. If students don't know how to utilize the software, then the interface and usability might be more of a barrier to someone who just wants to highlight or write notes on the book." Talal's response supports Angela's claim. He stated, "Sometimes, I found myself wondering about how to use some of the tools and features available in e-books. When I feel that way, I can't fully focus on the information." He added, "Lack of Internet connection could cause problems. If there is no Internet, there is no accessibility. And sometimes when I read e-books I ended up checking out Facebook or Twitter. E-books could be distracting." Talal also stated, "I'm more used to printed books which make me feel uncomfortable with reading e-books. And I can't understand anything when I feel uncomfortable." Benjamin provided a very similar reason to Talal's, "For students who

just like myself, attached to the physical aspect of printed books and the ability to write on them, they might have difficult time learning through e-books."

Larry said, "Students, like myself, like the feeling of the printed book in our hands. So reading e-books could be challenging for us. And since e-books are on a device that usually has an Internet connection, students might be distracted while reading e-books by checking out other websites." Mishary shared a similar perspective to Larry's, "Students who prefer the printed books could feel uncomfortable or frustrated when they use e-books. I believe when students feel that way, they won't be able to learn." Jamal also believed e-books could be distracting. As he stated, "Students could be easily detracted when they use e-books. I mean when they use e-books, they have Internet accessibility. So while they are reading, they might be distracted by something useless located in the Internet."

Qiu reflected on others' experiences. He said, "I think e-books could hinder learning! I know some people who don't like to use e-books. The technology is kind of complicated and challenging to them. So, I think they will not be able to adequately learn from e-books." He further explained, "They feel more comfortable when they read printed books because they are more used to them. For me, personally, it took me a long time to reach a point where I prefer e-books over printed books." Wang provided a similar response to Qiu's. He stated,

> I believe that e-books can be challenging and distracting to some people. I'm an elementary teacher in China and our schools promote teachers who use e-books when they teach. They also encourage students to use e-books instead of printed books. So, I've seen some of my colleagues face some challenges with the use of technology. You can say that they are uncomfortable and scared of the idea of using a new technology instead of what they are used to use. And as a teacher, I've seen my students using e-book devices to do things that aren't related to our assigned readings. They were distracted by the technology and Internet access.

Nadin believed that e-books could hinder learning for, ". . . students who feel more comfortable reading printed books. It is important to consider personal preferences and learning styles when it comes to learning." She added, "And it's easy to lose e-books. There were many cases where I need to read an e-book that I recently bought, but I can't find it in my laptop. To me, that's frustrating." Nadin also indicated that e-books could be distracting. She explained, "While students reading e-books, they might visit other websites or do other things in their reader device that aren't related to their readings." Evelyn shared a reason that might explain why e-books could distract readers. From her point of view, learning while reading e-books is, ". . . the responsibility of the reader. When reading e-books, it is easier not to pay attention to the information. Probably because e-books can be only accessed via technology and we have the feeling that technology is mostly about fun and games and not serious down to earth."

Asya shared her own experiences to describe how e-books are distracting. She explained, "Unfortunately, when I read e-books, I always like to check out my Facebook. And sometimes when I go to YouTube to watch a video related to what I'm reading, I feel like I want to watch other videos just for fun or out of curiosity." She paused, and then added while laughing, "Maybe if the videos were embedded in the e-books it wouldn't be that distracting."

Lisa believed that for people who, ". . . don't own technology devices or have Internet accessibility, e-books won't be the best thing to do because they may face some learning difficulties." Furthermore, the size of the screen in Maimunah's e-books reader device could impede her learning. As she explained, "Sometimes I feel frustrated when I read my e-book from my cell phone, because the screen is too small and I can't see the

whole page without zooming in. And when I do that, I don't feel like I'm able to understand the material very well."

The Impact of Prior Technological Experience, Knowledge, and Confidence on Learning and Decision-Making Associated with E-books

The findings in this section were collected from the first phase interview and indicated that all participants feel comfortable and confident, in terms of the technological knowledge and experience, when they use e-books. In this research, all 20 participants provided positive responses when they were asked, "Based on your experiences, do you feel comfortable and confident when you use e-books?," as Lisa confidently stated, "Yes, I do feel comfortable and confident. I've always considered myself technological savvy person." Dana also said, "Yes, I do. I believe it is easy to use e-books." Asya also stated, "Yes, I feel comfortable and confident. I'm good with e-books. I can open them up, read them, and write comments on them."

According to Jamal, he usually feels comfortable and confident when he uses e-books, but he might, ". . . feel nervous and less comfortable and confident when I don't have access to the Internet or knowing that my device will shut down at any second if I don't charge the battery." Mishary indicated that he feels comfortable and confident with e-books because he, ". . . used a lot of e-books and it took me a long time to feel that way. And sometimes I feel less comfortable and confident when I read an e-book that has complicated layout or tricky features."

Furthermore, all participants believed feeling comfortable and confident when using e-books are essential when it comes to successful learning. Otherwise, e-books could hinder learning. In addition, five participants believed that prior unsuccessful uses

of e-books could influence one's decision-making in terms of future use of e-books. The following paragraphs exemplified some participants' perceptions on the impact of prior technological experience, knowledge, and confidence on learning and future decision-making associated with e-books. The findings in this section were considerable in answering the main research question, as well as the third subsidiary research question.

Students Valued Being Comfortable
and Confident When Using
E-books

All students provided positive responses to the question, "Do you believe that feeling comfortable and confident when using e-books is important to ensure individuals' learning?," as Benjamin explained, "When you are studying, you must feel confident and comfortable with the media you have. Otherwise you will never be able to learn because you will be busy with other things that bother you or confuse you." Iman associated her personal comfort level with her decision-making in terms of the book format. She explained, "If I'm not feeling comfortable or confident when I study, I'll never be able to learn." She added, "That's why I said I like e-books for general reading, but when I want to study for a test, I want to have a printed book in my hands. Printed books make me feel more comfortable." Angela clearly explained her point of view on how feeling comfortable and confident when using e-books can affect student's learning process. She said,

> If students don't know how to use the software in an e-book, the interface and usability might be more of a barrier to them and for the learning process. So, I believe that feeling comfortable and confident when utilizing e-books are essential to ensure learning. If there were students who don't feel comfortable and confident, I don't think they will learn anything.

Asya had a perspective similar to Angela's. She confidently stated, "It is definitely important! Feeling comfortable and confidents goes one on one with learning. Student won't be able to learn if they don't know how to open an e-book and read it the way they usually do with printed books." She paused for a second, and then added, "The fear of technology could impede anything students supposed to learn. If I'm not feeling comfortable reading something, I will not be able to understand it." Maimunah stated, "If you don't feel comfortable and confident when you use e-books, you will waste your time trying to figure out how to use them instead of focusing your attention on the material in hands." Maimunah also shared her feelings by reflecting on her prior experience. She said, "Just like what I said before, when I read e-books through the small screen in my cell phone, I don't feel fully comfortable, then, I don't feel fully confident of my ability to learn."

Moreover, Evelyn and Frances reflected on other students' experiences. Evelyn believed on the importance of feeling comfortable and confident when using e-books in order to learn successfully. Evelyn also shared her observation of other students' experiences as an example. She said, "I work with senior students who don't have a consistent technology comfort level or technology experience. And it is really magnified that the use of technology, in general, made them feel uncomfortable and unconfident which impacted their ability to succeed in the course." Frances also reflected on other students' experiences. As she stated,

> Feeling comfortable and confident when using e-books really matters when it comes to learning. . . . I've taught classes where students were required to use some softwares [sic] in the computers. I've noticed that students who were not comfortable with the basic technology struggled with the most minor things even with being unable to find basic information.

Eric stated, "You got to know how to use a product to get the most out of it....
You don't need to be a tech savvy person to know how to use e-books. But, if you don't
like them or don't know how to use them, I don't think you would be able to learn or get
something out of it." Nadin expressed a similar response to Eric's. She believed, ". . .
personal preferences matter. If a person doesn't like reading from e-books because he
doesn't feel comfortable or confident when reading them, I don't think he will be able to
fully understand the content." Mishary also believed, "When students struggle with e-
books or feel uncomfortable or unconfident when using them, they won't be able to learn.
And even if they did, it won't be that effective." According to Jamal, "Anyone uses e-
books must feel comfortable and confident to be able to understand the material. . . . If
students don't like e-books or don't know how to use them, it's better to not use them."

Negative Experiences with E-books
Could Alienate Future Use

Five participants believed there is an impact from prior experiences on decision-
making associated with future use of e-books. In other words, they believed students'
positive experiences with e-books influence them to read more e-books, and vice versa.
As Dana clearly stated, "If people don't like e-books because they don't know how to use
them, I believe they will never learn anything out of them." She further explained, ". . .
and because they don't like e-books and don't know how to use them, they will probably
avoid reading them. I mean, why would you use something that you don't like or don't
know how to use?" Qiu also stated, "Feeling comfortable and confident when using e-
books can trigger the reader to read more, and vice versa. So, students are less likely to
use e-books in the future if they had prior failures with them." Larry explained his point
of view from the self-efficacy theory perspective. He said,

It is important for students to feel comfortable and confident. I think it goes back to the self-efficacy theory where you do things that you're more likely to do successfully. And when you feel confident that you can do something, you're probably going to do it. If students had bad experiences with e-books or did not use them successfully, like could not access them, they won't be able to learn. And they won't use them in the future because they didn't feel comfortable nor confident and did not learn as successfully as they usually do when they read printed books.

I, Rasha, wrote down my thoughts and reflections in my journal regarding my interview with Larry. I wrote:

Today I conducted an interesting interview with a student from the Educational Psychology Department. The interesting aspect of it was he connected my question regarding feeling comfortable and confident when using e-books with the self-efficacy theory by himself. It's thrilling to know that a student from different department touched on the same exact point of view I have.

Ahmad's response was, "E-books are designed in a way that a person must be capable of using them properly and using features available in them in order to get full advantages. And if that person didn't like e-books or didn't know how to use them, he is less likely to give them a second shot." Lisa said,

If somebody doesn't know how to use an e-book, he will not get something out of it.... I think when people use e-books and face troubles with them or did not use them the way intended, they won't be able to learn, then, they won't use them again. I'm sure those group of people trust the use of printed books more. . . . It is a big deal to have user-friendly e-books. Students hate going through many different steps to get what they are looking for. I think the ease of use contributes to any learning process and to the potential of future use.

Students Preferred to Use the Given E-book
to the Given Printed Book

In the second phase interview, participants were given a printed book to skim through. Then, they were given an electronic version of the same content (Appendix D) that included animated images, videos, audios, and tests, etc. that were not provided in the printed book. Finally, participants were interviewed to explore how they would

describe the use and impact of the e-book compared to the printed book. The findings from the second phase interview indicated the following: Three participants chose to use the given e-book for general reading but chose to use the given printed book if they were required to comprehend the material, and 17 participants chose to use the given e-book for all studying purposes even if they were required to comprehend the material. Furthermore, participants valued the demonstrative media, features (i.e., embedded definitions, highlighting with different colors, glossary, keyword searching), and self-testing approach and its immediate feedback available in the given e-book.

Participants provided reasons to justify why they: liked the given e-book more than the given printed book, valued demonstrative media in the e-book, valued features (i.e., embedded definitions, highlighting with different colors, glossary, keyword searching) in the e-book, and valued self-testing approach in the e-book. Finally, all the indicated reasons were summarized as 42 qualities that participants valued in the given e-book but were not available in the given printed book. The following paragraphs depict participants' perceptions on the given printed book, the given e-book, and demonstrative media, features, and self-testing approach provided in it. The findings in this section were significant in answering the fourth supporting research question, as well as the main research question.

Use of the E-book for General Reading
and the Printed Book When Learning
Mattered

Three out of the 20 participants (Ahmad, Iman, and Nadin) preferred to use the given printed book to the given e-book when they were required to comprehend the material for events such as exams. They are from the same group of participants who

shifted their preference to printed books during the first interview phase when they were asked if they still prefer to use e-books if they were required to fully comprehend the information. Despite the fact that they chose to use the given printed book, I noticed that while they were skimming through the e-book, they expressed positive comments, facial expressions, and body gestures. For example, in my field note for Ahmad, I wrote:

> He skimmed through the printed book so fast compared to the time he spent while skimming through the e-book. He took his time exploring the pictures provided in the e-book. And while he was exploring the e-book he nodded, which made me feel he was impressed. I also noticed he was more engaged when he was exploring the e-book. In fact, while he was skimming through the printed book, he was looking at people around us. But when he was exploring the e-book, he was more isolated from his surroundings. . . . He did the test provided at the end and showed different facial expressions regarding the feedback like when he smiled as an indication to choosing the correct answer. It seemed he was interested in the test and its feedback.

I also had positive comments for Iman. I wrote, "When exploring the printed book, she was distracted and looking everywhere on the pages . . . not focusing on a certain part. I believe she liked the e-book more because when she was exploring it, she was nodding all the time." I also wrote in my field note for Iman, "When viewing the animation with the narration she seemed impressed and said, 'Wow!' And while she was doing the test she was laughing. When she was done, she told me that none of her answers was correct, but it was fun and she liked it." In my field note for Nadin I wrote:

> She was done from the printed book in a very short time! She was just flipping the pages! And when she tried the e-book she said, 'Yah! This one is more interactive. It is better than the printed book'. And she was nodding while watching the images and animations, which made me feel she liked them.

During the interview, students were asked, "Which format do you like the most?." Ahmad, Nadin, and Iman stated they liked the e-book more, but still preferred to use the printed book when it comes to comprehending the information. According to them, they

liked the e-book more because it is more interactive and handy, explained complicated concepts better, had tests with immediate feedback, animated images and sounds, and was not overwhelming like the printed book. Yet, they favored the given printed book when they were required to comprehending the material. This preference is attributed to various reasons like that participants are more used to printed books, they like holding the book in hands, personal preference, they feel more comfortable with the printed book, and they trust the printed book more.

According to Ahmad, he is still attached to the traditional way of reading, and he is more used to holding the printed book in his hands. His response to the question was, "Hmm . . . I liked the e-book more. It is great and full of advantages! But, if I was a student who is required to fully understand the content, the printed book would be my first preference because it's the traditional way that I'm used to." He further explained, "I like holding the book in my hands and read every single word by flipping every single page and going back and forth from page to page. I know that I can do all of that and more in this e-book! . . . It is just my personal preference." According to Nadin, she liked the e-book but she felt more comfortable with the printed book because she can trust it and it fits with her studying style more. As she stated, "I liked the e-book. It was more interactive. It had animated images and sounds. I liked the one with the sounds because it explained the heart functionality very well even though it is a very complicated concept. And I loved the immediate feedback provided with the test." She paused, and then added,

But, I don't think I can use this e-book for everything. I mean I trust the printed book more. Maybe because I'm an old fashion person and not that used to technology! I don't know! I mean I can read this e-book to skim through it and get a general idea about the topic. I like all the interactive features in this e-book. But if I'm required to comprehend the information, I still prefer to use the printed book. I just feel more comfortable with the physical book. It fits my studying style more. I can flip the pages and know where each page is located in the book. And I can write and draw on it while I'm studying.

Iman also provided a very similar response. She liked the e-book more and considered the printed book overwhelming. However, she preferred to hold the printed book to prevent eye strain, smell the pages, flip them, and draw on them. She said, "I liked the e-book more. It was fun and not overwhelming like the printed book. The e-book explained some of the complicated information in still images, 3D images, animations, and sounds. I liked that about it! And the e-book was more handy than the printed book." She further explained,

But I also like the printed book. Umm . . . I don't want to confuse you! I know I said the printed book is overwhelming . . . I can use the e-book for general reading. But when I study for an exam, I prefer to use the printed book. I feel tired to read through the computer screen for a long time. My eyes hurt! And I like to sit and think . . . I can sit and think when I read the e-book too!

She paused and asked me to give her a couple of seconds to think about it, and I did. After about a one minute, she hesitantly added,

Um . . . I don't know why I prefer the printed book! You know, some people feel more comfortable when they are able to touch every single page of a book. I'm that kind of person. I like to hold the book in my hands, smell it, flip the pages, and be able to remember where every single piece of information is located in the printed book. You know what I mean! I like to hold my pen and write on the pages and circle important information. That's why I feel more comfortable with printed books.

Use of the E-book Even When
Learning Mattered

According to my observational findings, all participants expressed positive attitudes toward the given e-book, and 17 of them chose to use the given e-book to the given printed book for all studying purposes. Table 13 lists 35 reasons for why participants liked the given e-book more than the given printed book along with the number of participants who mentioned them in this section by frequency.

Seventeen students preferred to use the given e-book even if they were required to comprehend the material including participants who preferred to use printed books to e-books during the first phase interview. In fact, Larry was the only participant who favored printed books for all studying purposes during the first phase interview, but he shifted his preference to the given e-book during the second phase. While Larry was skimming through the e-book, he expressed some positive attitudes on it. For instance, in my field note for him I wrote, "I believe he liked the e-book because he was smiling the whole time while he was skimming over it. He also said positive statements like: 'Wow, I do like this e-book', 'the animations are cool! I like them,' 'I like the glossary too,' and 'The video is so neat!'" When Larry was asked during the interview about the format (printed book or e-book) he like the most, he responded, "Definitely, I like the e-book more." He started laughing, and then continued,

> The printed book is good and I'm more used to this format. But, I don't know why the e-book makes me feel more engaged with the material. Maybe because it is more efficient and has a lot of animated examples and check your learning opportunity. . . . And me being more engaged with the e-book is . . . kind of weird! Because that's not what I usually feel when I read e-books. And I definitely spent more time on the e-book than the printed one because there are a lot of things in the e-book that make you feel more interested and want to know more. . . . It's more interactive. It has animations and videos. It's a lot faster to

look up terminologies. And I feel like the visuals in the e-book give me a chance to see more details and know more.

Table 13

Why Participants Liked the Given E-book More Than the Given Printed Book and the Corresponding Frequency

Reasons	Frequency
1 . Demonstrative media: still images, 3D images, animations, and audio	20
2 . Interactive tests	12
3 . Interactive	11
4 . Not overwhelming like the printed book	11
5 . Explains complicated concepts better than the printed book	10
6 . Embedded definitions	9
7 . Feels easier to understand the content in the e-book	7
8 . More engaging and appealing	7
9 . Provides feedback	7
10 . Embedded features (keyword search, glossary, flash cards, note adding, highlighting, etc.)	5
11 . More interesting	5
12 . Zoom in and out	4
13 . Consolidates aspects (e.g., definitions, visuals, etc.) into one component	4
14 . Media features explain processes in motions and with audios (better than only reading a text and viewing still images)	4
15 . Decrease the need for external resources	3
16 . Narrowed/chunked information	3
17 . Not distracting like the printed book	3

Table 13 (continued)

Reasons	Frequency
18 . Reinforces learning through multiple channels (eyes and ears)	3
19 . Reinforces the (I can do) attitude	3
20 . Stimulates curiosity	3
21 . Adapts and anticipates reader's needs	2
22 . Feels like someone is talking and explaining things	2
23 . More convenient	2
24 . More efficient	2
25 . More simple	2
26 . Saves time and effort	2
27 . Supports active learning	2
28 . Widens learning opportunities	2
29 . Can rotate images	1
30 . Easier to carry	1
31 . Easier to work with	1
32 . More handy	1
33 . More manipulating	1
34 . Not messy like the printed book	1
35 . Reinforces the ability to retrieve comprehended information	1

As for Benjamin, I wrote in my field notes:

I could tell he was interested in the printed book. He was nodding while he was reading it and his facial expression showed that he was trying to concentrate on the content. . . . When he looked over the e-book, he smiled and tried to do many things on it. He tried highlighting, adding notes, and did the test many times to get

the right answers as much as possible. When he clicked on the animated visual with the audio, he was surprised by the audio and said, "Cool!"

When Benjamin was asked: Which format do you like the most? He answered, "I liked the e-book. It was more simple and the printed book was a bit messy." Benjamin further explained, "I mean when you open the printed book you would see too many information. But the e-book presents information in sections and the visuals are related to the exact part you are reading about. It's easier for me to understand the content in the e-book."

Asya expressed positive attitude and comments toward the printed book, but she said she liked the e-book more. In my field note for Asya I wrote:

> When she looked over the printed book she said, "It has so many visuals, I like it." She was flipping the pages fast. I can tell that she was only looking at the pictures. But when she looked over the printed book she said, "Oh! I like this one more." I could tell she was more interested in the visuals in the e-book. She clicked on all of the pictures. She watched the whole animated visual with the audio and while watching it she said, "Nice!" and "Oh wow! It is very Cool!" She tried highlighting and adding notes. She also did the test and looked excited while doing it. And at the end of it she said, "Yay! I got most of the answers right."

When Asya completed skimming through the printed book and the e-book she said, "I definitely prefer the e-book. . . . Totally the e-book." Then I said to her, "But at the very beginning of this interview you said you prefer printed books." She started laughing, and then commented,

> Yes I did! But this e-book is different and more interesting. I would prefer that kind of e-book to any printed book because of the visuals. They are amazing! especially in such a subject area. Oh my god you need to see things in motions to be able to understand them. The printed book has still images, which is OK! Umm . . . but watching the animations helps more. And I think this kind of e-book is applicable for any area of subject. I mean, imagine an e-book just like this one covers the history of American Revolution for example and there are videos of presidential speeches and images of important events, it would make a really great book.

Eric also liked the e-book and the visuals in it and wished all e-books could be similar to it. As indicated in my field note for him:

> I could tell he was interested in the printed book, but then his interest was vanished. In essence, at the beginning, he was slowly flipping the pages, but very soon he started flipping the pages without paying attention to the content. When he looked over the e-book, he was slowly viewing every page and tried zooming in and out many times. He watched the whole heart visual and said, "That's cool! I wish all e-books do that!" He also seemed interested in the test because he did it twice.

When Eric was done, I asked him, "Which format do you like the most? And why?" He answered, "I definitely like the e-book more. I like the fact that I can zoon in and out. My Kindle has a very small screen and the text in it is very small. So, I have to hold the kindle so close to my face." He started laughing, and then continued, "I don't like that! But with this e-book, I can just use my fingers to zoom in and out. I also like the test and pictures in the e-book. The pictures are really colorful and interactive. They are better than the ones shown in the printed book."

As for Maimunah, I wrote in my field note for her, "She seemed bored when viewing the printed book. But when she was viewing the e-book, she seemed interested and impressed because she was smiling, nodding, clicking on images and bold words to explore definitions." When Maimunah was asked during the interview about the format she liked the most, she stated, "For sure the e-book. The best thing was the embedded definitions in the bold words. . . . I also loved the animations. I think these animations can be helpful when a student tries to understand complicated ideas." Dana also favored the e-book for its visuals and embedded definitions. Her response was, "I liked the e-book more. Because when I read it I don't have to search through YouTube or Google for images, videos, or even definitions. This e-book combines everything: definitions,

visuals, simulations, and images. I like that." As for Ping, she did not like the fact that she was not able to know definitions of some terminologies while she was skimming through the printed book as indicated in what I wrote in my field note for her,

> While she was viewing the printed book, she asked me about the meaning of a term and I could not address her question because I wanted her to get what she can get by her own form the book she had in hands. I could tell she did not like the idea. She rolled her eyes and said, "Ugh!" . . . She seemed more interested in the e-book. She tried clicking on images, definitions, highlighting, and note adding. When she heard the narration in the animation she said, "Oh wow! I like that." She also tried the test. When she found out that almost all of her answers were wrong she laughed so hard.

During the interview, Ping stated, "I liked this e-book more. It is rich with different resources: text, images, animations, videos. . . . The pictures are very interesting! Um . . . the printed book is good. But the e-book is way much better." She paused for seconds, and then continued, "For example, while I was reading the printed book, I wondered about the meaning of a word. I could not do anything about it! But while I was reading the e-book, I got a chance to click on many words that I don't know what they mean, and get their definitions immediately." For Mishary, his comments and facial expressions while viewing the printed book made me believe that he perceived it as overwhelming. I wrote in my field note for him,

> I could tell he didn't like the printed book from the very beginning. As soon as his eyes laid on the book he said, "Oh! That's a lot of information!" And his eyes were narrowed which made me think that he was trying to focus on the information. But his attitude indicated that he was more interested in the e-book. When he was skimming through the e-book, he was smiling which made me believe he liked it more. And when he watched the animation with the audio, he nodded. And when he tried the test, he smiled and said, "That's really nice." He also seemed more engaged because he spent more time viewing the e-book than the printed book.

During the interview Mishary explained, "I liked the e-book for sure! It seemed more engaging. I liked the features, videos, animations, and the test. They are great! The

printed book was OK even though it has a lot of information. But the e-book is way much better." As for Talal, he also seemed overwhelmed while viewing the printed book and impressed by the e-book. As indicated in my field note for him, "When he held the printed book, he laughed and said, 'Wow! Do I have to read everything?' I believe it was overwhelming to him. When he watched the narrated animation in the e-book he said, 'Nice'. He seemed impressed by the e-book because when he was done, he gave me a thumbs up." When Talal was asked about his preferred format, the printed book or the e-book, he responded, "I prefer the e-book. The printed book had too much information. It was overwhelming and distracting! But, the e-book was more engaging with the animations, definitions, auditory narrations, tests, and feedback." Similar to Mishary and Talal, Qiu expressed attitude and comments denote that he was overwhelmed by the printed book. I wrote in my field note for Qiu,

> When I gave him the printed book he laughed and said, "That's really a big book." He seemed uncomfortable. I could tell he felt bored at the end because he was just flipping the pages without focusing on the content. But, he seemed more excited and impressed when he was viewing the e-book because he was clicking on almost everything and nodded a couple of times. He tried adding a note, highlighting, and performing the test. When he was done, he gave me the e-book back and said, "This book is awesome."

During the interview Qiu stated, "Of course I liked the e-book. The printed book was too much. And when you use this e-book you don't just read. You read, check your learning, receive feedback, watch moving images, watch videos, search through the content, and define new words in different languages." As for Frances, the printed book was, "A lot!" As she stated in her response, "Certainly I liked the e-book more! I mean oh my god look at the printed book, it was just a lot!" She explained,

> I liked the video and interactive images in the e-book. I also liked being able to watch the video that shows the reaction of things again and again to reinforce

what I just read. I even liked the still images! I liked being able to enlarge them to take a closer look at something and twist [rotate] them in different directions. . . And the 3D images, like the image of the heart, were very nice. And some of the visuals had multiple options. You can click on a piece of an element then another picture would pop up with more details, or a video that shows another reaction . . . I had multiple options to touch different parts of the human body to see different concepts. And I loved the instant feedback of the quiz at the end. It helped me know if I learned something right then and there! That was nice!

Isabella seemed also interested in the multimedia objects provided in the e-book even though she is "a text person." When she watched the animations, she said, "Oh! That's cool." And when she listened to the narration in the animation she said, "What! Oh my god. Is this a video?" When Isabella was asked, "Which format do you like the most?," she chose the e-book and wondered why anyone would not prefer the e-book to the printed book. As she answered,

Absolutely the e-book. In the printed book, I liked the pictures and stuff, but the e-book has better pictures and videos. Perhaps this is because the topic is kind of challenging for me. I'm a text person; I don't use pictures or videos that much. But when I read this e-book, I liked me being able to make the pictures bigger, watch the videos, and have quizzes that have this instant feedback. That was super cool! I don't know why anyone would not pick the e-book over the printed book especially if it covers such a challenging topic.

Jamal also valued the demonstrative media provided by the e-book. He was expressing some positive comments while skimming through the e-book. As denoted in my field note for him, "When he watched the narrative animation he smiled and said, 'Oh! I like this.' He completed the animation to the end and said, 'Excellent video'. Even when he was doing the test he said, 'I like it!' He seemed impressed by the e-book because of his positive comments." When Jamal was done, he gave me the e-book back and said, "I like this e-book more. It's really good. I like how the pictures in it are moving. They are very nice and attractive." Jamal paused, and then added, "I also loved

the audio. For me, it is very helpful to listen to information while watching an image or reading a text. I feel like I can understand better that way."

Angela's curiosity drove her to click on almost all buttons in the e-book just to see what they would do. As I wrote in my field note for her, "I could tell she was curious and excited when viewing the e-book because she was clicking on almost everything. She clicked on all features and visuals just to see what they would do. And I believe she liked the e-book because she was smiling while exploring it." According to Angela, the e-book was not overwhelming like the printed book and helped her to facilitate the information in a better way. As she stated,

> I liked the e-book more. I liked the 3D diagrams. And I also liked how the pages in the e-book were not distracting. The printed book was little hard for me to focus because there is so much information. The e-book was clearer and when I clicked on the diagrams I was like: Oh! Did I just read about this, and what did I learn about plasma and what not. So it really helped me to kind of narrow in to this specific topics . . . the e-book was more helpful in terms of facilitating the content. It was more interactive and easier to work with. It helped me to self-check my learning to see if I understood the content.

In my field note for Lisa I wrote, "She seemed bored when viewing the printed book and was just flipping the pages, but she seemed happy while she was skimming through the e-book. She was smiling and nodding all the time. When she was done, she looked at me and said, 'That was so much fun!'" And during the interview Lisa stated that she liked the e-book more because she, ". . . can highlight, write notes, search for certain words, and do other interactive stuff. I liked the images and animations in it too. I also liked being able to just click on an animation while I'm reading the e-book and feel more engaged with learning." She paused, and then explained, "I felt very passive with the printed book. I was just flipping pages. But with the e-book I was interacting with the content. I liked the feeling of practicing active learning."

When Evelyn and Wang preferred the e-book for its interactive multimedia objects. As Evelyn stated, "I liked the e-book more. It would be a great format for subjects that must include interactive visuals to facilitate the information. I loved it." As for Wang, he said, "Of course I liked the e-book! It has 3D images, audios, and animations. Umm . . . I also liked the embedded definitions."

When participants were asked: How would you compare the use of the e-book to the use of the printed book? Many participants described the printed book as overwhelming including Iman who said she prefers using the given printed book to the given e-book if she were required to comprehend the material. As she stated, "The printed book had very rich and detailed information, which made me feel overwhelmed, and could not focus on one thing. I felt like if I use it for study, I may miss something important without noticing." She posed, and then continued, "Hah! It's weird to say that when I just said I prefer to use the printed book!" Ahmad, who also stated he prefers using the given printed book to the given e-book if he were required to comprehend the material, responded,

> The e-book was more convenient than the traditional book. It was embedded in the device so it has no weight and the printed book was so heavy. I can bring the e-book with me wherever I go and read it anytime and anywhere. . . . And the features available in the e-book were great. I liked how some terms were defined when I just clicked on them. This would save me time especially as an international student. And it was easier to search through it. . . . I Also liked the dynamic movements in some of the pictures and videos in the e-book. And the quiz at the end of the section was interesting and I bet would be helpful. The overall appearance of this e-book was great and everything in it was engaging. But as I said, if I'm getting myself ready for an exam or something like that, I would choose the printed book.

Frances also considered the printed book as overwhelming. According to her, the printed book was very clear and well laid out. But, "the text was too much and too small!

I mean the information is kind of overwhelming. In the e-book, I was definitely reading certain passages and sections. But in the printed book, the text was very small and it got smaller in special sections. I ignored the smaller text!" She laughed, and then added,

I only focused on bolded words and they were quite a few. And the pictures were still, like the heart picture. It had arrows that implied one direction. These arrows were kind of confusing and you have to figure out the whole concept by yourself. You might misunderstand them! But the animation in the e-book showed the physical movement of the heart. It was very nice and easier to understand. . . . The first time when I looked at the printed book I said, "that's a lot!" But when I looked at the e-book, I did not have such a thought at all. I was like, "I can do this," and "I can learn this." The e-book reinforces the (I can do) attitude!

Isabella provided a very similar response to Frances's as she stated,

The e-book was way much better. Just by looking at the printed book, I felt overwhelmed. There was too much information. The pictures were helpful but I did not know where to look and there was so much information on every page. If I were required to read everything on the section you gave me, it would take me at least an hour. Just reading not even like fully understanding everything . . . and when you gave me the e-book, I went from (I'm super overwhelmed) to (I actually can learn this) with all of the interactivity, images, videos, and embedded definitions. . . . I mean, I went from feeling (this is over my head) to like (I can probably learn this) if I have to.

According to Benjamin, the printed book, ". . . presented a lot of information on each page, which was pretty distracting. On the other hand, the e-book was more helpful with all of these interactive images and it was just easier to read through it." Dana also indicated that her understanding was scattered because of a number of overwhelming aspects in the given printed book. She explained,

The printed book showed a lot of information on every page and it scattered my understanding. Some of the pictures were too small, and the text and arrows were small too. But the layout of the e-book was chunked and well organized. I was able to focus more on the content when I was reading the e-book. The test with the immediate feedback was helpful too. . . . And the pictures were big and with high resolution. And the simulations were very helpful. I was able to see a process happening in motion and hearing someone explaining it in the e-book. It is definitely better than only reading it and imagining it through a printed text.

When Wang was reflecting on his perception toward the given printed book, he pointed out that he liked the fact that he, ". . . had everything in front of me in two pages and I can choose what to focus on. But, still the e-book was better. It made me feel like I can easily understand the content." He paused for seconds, and then further explained, "Umm . . . I think I felt that way because the printed book had a lot of text and the font size was very small. When I held it the first time, I didn't feel like I want to read it! But, the e-book made me feel like I want to read! I want to view the pictures and videos." Similar to Frances, Nadin and Asya did not appreciate the arrows provided in the printed book. Nadin, who said she prefers using the given printed book to the given e-book if she were required to comprehend the material, stated, "The e-book was more engaging, interactive, and explains some complicated concepts in a better way. It showed the process in motion, which was better than using still images with arrows." And Asya said,

> I think the pictures in the printed book were good and the arrows were helpful, but I felt like it was hard to understand the images sometimes. I had to read the text to understand the process! But the animations and videos in the e-book explain everything in motion, which made understanding the content easier.

Furthermore, Asya expressed negative feelings toward accessing hyperlinks provided in the printed book to view the pictures moving in motion online. As she stated, "The printed book provided a link of a website that can show the pictures animated, as I believe! But I would not think about checking out the link if I don't have a computer in front of me. And if that link was in an e-book, I would feel excited to just click on it." When was reflecting on his perception on the given e-book, Eric said, "The e-book was more helpful and narrowed. I mean, in certain parts, I felt like the e-book was talking to me saying: This is what you read and this is how the heart works, and the animations explained it very well." As for Maimunah, she described the printed book as good, but, ".

. . the e-book was more interesting and interactive. So when you click on a visual, you can see moving pictures and listen to someone explaining things to you, and you can zoom in and out of the visuals. I like that!"

Moreover, when students were asked, "Do you believe it is better for students, when they aim to learn, to use this e-book including the features and the visuals available in it?," 19 participants said "Yes" including Ahmad and Nadin who preferred using the given printed book to the given e-book if they were required to comprehend the material. As for Iman, the only participant who did not provide a positive answer to the question, did not provide a negative answer as well. Yet, she said, "I can't say one is better than the other for anyone because people learn differently." Ahmad's response to the question was, "Yes, but it is also a personal preference. I mean if someone preferred that e-book to that printed book, it would be reasonable." As for Nadin, she provided a positive answer along with reasons. She stated, "Yes, it is better. I know I said I would rather use the printed book, but the e-book can be better for other students because it is more engaging and interactive. It explains some concepts better than the printed book, and it gives students a chance to check their learning."

Jamal said when responding to the question, "Certainly! And as an educator, I would give it to my students. It's really a great e-book. It's interactive and easier to use. I believe it helps students to understand the information faster and better." Asya also believed that the e-books could reinforce students' ability to comprehend the information. As she stated, "Yes! Because of all of the media they can access. I believe it makes comprehending and remembering the information easier." And Eric stated,

Yes, I believe so. The e-book is more manipulating and interactive. When reading it, it feels like someone is actually talking to you and explaining things. It is different! For different people, certain styles stick to them more. For myself, I'm a very visual person. And so it is helpful for me to have those interactive pictures, videos clips, and even the tests.

Mishary provided a similar response to Eric's. He indicated that it is better for students to use the given e-book because it has, ". . . too many good things. When students use it, they would learn through their eyes and ears. It allows them to read text, view images, watch animations, and listen to someone talking to them explaining things at the same time." As for Evelyn, she said when responding to the question, "Of course, because this e-book adapts and anticipates reader's needs." Furthermore, Ping answered and reflected on her own experience with the given e-book,

Yes! In fact, if I were asked to recommend either the e-book or the printed book, I would definitely choose the e-book. The e-book is more interesting. When I read the printed book, I felt bored. But when I read the e-book, I was more engaged and curious. I was clicking on so many buttons just to see what's going to happen.

Wang believed the e-book can widen students' learning opportunities. As he explained, "Yes of course! This e-book widens students' learning opportunities because they get a chance to learn through eyes and ears instead of only eyes. You know with the visuals, audios, and everything in it." Frances stated a very similar response to Wang's. She said, "Oh yeah! Students could get more options to reinforce their learning on whatever they are reading about with this interactive e-book." As for Benjamin, he believed it is better for students to use the e-book because of, ". . . the beneficial interactive visuals. Almost each visual shows a whole picture of a process. And this is something can't be found in a printed book." Dana also said, "Yes, especially for complicated topics. Umm . . . I mean the visuals in the e-book can facilitate any complicated concepts and fit one's learning needs." Lastly, according to Larry, it is better

for students to use the e-book because he admired the ability to actively learn through the

given e-book. As he stated,

> Yes, definitely, because the material in the e-book is very engaging and interesting . . . like for myself, when I was reading the printed book, I was just flipping the pages. But when I was reading the e-book, I felt like I can be more active and actively learn through the visuals and features. I felt more engaged and more interested in understanding the material.

Finally, when students were asked, "Would you use this e-book for reading that

requires information comprehension?," 17 participants who chose to use the given e-book

to the given printed book for all studying purposes said, "Yes." Jamal was one of the

students who shifted his preference to printed books during the first phase interview,

when he was asked if he still prefers using e-books if he were required to fully

comprehend the information. But during the second phase, he stated that he would still

use this e-book even if he were required to comprehend the material. According to Jamal,

> Oh yes for sure! I know at the very beginning of this interview, I said that I prefer printed books when it comes to serious studying, but this e-book is different! I would use it even if I was required to fully understand the content. I liked the visuals, audios, test, and features. I liked everything about it! Umm . . . you know if all e-books were like this one, I feel I would prefer to use e-books to printed books all the way. With this e-book, I don't need to use any other resources because it has everything in it.

Benjamin's response to the question was, "Yes. This e-book is clear, interactive,

and simple. And it consolidates everything, you know with the features and visuals, into

one component." As for Asya, she said she would use the e-book because it made her feel

curious and excited toward textbooks' materials. She described her feelings as an

unusual. She stated, "Yes, for sure I would use it! This e-book made me feel curious and

more excited to read a textbook. It's an unusual for me to feel that way!" Lastly,

according to Eric, he would use the e-book but he, ". . . will be concerned about the eye

strain. Because after looking at the screen for so long, my eyes will start hurting."

Students Valued Demonstrative Media
Provided in the E-book: 3D Images,
Animations, and Audio Narrations

According to the findings, all 20 participants valued demonstrative media

provided in the given e-book. When students were asked, "How do you perceive the

visuals (images, animations, narrated animations, videos, audios, etc.) available in the e-

book? Were they helpful in terms to facilitating the content? If yes, how? If no, why

not?," they all provided positive responses, as well as 16 justifying reasons. Table 14 lists

the reasons for why participants valued demonstrative media provided in the e-book

along with the number of participants who mentioned them in this section by frequency.

Angela provided an example from her own experience with the given e-book to

explain why she perceived the animated visuals as helpful. As she explained,

> I believe these animated visuals are helpful, like the animated diagram with the
> flow of the blood through the heart staring from the atrium then going down . . .
> then going to the left side. These visuals really helped me process the order of
> such an operation because I got a chance to see it moving . . . I learn best with
> visuals and animations especially when I'm learning about processes and have to
> remember orders.

Table 14

Why Participants Valued Demonstrative Media Provided in the Given E-book and the Corresponding Frequency

Reasons	Frequency
1 . Media features explain processes in motions and with audios (better than only reading a text and viewing still images)	13
2 . Reinforces learning through multiple channels (eyes and ears)	6
3 . Explains complicated concepts better than the printed book	5
4 . Reinforces the ability to retrieve comprehended information	5
5 . Can rotate images	4
6 . More engaging and appealing	4
7 . Visuals are more realistic	4
8 . Decrease the need for external resources or help	3
9 . Feels like someone is talking and explaining things	3
10 . More interesting	3
11 . Can zoom in and out	2
12 . Reinforces the (I can do) attitude	2
13 . Supports active learning	2
14 . The audio could improve second language speakers' pronunciation	2
15 . Adapts and anticipates reader's needs	1
16 . Stimulates curiosity	1

Ahmad also believed that visuals provided in the e-book could reinforce learners'

ability to retrieve comprehended information. According to him, these visuals could

make learning so, ". . . interesting and appealing. They also could be helpful with

recalling information. I mean instead of going through text and still pictures, these visuals

show you things in motions to see and understand the actual functionality of humans'

organs." Ahmad further explained,

> It is easier to remember a picture that moves and explains things, but it is hard to
> imagine the functionality of these organs just from reading the text, and then good
> luck with remembering what you read . . . these visuals and media helped me to
> understand some of the complicated concepts in the e-book. This e-book made me
> feel like I don't need to go to Google and YouTube to view additional pictures or
> videos.

Eric intended more to compare visuals available in the e-book and the printed

book. As he said, "In the e-book the visuals are more colorful and realistic as opposed to

the pictures shown in the printed book. They also show the real life picture." Eric further

added,

> Honestly, these visuals helped me to understand the information and I feel like I
> will be able remember it later. . . . And the animations with the audio felt like
> there was someone talking back to me. I liked that part! And you know sometimes
> when you read a book for a long time, the words stop going inside your head. In
> the e-book case, if that ever happened, you can watch the animation. It will help
> you process the information better because you are also hearing it and that's a
> different platform.

Moreover, Mishary mostly liked, ". . . the animations with the audios. It's a great

thing to be able to listen to someone talking to you." As for Isabella, she stated, "I felt

more interested and engaged with the e-book because of the visuals. The pictures in the

printed book are good. But I prefer to be able to twist [rotate] them, watch them actually

moving like the way they do in realty, and listen to an audio that explains them." She

further added, "I also liked the fact that I have different ways to look at concepts

provided in the e-book. I read text, watch visuals, and listen to audios. I believe I'll be more able to remember what I read that way . . . I feel like if I had to sit down to study, the e-book would be better to use."

Maimunah mostly appreciated the audio due to the fact that she learns the best when she listens. As she stated,

> I liked these visuals. I think they are helpful especially when it comes to complicated concepts or ideas. And the vocal explanation in the animation made me feel like there was someone talking to me and trying to explain information. That was really good! Because for myself I learn the best when I listen. And the only opportunity I have is during a lecture or in an in class lesson. But this e-book can vocally explain things to me. And that's definitely very helpful because when I listen to words, they stick in my mind better than just reading them.

Maimunah further added,

> I wish I had more e-books like this one for my classes. I've been in situations where I tried to imagine certain things like charts, for example, in 3D in order to be able to understand them. Honestly, it's difficult to imagine things sometimes! I wish I could see such charts as 3Ds that I can twist [rotate] around, or even as animations that include audios. That would be really beneficial.

Similar to Maimunah, Larry was craving the idea of having animated visuals or videos in his e-books. His response to the question was, "These visuals are awesome! I believe it is going to be helpful to see animations that explain psychological process or a video of therapy. I like the idea of that!" In addition, Qiu also learns the best when he listens to audios and views animations. As he stated, "These visuals are very cool and beneficial! I learn best when I watch things that are moving, and listen to narrations or sounds more than just reading bunch of texts." As for Lisa, she mostly appreciated the animations because, ". . . they could explain ideas or processes that are hard to be explained through still images or text. And I like the fact that I can zoom in and out and

rotate images. . . . You know, sometimes when you see still images in printed books it's

hard to understand how things actually work or look." She paused, and then added,

> You know what I mean? . . . Umm . . . These visuals can help you to look at
> things more in depth and see them as they are moving in real life. You can just
> watch things as they are in realty! They solve the mystery part for you. These
> visuals influence active learning instead of just reading a text and wondering if
> you will be able to recall what you just read or not.

Similar to Lisa, Benjamin also valued the realistic concept presented through

animations. As he explained, "The breathing visual shows the actual process of breathing.

I believe it is impossible to present such a thing in a printed book. In fact, with these

visuals you don't need YouTube or any extra resource." Benjamin added, "In the printed

book, the images try to explain a process, but in the e-book you can see it actually

happening. It is really helpful to view a process instead of trying to visualizing it."

Evelyn perceived the visuals as appealing because, "People are not able to see [a] moving

heart in real life. So, having the animation in the e-book is a credit . . . and I liked the

combination of animations and audios. It is great to have them together to reinforce

learning instead of having one without the other."

According to Wang, he valued visuals provided in the e-book because he

understands materials better, ". . . when they include videos or animations. For me, it's

better than just reading a text." Furthermore, Wang reflected on his needs and

experiences as a second language speaker. He stated, "I liked the audio because it can

improve my pronunciation, as a second language speaker, by just listening to it. And

because I comprehend information better when I listen to a sentence as a whole instead

quote. of me trying to read words one by one." Similar to Wang, Talal also valued the

fact that the audio could teach second language speakers English words pronunciation.

As he stated in his response, "These visuals grabbed my attention! I felt like I want to know and see how the organs in my body actually work." Talal further explained, "It was helpful to see things moving in the animated images . . . and as a second language speaker, the audio taught me how to pronounce some new terms."

As for Ping, she perceived the visuals as, ". . . interesting! These visuals change the state condition. I mean when I was reading the printed book I was bored. I was just flipping page after page. But when I was reading the e-book, these visuals made me more inquisitive, engaged, and active." As for Iman, she believed that the visuals, "in the e-book are better than the still images in the printed book. They are amazing! You can zoom in and out. You can view animations, which is better than just viewing still images or reading text. . . . These visuals made reading such a complicated topic more doable." Furthermore, according to Asya, because of these visuals that combined texts, images, and audios together she, ". . . got 3 out of 4 in the test." She added, "If I just read the printed book and did the test at the end, I would not do as good . . . I like the visuals and how they explain concepts in motions and sounds while I'm reading the text. I feel like I already understood the content." As for Jamal, he reflected on his needs and experiences as an international student. He stated,

> These visuals are extremely helpful because they explain a lot! You know, as an international student and as a second language speaker, sometimes I take my books with me to some people who are willing to explain complicated concepts for me. But this e-book does it all! It explains concepts with still images that can be twirled, animated images, and audios. With this e-book, I feel like I can fully understand the material by my own and I don't need any extra help.

Furthermore, Jamal also reflected on his 13 year-old son's needs and how the given e-book could fulfill them. As he added,

And students with disabilities or certain needs might benefit from this e-book too. For example, my son, he is 13 year old, he wears glasses and he always forgets to wear them. If he happens to read this e-book without his glasses, I believe he could learn something because of the audio explanation. With this e-book, learning is not limited to what can be seen or read through the eyes. The support of the audio is a big credit for the e-book.

Students Valued Features Provided in the E-book

According to the previously reported findings, nine participants mentioned the embedded definitions and five participants mentioned the embedded features as the reasons why they liked the given e-book more than the given printed book. However, when all participants were asked, "How do you perceive the features (e.g., glossary, adding notes, word definition, etc.) available in the e-book? Were they helpful? If yes, how? If no, why not?," all 20 participants provided positive responses. In addition, they listed 13 reasons that could justify their positive perceptions.

Table 15 shows features favored by participants along with the number of participants who mentioned them. Furthermore, Table 16 lists reasons why participants valued these features along with the number of participants who mentioned them by frequency.

Table 15

Features Provided in the Given E-book and Favored by Participants and the Corresponding Frequency

Features	Frequency
Embedded definitions	11
Highlighting with different colors	6
Glossary	5
Keyword searching	4
Notes adding	4
Notes searching	3
Flash cards	2
Underlining	2

Table 16

Why Participants Valued Features Provided in the Given E-book and the Corresponding Frequency

Reasons	Frequency
Decrease the need for external resources or help	12
Saves time and effort	8
Easier to work with	5
Adapts and anticipates reader's needs	4
Can easily identify and organize information	4
Reinforces the (I can do) attitude	4
Interesting	2
Consolidates many things (e.g., definitions, visuals, etc.) into one component	2
Reinforces the ability to retrieve comprehended information	2
Reinforces thoughts organizing ability	2
Widens learning opportunities	2
More convenient	1
More efficient	1

According to Eric, the underlining and highlighting with different colors features could assist him to be more efficient with organizing information. As he stated when comparing his Kindle to the given e-book, "This e-book has many helpful features, especially when we compare it to my Kindle. It just feels that it is easier to work with this e-book because it offers many options to choose from to efficiently organize information while reading." He paused, and then added while smiling, "Umm . . . Specifically, the

underling and highlighting features. I can underline important text and also highlight it in different colors to code it depending on its importance. I like to have many options to choose from to efficiently organize the information while I'm reading." Larry also valued the different shades of colors offered by the highlighting feature. As he said, "I liked how the highlighter has different colors. That was nice! To me, it's more convenient than carrying all these colors with me to highlight my printed book, or highlighting my e-book with a single color." Larry further added, "I liked the glossary too. It was as far as one click! And having it embedded like that would fulfill users' needs where they won't use an external glossary anymore."

Similar to Larry, Lisa also valued the glossary feature. As she stated when addressing the question, "I found the glossary one of the most helpful features. I also loved being able to search for words and click on them to read embedded definitions. With these features, students can easily locate information and expand their learning without using any external resources." As for Benjamin, he said, "I liked them. And yes, they are helpful." He further added,

> I mean these features, like the keyword search, highlighting, underling, and writing notes, could help me with identifying the information I'm looking for and then organizing it. Honestly, these two things are very important for me when I want to learn anything! And I want them like that! Um . . . I mean all in one place. . . . I also like the fact I can search for my notes within the book instead of having two separate things. Having all of my notes in front of me like that could help me to organize my thoughts and then feel more eager to learn. I mean it is easy to click one button to read everything I thought of whenever I need to. It's way much better than spending too much time searching through my notes to figure out what I exactly thought of. And then, I would feel exhausted and scattered.

According to Frances, the features provided in the e-book were interesting and made her feel that she should use them. As denoted in her response, "The features were

really great! I felt like I want to use them! They made me feel I should use them, and I

can do this and that! You know what I mean?" She started laughing, and then explained,

> The features made me feel more interested . . . I liked the fact that the e-book has
> flash cards embedded in it. So, there is no need for an extra source or help. And
> you can color code your highlighting. That's awesome! It could take too much
> work and forever to do it by hand. I also liked how you can see all of your notes
> together in one place and it shows you where each note is located. I believe
> reading all of your notes together helps you to organize your thoughts because
> you review everything at once.

> As for Iman, she, ". . . liked the embedded definitions in the bold words. That was

really awesome! So I don't have to translate everything in Google Translate. I also liked

the flash cards. The use of the flash cards would motivate readers to know more and

better." Ahmad, as an English second language speaker, mostly favored the embedded

definitions. As he stated, "All of the features were interesting, but I mostly liked the

embedded definitions. It is very important especially for someone like me who usually

do[es] extensive reading and definition search." Ahmad further explained, "This e-book

won't waste my time, as an international and graduate student, who always search for

word definitions, pictures, figures, etc. This e-book combined everything, thus, reading it

would save my time and effort."

Asya also valued the word definition feature and the fact that it could be displayed

on the same page. Her response to the question was,

> Oh yes! There is no doubt they were helpful, especially the word definition
> feature. Oh my god it was great that I just clicked on a word and had the
> definition on the same page. That made me feel like I don't need to use external
> translators and I can remember the definition later. The fact that I can read the
> definition on the same page can definitely enhances my long-term memory and
> my understanding of the content. Because I can instantly know what every single
> word on the page means. I love it!

Jamal and Mishary expressed very similar responses. Jamal perceived all features as, ". . . very helpful. I mostly liked the embedded definitions in the bold words. I was impressed how easy it was! If all of my books were like that, I don't have to go back and forth from the book to the translator. Sometimes it's exhausting!" As for Mishary, he said, "I liked them all, but the best thing in this e-book was the embedded definitions. If all of my e-books were like this e-book, I would hardly use the translator. I like the sound of not using my translator as an additional resource, because, honestly, sometimes I feel lazy to translate words."

Ping and Isabella also valued the embedded definition feature. As Ping stated, "Yes, they were very helpful. I mostly liked the embedded." I think it would mostly benefit second language speakers, or students who are learning about a new topic that has new terminologies." She further added, "As for myself, as a second language speaker who never read about this topic, the embedded definitions made me feel like I can give it a try." As for Isabella, she said,

> I loved how the definitions were embedded in the bold words. Sometimes I struggle with new terminologies and this could be the most helpful feature . . . I mean, most printed books have definitions in the margins or in the glossary at the very end, but it's so much more natural to just click and then here is what it is! I believe reading the e-book could help me to remember what I've read because it was more streamlined.

Students Valued Self-Testing Approach
and Its' Immediate Feedback Provided
in the E-book

According to my previously reported findings, 12 participants mentioned the interactive tests and 7 participants mentioned the feedback, embedded in the tests, as the reasons why they liked the given e-book more than the given printed book. Yet, when students were asked, "Do you believe the test provided at the end of the chapter in the e-

book would contribute to individuals' learning?," 19 participants provided positive

answers and mentioned 7 reasons to justify their responses. Iman was the only participant

who provided a vague response. Iman's response was, "The test is good and I think it's

helpful, but not for everyone! I believe that some people don't wait until they complete

the test. . . . I mean they might check the right answers right away before they complete

the test. In that case, the test won't makes any difference to them." Table 17 lists the

reasons for why participants valued the self-testing approach along with the number of

participants who mentioned them by frequency.

Table 17

Why Participants Valued Self-Testing Approach Provided in the Given E-book and the Corresponding Frequency

Reasons	Frequency
Provides immediate feedback	14
Motivates users to check their learning and identify their weakness	9
Saves time and effort	8
Grabs attention to important information	6
Interactive	3
More engaging	2
Reinforces the self-esteem and confidence	2

Offering tests with instant feedback could motivate students to examine their

learning and identify their learning weakness. As Wang stated when answering the

previously mentioned question, "Yah of course! This test motivates students to check out

their understandings of the content. Then they can go back to re-read what they figured

out that they didn't fully understand." Dana also stated,

> Without a doubt! It is a good way to check your understanding. . . . That kind of self-test encourages learners to identify their weaknesses. I mean, who doesn't want to know his or her weaknesses before an exam? For example, if I did this test and I missed one question, I would go back and read more about it. Such a test can determine where I need to pay more attention to.

> As for Jamal and Asya, they perceived the test as engaging, and valued the fact

that it influences users to evaluate their understanding. Jamal stated,

> I liked it! It was very engaging. It made me feel motivated to try hard to provide right answers, and then to know what the right answers were. I've learned something from this small test. You know sometimes when I study for an exam, I like to ask myself questions to test my learning. So, this test is way much better. It asks questions that I probably haven't thought of. So, it could help me, as a student, to test my learning in a better way.

> Asya stated, "Yes, sure! I liked it so much. I believe this test makes students

being in charge of their own learning. Do you know what I mean? . . . It influences them

to check their understanding and gives them immediate feedback that helps them to know

whether they fully understood the content or not." Asya also reflected on her own

feelings when she was trying the test herself. As she further added,

> That's a plus for the e-book. And I think all e-books should offer similar self-tests. It makes students more engaged and accountable of their own learning. That was how I felt when I was doing it! I got 3 out of 4 and I felt so good that the majority of my answers were correct. I think this self-test also can help students to have a high self-esteem and feel confidents of their understanding.

> As for Ahmad, he stated, "When learners read the e-book for an exam for

example, they would get a chance to test their learning as much as they want in an

interactive way. I mean we can't get an instant feedback from a printed book, right?." He

also added, "These tests also could strengthen students' confidence on their

understandings before schools' exams."

Moreover, Frances described the test as, ". . . pressure free." As she said in her response, "It was perfect, I loved it! . . . I loved its instant feedback to know whether I learned something or not. Plus, it had no pressure. I mean it was not like the tests I have to take in class, or like everybody can see my answers. And because it was pressure free, I felt motivated to give it a try." And Lisa stated, "Oh my God! It was amazing to try it. Sometimes I like to try quizzes just for fun and to see how far I can go. . . . I liked the immediate feedback, it was really helpful." She also explained, "When I say the feedback is helpful, I mean that in the printed book you have to search everywhere for the answer, and that's if it was provided for you somewhere in the book. And then good luck with figuring it out by yourself!"

Talal also valued the fact that the instant feedback saves time and effort, compared to other tests in printed books. He said when addressing my question, "Yes definitely! This test was different from printed books tests. In printed books, you waste your time and energy checking your answers. But with the test, the feedback was as easy and fast as one click. It made me feel motivated to give it a try and see how many questions I can get right!" As for Isabella, she responded,

> I liked it a lot and I bet anyone could benefit from it. I wish all of my e-books had these kinds of tests. As a student, I would like to read a book and then at the end have a test with such an instant feedback. . . . The whole test was conducive. . . . I mean in printed books, I answer the questions and then I have to flip to the end of the book to find the quiz, then to find the question, and then to find the answer. In the e-book, the quiz tells you correct or wrong right away. I loved it!

And Larry stated, "Yes, I think so. If I used this e-book to study for an exam, the test would be very beneficial. I mostly liked its instant feedback, because when I do tests in printed books, I have to go back and forth between pages to check the answers. Truly, I'm not a fan of such a method." Furthermore, Maimunah, Qiu, and Benjamin also valued

the fact that the instant feedback saves time and effort. As Maimunah said, "Yes, this test could contribute to anyone's learning! I liked the instant feedback. I feel lazy to do the tests provided in printed books because I have to go back and forth to check my answers, but this test evaluated my answers right away! I loved it."

As for Qiu, he believed that students would benefit from this test because, ". . . when they do tests in printed books, they have to write their answers down and check whether they are right or wrong by themselves. And sometimes they have to buy an extra book just for these tests. But the test in the e-book is interactive and provides an instant feedback." According to Benjamin, the test could help students focus on important parts in the book. As he explained,

> Yes, it is a great way to do like a review on important parts. Usually these kinds of tests cover the most important information. And it is very helpful to have your answers evaluated immediately. I mean, some printed books give questions at the end of each chapter and you have to go to the very back of the book to check your answers. But the test I tried in this e-book was way much better. I liked how it was interactive and showed my score as soon as I was done.

Similar to Benjamin, Evelyn, Mishary, Angela, and Eric believed the tests covers the most important parts in books. Thus, when students do these tests, their attention would be drawn to them. As Evelyn indicated in her response,

> Yes, this test was great! I liked it! It was about various parts from the e-book and I think they were the most important ones . . . I also liked how the test provided an immediate feedback in a nice way. I mean some tests honk a horn if you get a wrong answer and it's really disturbing. And when I do tests in printed books I have to correct myself by checking the right answers often provided at once. Then I end up knowing the answers of the questions that I haven't answered yet! The fact that I can get the right answers shown with one click, without disturbing sounds, which makes me feel more into giving it a try.

According to Mishary, the test could be very helpful because it, ". . . can test students learning, provide instant feedback, and help them to focus on the most important

points in the chapter. Usually these tests focus on the most important points in books." As

for Angela, she reflected on her own experience with the test in the e-book. She stated,

"It was great and I believe it would be fruitful for students to use it. I liked how it was

narrowed to specific and important pieces of information. It helped me to hone into what

the e-book was trying to tell me. . . . It was really good and helpful. I didn't think I would

do as well as I did." Finally, Eric said,

> I think this test could be very helpful for someone who is preparing for upcoming
> exams or quizzes. It highlighted the most important parts of the book because
> there is a reason for any question. Most likely the reason would be that the
> question covers one of the most important parts in the book. . . . It is a very good
> way to help students to focus on these important parts.

Forty-two e-book related qualities were valued by participants who claimed that

these qualities were unavailable in the given printed book. These qualities were

summarized based on the reasons participants previously addressed to justify why they

liked the given e-book more than the given printed book, valued demonstrative media in

the e-book, valued features in the e-book, and valued self-testing approach in the e-book.

Table 18 shows all the summarized qualities indicated by participants, during the entire

second phase interview, along with the number of participants who mentioned them by

frequency.

Table 18

A Summary of 42 Qualities Participants Valued in the Given E-book and Not Available in the Given Printed Book Along with the Corresponding Frequency

Qualities	Frequency
1 . Demonstrative media: still images, 3D images, animations, and audio	20
2 . Provides feedback	17
3 . Decrease the need for external resources	15
4 . Explains complicated concepts better than the printed book	14
5 . Media features explain processes in motions and with audios (better than only reading a text and viewing still images)	14
6 . Saves time and effort	14
7 . Interactive	13
8 . Interactive tests	12
9 . More engaging	11
10 . Not overwhelming like the printed book	11
11 . Embedded definitions	9
12 . Motivates users to check their learning and identify their weakness	9
13 . Reinforces learning through multiple channels (eyes and ears)	8
14 . Reinforces the (I can do) attitude	8
15 . Adapts and anticipates reader's needs	7
16 . Feels easier to understand the content in the e-book	7
17 . More interesting	7
18 . Reinforces the ability to retrieve comprehended information	7

Table 18 (continued)

Qualities	Frequency
19 . Can zoom in and out	6
20 . Easier to work with	6
21 . Grabs attention to important information	6
22 . Can rotate images	5
23 . Embedded features (keyword search, glossary, flash cards, note adding, highlighting, etc.)	5
24 . Consolidates many things (e.g., definitions, visuals, etc.) into one component	5
25 . Can easily identify and organize information	4
26 . Visuals are more realistic	4
27 . Widens learning opportunities	4
28 . Feels like someone is talking and explaining things	3
29 . Narrowed/chunked information	3
30 . Not distracting like the printed book	3
31 . Stimulates curiosity	3
32 . Supports active learning	3
33 . More simple	2
34 . Reinforces the self-esteem and confidence	2
35 . Reinforces thoughts organizing ability	2
36 . The audio could improve second language speakers' pronunciation	2
37 . Easier to carry	1
38 . More convenient	1
39 . More efficient	1

Table 18 (continued)

Qualities	Frequency
40 . More handy	1
41 . More manipulating	1
42 . Not messy like the printed book	1

I would like to conclude this section with an excerpt from my research journal. I wrote:

It was very interesting to see participants go with e-books, then go with printed books, and then go with e-books again. During the first phase interview, 19 participants, which is almost all of them, said, "We chose e-books" . . . when I asked, "Would you use it when you prepare yourself for an exam?" 14 participants said, "No!" . . . During the second phase interview, 17 participants, including the participants who said, "No" in the first phase, said, "We chose this e-book over this printed book" even if they were studying for an exam . . . when they were exploring the e-book I gave them, I enjoyed watching their facial expressions and seeing their eyes go wide open. I also liked listening to their positive comments like, "Wow!," "This e-book is awesome," "Cool!." and "I love it." My enjoyment was driven by the sense of me getting closer to know why participants don't like e-books. . . . All 20 participants liked the e-book and they liked it because of the interactive media features in it. Even those participants who described themselves as "a text person" liked the media features and recommended them to be included in all e-books out there. So, this made me wonder. . . . Do participants prefer to use printed books because they are more used them?, or because most of the e-books weren't developed in a way that encourage participants to use them more?, or maybe both?.

Changes to E-books Recommended by Students
to Better Support Learning

In the third phase interview, participants were asked about changes they would like to see in e-book's layout, functionality, and reader hardware. The following paragraphs report participants' recommendations for changes associated with e-book's layout, functionality, and e-book's reader hardware to better support their learning and goals. Furthermore, in the third phase interview, participants were given blank sheets of

paper and pens, and were asked to draw sketches of the ideal e-book layout they believe would best support their goals. Participants' sketches are provided as artifacts in the following paragraphs to deliver an additional source for insights in order to better understand participants' point of views regarding changes.

The aim of the third phase of data collection was to understand what a perfect e-book would look like from participants' point of views. This section of the findings can benefit e-book authors, e-book publishers, and technology production companies and their understanding of the root causes of participants' preference or reluctance to the use of e-books. In addition, the findings precisely contributed to answer the primary research question, as well as the fifth subsidiary research question.

Changes Associated with E-book's
Layout and Functionality

All 20 participants recommended some changes they would like to see in e-book's layout and functionality to better support their learning. When participants were asked: What changes would you like to see in e-books so it will best support your learning? they recommended 27 changes associated with e-book's layout and functionality. Having more demonstrative media like still images, 3D images, animations, and audios was the change recommended by all 20 participants. Table 19 lists the changes recommended by participants associated with e-book's layout and functionality along with the number of participants who mentioned them by frequency.

Table 19

Changes Recommended in E-book's Layout and Functionality by Participants and the Corresponding Frequency

Changes	Frequency
Have more demonstrative media: still images, 3D images, animations, and audios	20
Tests with instant feedback	15
Direct links for references and external resources	11
Able to handwrite notes	10
Embedded definitions with vocal pronunciation and images to further explain the meaning	10
Cheaper than its printed copy	9
Have features (glossary, highlighting with different colors, notes adding, keyword search)	8
Audio format	7
Able to draw	5
Social interaction opportunities	5
Able to modify the font type, color, size, and background	4
Have material chunked and connected to feel more able to locate myself	3
Have notes hidden	2
Zoom in and zoom out	2
Able to voice record notes	1
Adaptive functionality on any device	1
Bookmarking with emojis that reflect emotions and perspectives	1
Download visuals and written notes from e-books	1

Table 19 (continued)

Changes	Frequency
Have demonstrative media hidden	1
Have features hidden	1
Have space in the margins to do handwriting or drawing.	1
Have the material connected with hyperlinks	1
Provides additional information relevant to topic area	1
Share written notes with others online	1
Smaller file sizes	1
Tests that could track user's progress	1
Unlimited time accessibility	1

In her response to the question, Nadin highlighted a number of changes (e.g.,

smaller file size, cheaper price, more demonstrative media, and more tests with instant

feedback) that she wished to see in e-books. Nadin also recommended a certain way to

chunk the content in order to increase students' ability to know in which section they are

in while reading e-books. As she explained,

> I wish to be more able to locate myself while I'm reading e-books, since that's
> what I hate the most about them. I believe I could locate myself easily if the first
> thing I see when I open the e-book is links of all the chunked contents. For
> example, (Chapter 1, PowerPoint slides 1, Quiz1), and (Chapter 2, PowerPoint
> slides 2, Quiz2), etc. In terms of the layout of the content, I wish to have enough
> blank space in the margins to do handwriting or drawing. We also want to have
> more tests with instant feedback. In my field, we mostly solve math problems. I
> wish to have tests that can correct us sequentially while we solve these math
> problems. And in the references page, we want to have direct links for each
> reference so we can immediately read them if we want to. That would be really
> great! And we want to see more interactive images, animations, figures, and
> tables. . . . And I don't like it when I buy an e-book that has a big file size. It

slows my laptop down and then I either delete it or upload it in a USB flash drive or something. We want to have e-books that have small file sizes and cheaper prices than their printed copies.

Moreover, Figure 12 displays Nadin's sketch where she tried to visualize all of her recommendations. In her drawing, she explained her idea of chunking information in a way to increase e-book users' ability to locate themselves within the content. Nadin also included all changes she recommended in her response to the interview question.
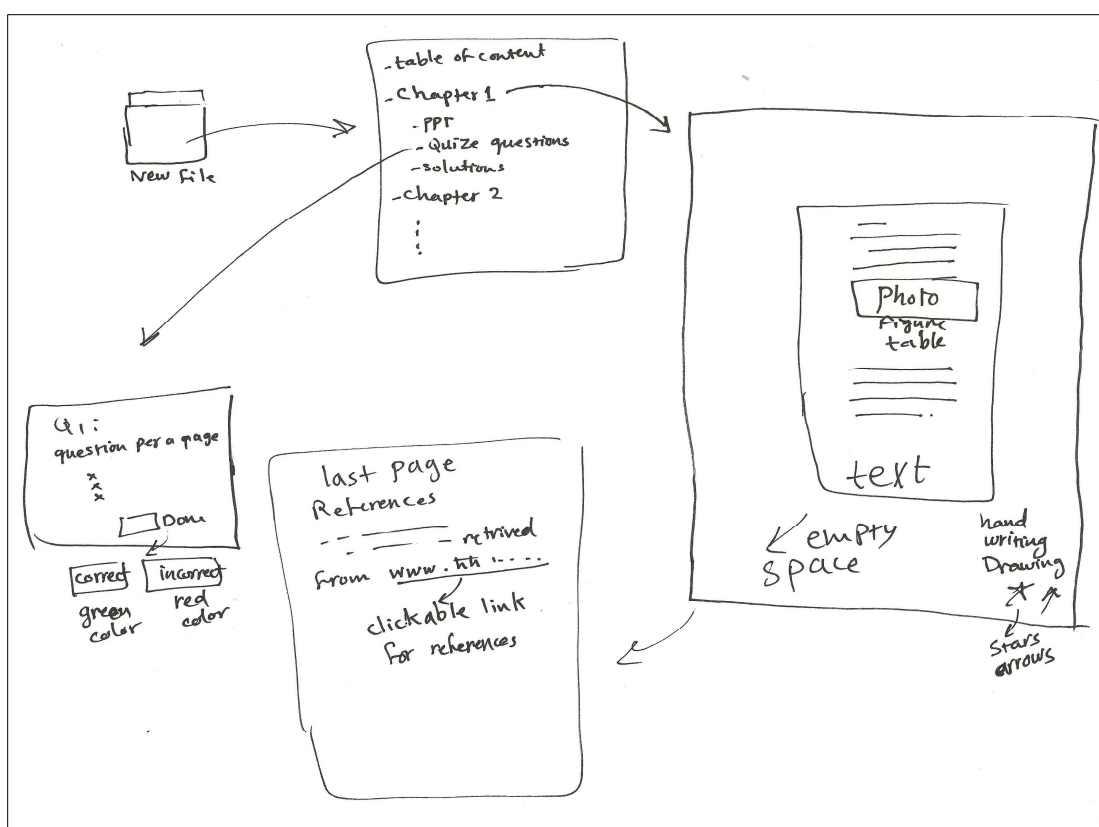
Figure 12. Recommendations visualized in a sketch by Nadin.

Ping provided a very similar response to Nadin's, as she said, "We want to start each chapter with bulleted list of the most important points. We also want to see a clearly chunked e-book and each chunk of information would be a section or part like: part one,

part two, etc. I mean e-books make me feel lost sometimes." She further explained, "I would feel more comfortable with reading e-books if the content is chunked in a way where I can organize it in my mind. So these chunks are suppose to be small, but we can be enlarge by clicking on a button. And it would be great if each chunk of information has an audio format."

As for Ahmad, he described himself as a text person who needs demonstrative media but rather to have them hidden under a button. He wished to have demonstrative media and features displayed only when needed, so he wouldn't be disturbed by them. As Ahmad stated,

> For me personally I prefer to have more media visuals, but hidden where I can see them only when I click on a button or something. I'm a text person but sometimes I need these pictures, so I want to see them only when I need them. Also the features are important to have like highlighting, keyword search, and notes adding. Another important thing that would be great to see in e-books is the hand writing ability. I wish I could write my comments on e-books the way I do on printed books. And some e-books show the features all the time where I feel bothered by seeing them while I'm reading. Having them hidden would be great, just like the e-book you showed me. And I wish e-books provide an audio format so I can listen to the book while I'm driving or jogging. It would be very beneficial.

Moreover, Larry, who was the only participant who indicated at the very beginning of the first phase interview that he prefers to use printed books to e-books, said, "I want to see more tests, videos, pictures, and animations that show details. I also want to be able to highlight. I also want to have embedded glossary and be able to read additional information that could be presented in a fun way. He further explained, ". . . like the 'did you know?' idea that shows an interesting fact relevant to topic area! It could provide additional and different information along with the content. I like the idea of that!" Figure 13 presents Larry's sketch where he transformed his recommendations into

a picture. In addition, he drew two pages displayed at a time, which could be one of the

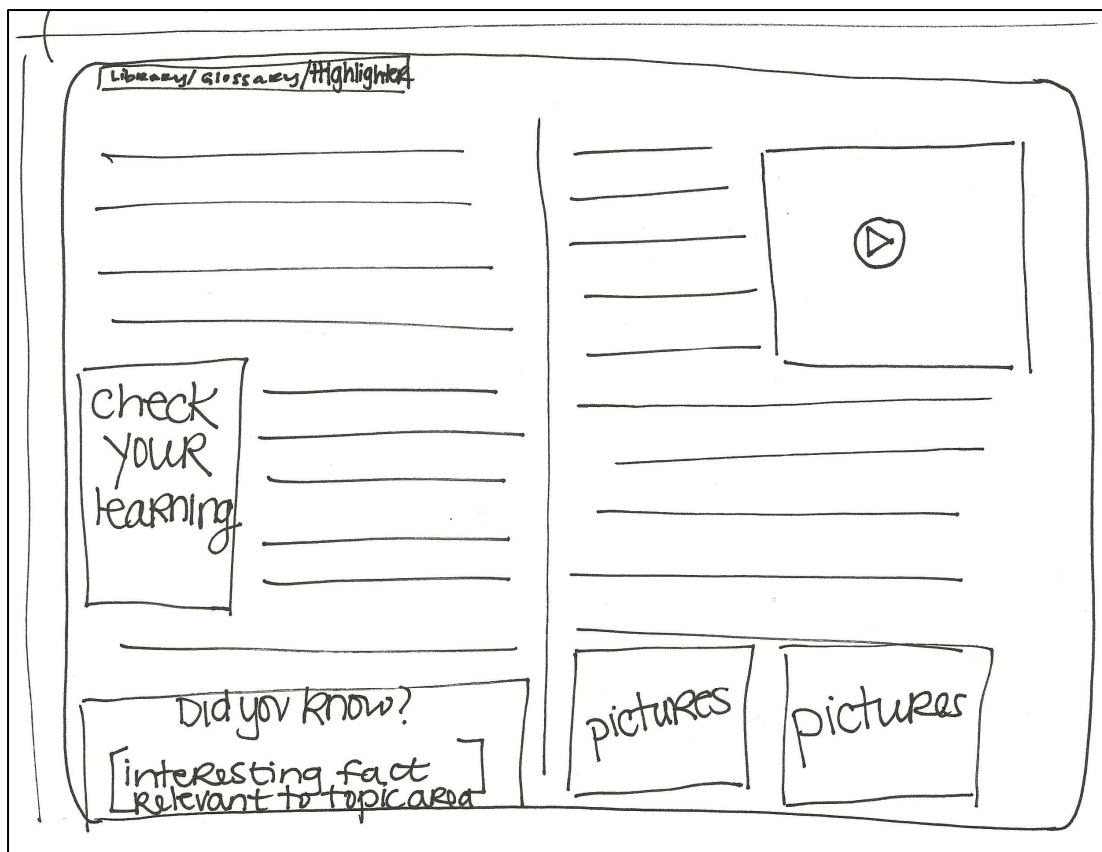reasons why he said, "I like to have the printed book in my hands."

Figure 13. Recommendations visualized in a sketch by Larry.

According to Iman, whose sketch is displayed in the following section (see Figure

20), having embedded definitions would be very helpful for her as a second English

language speaker. As she explained,

> I want to have more embedded definitions. English is my second language, so I do
> a lot of translation. Sometimes it is exhausting to go back and forth between the
> book and the translator. And I must understand the meaning of every single word
> to move forward with my reading and ultimately my learning. . . . I want to be
> able to modify the font type and size based on my preference to get more
> comfortable with the e-book. I want to have links for external resources and more
> images and videos. They are really helpful! And I want to do hand writing on e-

books instead of typing my notes. Also some e-books are offered in prices that are higher than their printed format. I mean we are students and money matters. Umm . . . but it is important to say that I've bought expensive e-books just because I believe they worth the price and they are better than their printed format.

Frances provided detailed information through her sketch (see Figure 14), and interview response to describe what the "perfect e-book" look like from her point of view. She said, "My perfect e-book has tests with immediate feedback, 3D images, videos, audios, links for additional resources, and embedded definitions. And it allows me to listen to the book through an audio format option and to highlight with different colors." Frances also recommended includingsocial interactions as a part of the e-book. As she stated,

I also want to add the social aspect for learning to be a part of the e-book. It is going to be great if students can read the e-book in the class and can communicate with each other at the same time. It is a great opportunity for students to discuss things while they are reading the same material at different times and different locations. It does not have to be during the same time like if a students decided to read the e-book later, he can click on the social button to see if somebody had the same question and others have answered it . I like the idea of having the social aspect for learning as a part of the e-book and not separated. . . . And I want to be able to hand write my notes. I like the idea of doing free style writing and drawing in the margins. Also the cost needs to be reasonable for students. Students don't want to spend money. Actually, they don't have to! When you create this awesome e-book for students, you should help them to buy it so they can benefit from it. I like the fact that e-books are cheaper than printed books or even free. But some e-books are as much as expensive and that's an unfortunate for us as students.
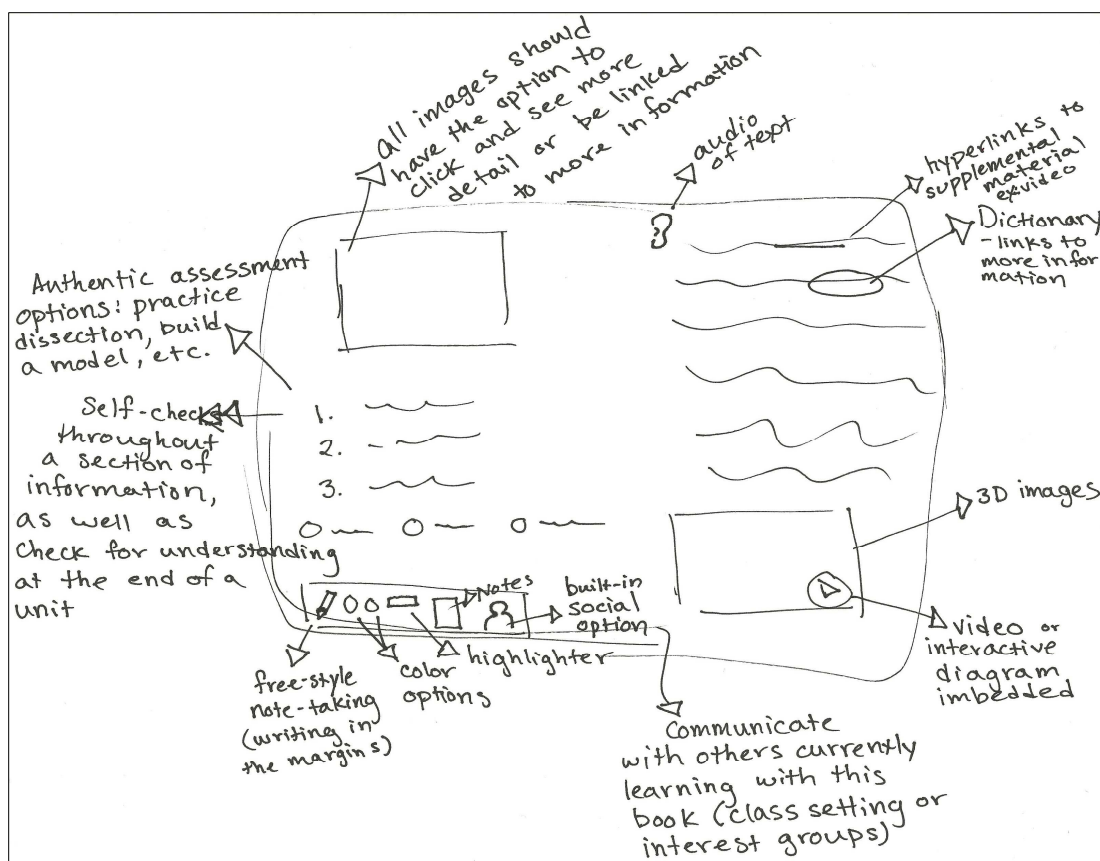
Figure 14. Recommendations visualized in a sketch by Frances.

Asya provided very similar recommendations to Iman and Frances. Similar to Iman, she wished to be able to modify the font type and size based on her preference. And similar to Frances, Asya wished to have the social interaction aspect included in her ideal e-book. According to her, "I wish all e-books to be ideal! Um . . . to me, the ideal e-book has visuals and figures because people learn differently and has self-test embedded because they really are helpful. It also has embedded definitions, and links for external resources." Asya further added, "And it allows users to do keyword search and modify

the font based on their personal preference. And most importantly, it allows them to communicate with others and know peoples' comments and opinions on the content."

As for Lisa, she provided a detailed idea through her response and sketch (see Figure 15), to communicate the kind of elements she wishes to be included in e-books. She stated,

> I want to be able to highlight, search for keyword, write notes. And I wish to be able to download notes from the e-book into a Word document or something like that. It would be cool if I can download figures or images from the e-book along with my notes. And I wish I could share my notes with my instructor or classmates. I like to see how other people look at things like what my instructor highlighted, or what my classmate commented on a specific part in the e-book. That kind of social interaction is really helpful. It could be in a blackboard that is attached to the e-book, or under a button or a star that hides the social interaction part while you are reading. And you just click on it then you can see what others think about the content. I also want to see more glossary terms or definitions, self-quizzing with immediate feedback, animations with narration, and videos.

Lisa further added,

> I also want to have an audio format of the e-book with a click of one button. I like being able to reading it, hearing it, watching it, and doing it while I'm reading an e-book. There are some students who do not like to just passively read from a book. They would like to listen to the information in order to fully process it. It would be great for students with disability too! I also want to have links for external resources like in Google or other websites. And it would be great if the feedback from the quizzes can locate the information in the e-book. So, if you want to read more about something its questions was answered wrong, you just click on a hyperlink that takes you immediately to a page in the same e-book. And while I'm reading the e-book, I want to be able to just click on a link and go directly to the home page and other chapters or important pages. Being able to practice active learning instead of passive learning is a big deal for me!
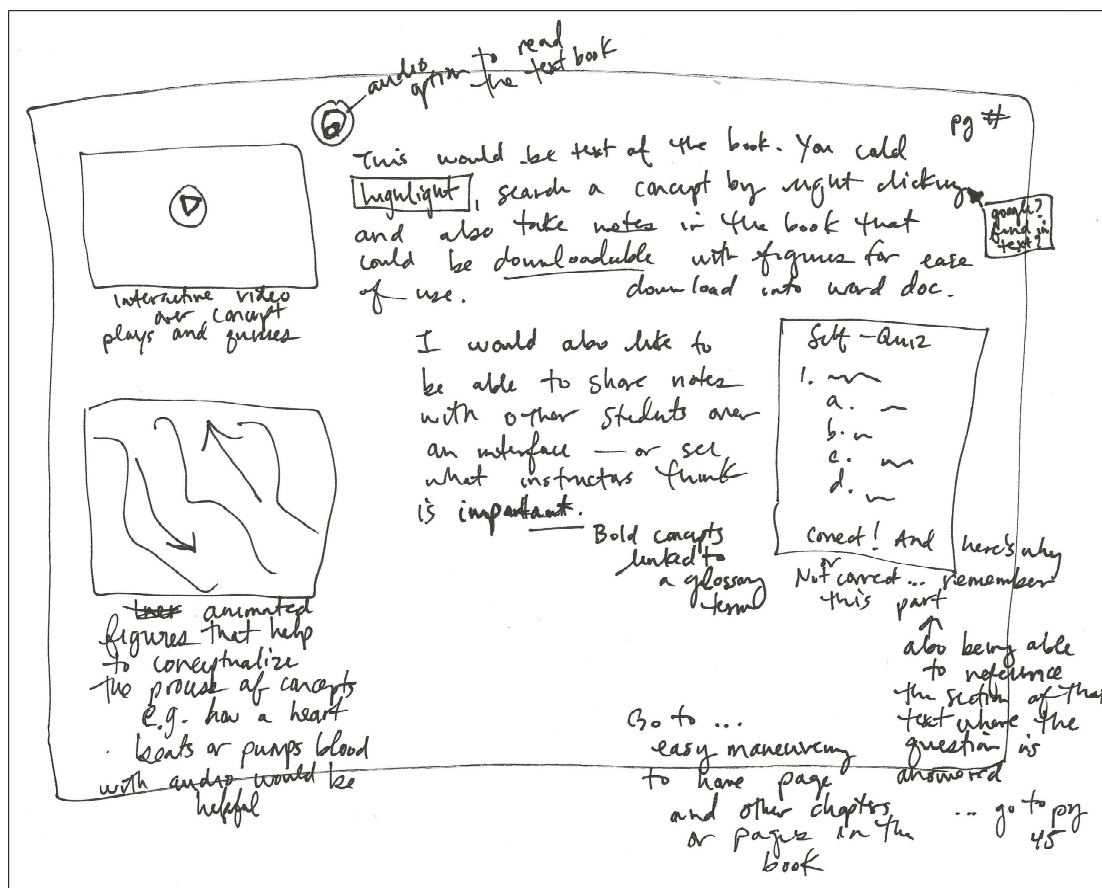
Figure 15. Recommendations visualized in a sketch by Lisa.

As for Jamal, he valued having the audio formats of the e-books, embedded

definitions, quizzes, links of external resources, images, animations, and videos (see

Figure 18). He also wished to be able to,

> . . . do more social interaction like with my classmates or instructors. I want to be
> able to know their recommendations or opinions on the content. The social
> interaction aspect could be hidden under a button that you can just click to see
> peoples' comments and suggestions. If there were new comments, the button
> would be read, and if there aren't, it could be green for example. Sometimes, I
> found myself learning the best from my classmates.

Moreover, Dana highlighted the need for having more visuals and simulations

with spoken words. She further indicated students need to have, ". . . exams that record

the scores so a person could track his or her progress. And I wish e-books have embedded translation that includes all languages, spoken pronunciation, and images to further explain the meaning." In Qiu response, he indicated the need for demonstrative media, quizzes, embedded definitions, links for external resources, notes adding and, ". . . drawing pictures that could help me remember the information. And I wish to be able to bookmark pages in a more fun way like with cartoon faces that reflects feelings and expressions."

According to Benjamin, when he was addressing my question, he wished to be able to ". . . draw on images and handwrite my notes to annotate my thoughts. I also want to have my notes hidden under a link or a button and I only read them when I need them." He paused, and then added, "Oh yes! I want to have quizzes with feedback. They are important to include. I also want to have features like keyword search, interactive visuals, and zooming in and out. And it would be great if e-books provide links for extra resources." Figure 16 displays Benjamin's layout of all recommendations he listed.
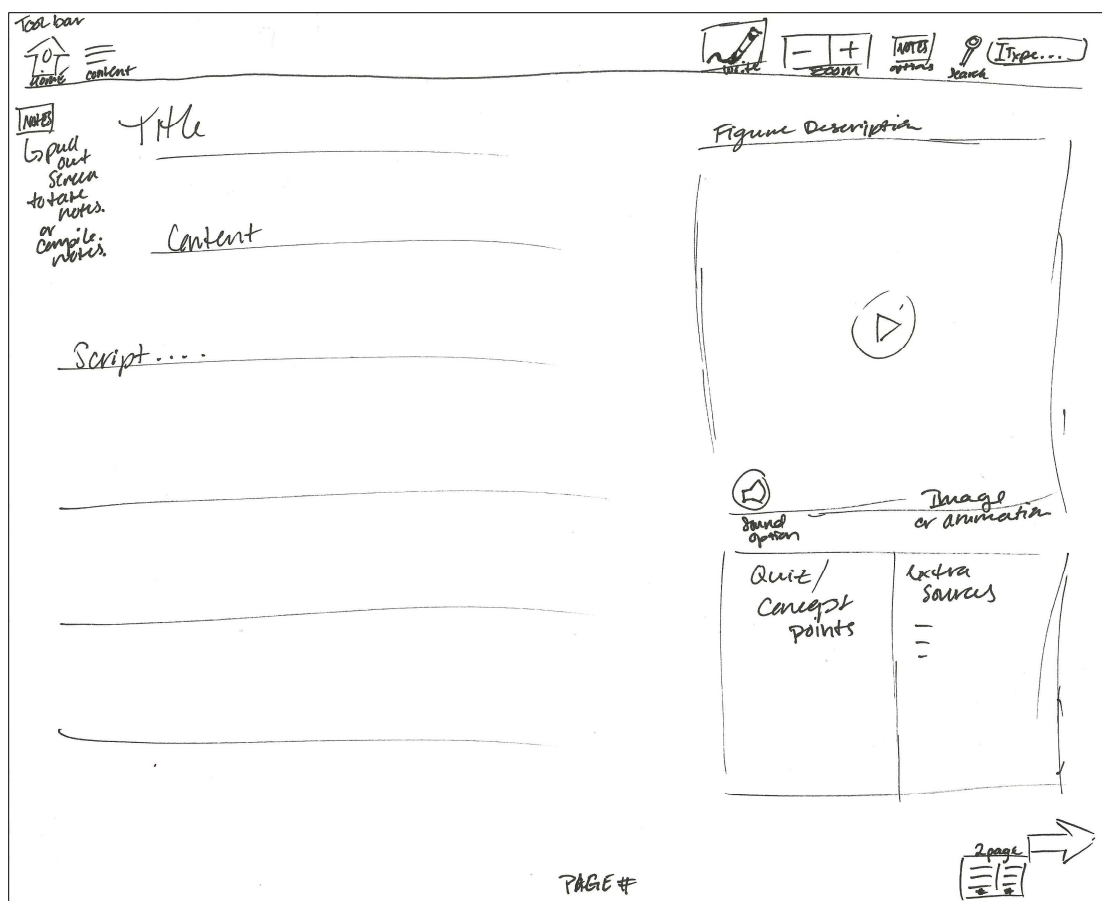
Figure 16. Recommendations visualized in a sketch by Benjamin.

A number of participants mentioned the importance, for them as students, to have e-books offered in affordable costs, and cheaper than their printed format. As for Eric, his response denoted that e-book's cost could be a major influence for him to buy e-books more, and vice versa. As he explained, "Sometimes, e-books prices are not that different from their printed version. You know as a student I have a very limited budget. So, if the price difference is less than $7, I usually buy the printed version. But when it is more than that, I buy the e-book to save some money." Eric further added,

I wish all e-books had animated pictures and videos. The tests also are very important to include. And there are some books comprising a CD that has an audio format of the book. I like to listen to the books sometimes instead of reading them just to relax my eyes when I feel exhausted. I just put my headphones on and listen to the book. I really like that! So, I wish e-books had an audio option to listen to the book instead of having a separate CD. And I don't know if it is possible for the developers to give us a chance to write and draw on our e-books. I just like the feeling of it!

Maimunah reflected on her needs as a student when she was listing changes and important aspects she wished to be included in e-books. According to her, the features could help her adapt to the use of e-books, demonstrative media could help her to comprehend material better, the embedded definitions could decrease her need for external resources, and e-books' affordable cost could influence her to buy them more. As Maimunah explained in her response,

I wish all e-books had the basic features that allow us to do whatever we like to do in printed books like highlighting with an electronic pen, plus the keyword search and adding notes. I want the notes to be hidden so they won't be distracting. I also want to see more 3D images, animations, vocal explanations, and videos so we can easily understand the materials, because when you see things that are moving, it is better than trying to imagine the movement or the motion by yourself. For example, in our area of study we have a lot of still charts. If these charts were in 3D and we can spin them around and see them from all angles, we will definitely be able to understand them better. . . . I want to see more tests with the immediate feedback. I also want to see more embedded definitions so I don't have to search through Google a lot! And we want e-books that are cheaper than their printed copies, because when I see an e-book that has a similar price and qualities of its printed format, I just go ahead and buy the printed one.

Angela recommended e-book authors and publishers to separate their e-book format vision from the printed one in order to produce effective e-books. In her sketch (see Figure 17), she drew her ideal e-book layout that incorporates all of her recommendations. Angela said, "I like the idea of having the videos built in. My e-books have only links that go to the videos. They were designed to match the printed books

layout. It would be better if e-book publishers separate the electronic format from the printed one." Angela further added,

> Looking at it that way will influence book authors to provide more things like videos, visuals, self-tests, and animated visuals. I wish to develop my own test so I can focus on certain points. It would also be great if I can listen to the book through an audio format. And I like to change the color, size, and type of the font depending on my needs. For example, if I were tired I would make the font size bigger to make it easier to read. I want to be able to handwrite notes that could be hidden on command. I also want to be able to record my comments instead of typing them if I want to.
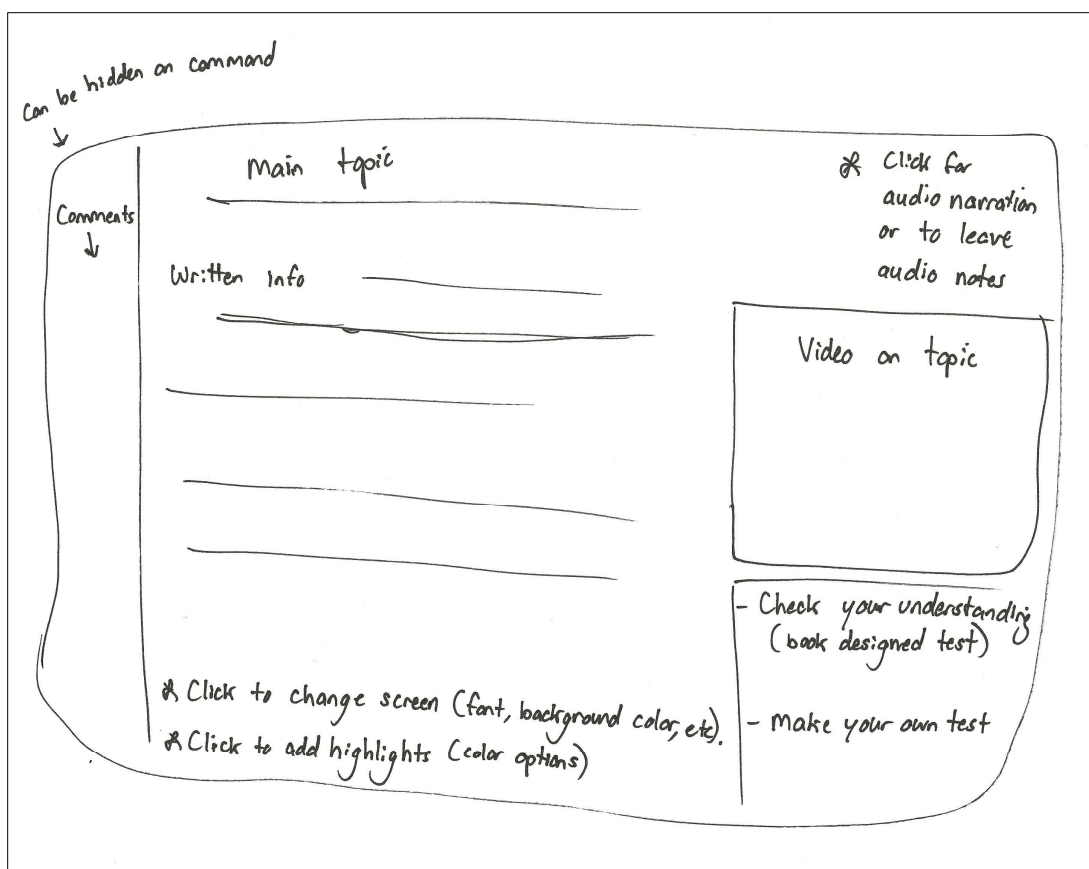

Figure 17. Recommendations visualized in a sketch by Angela.

According to Evelyn, she wished to have more demonstrative media, have more access to external resources, and be able to see what, ". . . my classmates highlighted or

commented on the content so I can learn from them. I also need to have more organized content to be able to see the progress of my reading and allocate myself through the whole book. So, I can know exactly how many parts or chapters are left." In addition, Evelyn expressed her feelings toward one of her previous experiences with the limited time accessibility that some e-books have. She stated,

> Some e-books I can buy them for life. But, a number of my e-books that I've gotten in Nook I have them just for three years. So, I would just hope that three years later I don't care about these e-books. You know as a student, it is kind of disturbing to buy or rent a book that and feel like I have it, I have it, I have it. . . . And then when I really need it I realize that I don't have it anymore.

As for Isabella, she wished that all e-books offer handwriting ability and include links of external resources and videos because, "I like the idea of 'here's what you read' and 'watch someone doing it'. I think it is really helpful to learn that way." She added,

> The functionality of e-books differs depending on the device. I mean . . . I remember one time I bought an e-book that I was able to read on my laptop but not on my cell phone. I wish I could read my e-books on whatever device I have in hand. It would be nice if I can read a chapter on my cell phone while I'm setting in the car and my friend is driving. And I wish to see more quizzes with instant feedback. Even if it's just one question at the end of each chapter just to alert me whether or not I paid attention. Sometimes when I'm tired, I may read a whole page and I don't remember what I actually read. The quiz would keep me on task. . . . And the prices of e-books sometimes are very similar to their printed format. I feel like they should be way cheaper. I mean I'm willing to pay the same price or even more if the e-book is similar to the one you showed me. It has so many helpful features that will enhance my learning.

Changes Associated with E-book's
Reader Hardware

When the participants were asked, "What changes would you like to see in e-books devices so it will best support your learning?," only 11 participants recommended changes they would like to see in e-book's reader hardware to better support their learning and goals. Table 20 shows five changes recommended by participants associated

with e-book's reader hardware along with the number of participants who mentioned them by frequency.

Table 20

Changes Participants Recommended in E-book's Reader Hardware and the Corresponding Frequency

Changes	Frequency
Has an electronic pen	5
Has a screen mitigating eye strain	5
Resembles printed books	5
Has reasonable price	3
One large device to support classrooms' social learning needs	1

The first three changes: has an electronic pen, has a screen that mitigates eye strain, and resembles printed books, indicate students' need to have the feeling of reading printed books while reading e-books. According to a number of participants, these recommended changes could help them to adapt to the use of e-books. The remaining 9 participants stated responses such as, "Nothing!," "I love my iPad," and "My devices work great for me." Their responses indicate their satisfaction with the technological devices they were using.

According to Jamal, having an e-book device that resembles printed books' designs would help him, as well as other e-books' users, to adapt to the use of e-books. He sketched his idea and included all the changes he recommended, and addressed in the previous section, on e-book's layout and functionality (see Figure 18). When answering the previously mentioned question, Jamal stated,

I wish to have an e-book device that looks like a traditional book. I open it and close it just like my printed books. And I can view two pages at the same time and hear them flipping just like the way they do in printed books. Um . . . I don't know if that's something can be developed, but it is important to say that such an idea could be very helpful for people like me, who could not adapt to the use of e-books.
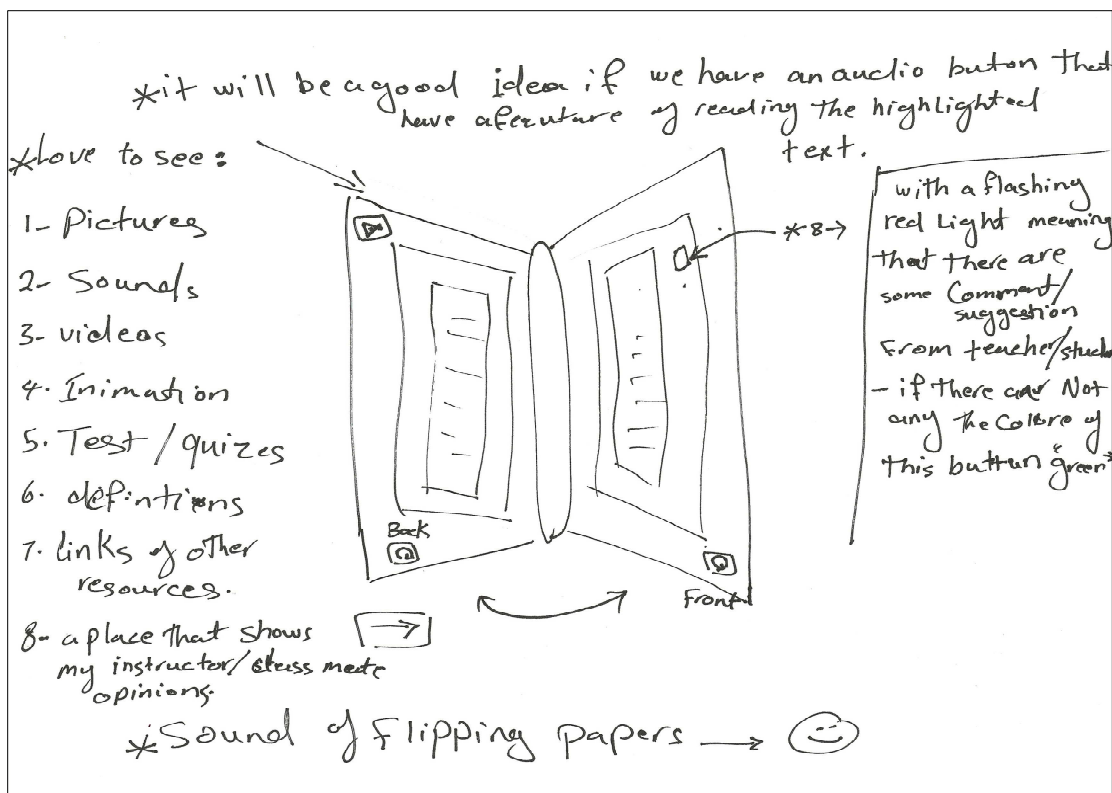

Figure 18. Recommendations visualized in a sketch by Jamal.

Moreover, Mishary provided very similar response and sketch to Jamal's (see Figure 19). As Mishary said, "I really wish to have a device that looks like a printed book. So we open it, close it, handwrite notes on the margins, bookmark it, and flip the pages just the way we do with traditional books."
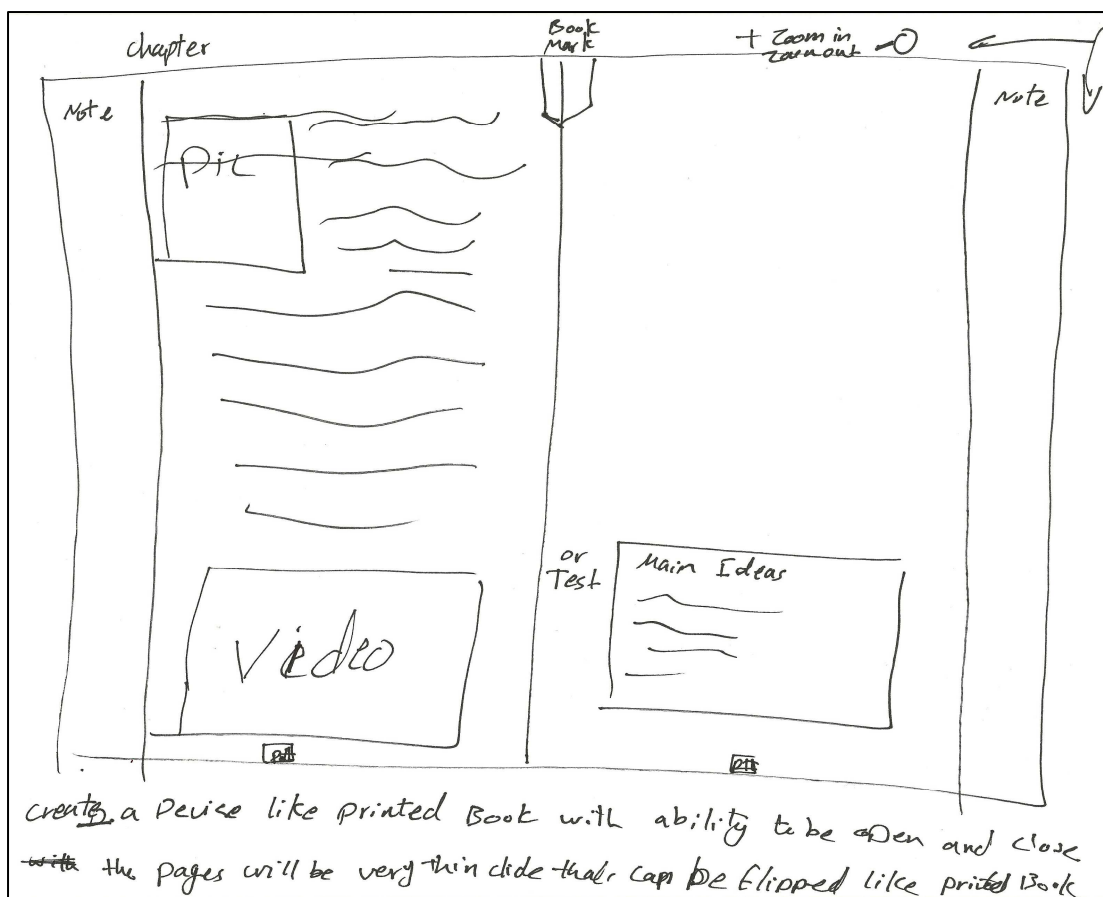
Figure 19. Recommendations visualized in a sketch by Mishary.

Wang also wished to, "have a device that looks like a printed book! I want to be able to view two pages at a time just like printed books! I want to feel like I can see all the pages and I can easily find the information I'm looking for." In addition, according to Evelyn, when she reads e-books, "I wish to have the feeling that I usually get when I read printed books. I want to hold the e-book device with both of my hands and flip the pages instead of scrolling down." She added, ". . . but I don't want to have a device for only reading e-books and then stick with only whatever that device offers. I want to have the additional functions in a tablet, but within a reasonable price range for a student."

According to Nadin, writing with an electronic pen would help her to get the feeling of writing on printed books. When addressing the interview question, she wished to, ". . . be able to do handwriting with an electronic pen so I can get the feeling I usually have from writing on printed books. I know I can buy it like from any store!" She paused, and then added, ". . . but I want it to be an essential part of the reader device. I want it to stick to it in some way! I want the reader device to be designed in a way that encourages us to use that pen." As for Maimunah, having an electronic pen, or as she described as an "e-pen," and a device screen that mitigates her eye strain, would motivate her to buy and read more e-books. As she explained,

> I want to have something like an 'e-pen', I would say, to write on e-books. That would be very efficient for us as students. . . . I want to have an e-book that looks like a printed book. Or at least when I read it I feel like I'm reading a printed book . . . you know . . . I mostly print pages from my e-books because I get tired from staring at the computer screen. So, I wish to have a device with a screen that does not hurt my eyes. Honestly, having an 'e-pen' and an 'eye friendly' screen would motivate me to buy and read more e-books.

Similar to Evelyn, Eric did not want to have a reader device that limits users to only reading e-books. According to him, having a device that has a screen that mitigates eye strain, like the Kindle, and offers advantages beyond just reading e-books, like the iPad, will make him "go 100% to e-books." As Eric said,

> It would bring us a great feeling to write with an electronic pen! Just like the way we do with our printed books. . . . I also wish to have an e-book device that considers my eye strain like the Kindle, but also more advantageous for other uses like the iPad. I don't want to have one without the other, and I can't have them both. I wish there is a one device that offers both aspects for me. It will make me go 100% to e-books.

According to Dana, she wished to, "use a pen to draw and handwrite my comments on the e-book instead of typing them." She added,

But, the most thing that I really wish to change is the screen. I usually spend at least 2-3 hours a day reading from the computer and the bright light from the screen hurts my eyes. I use eye drop every day just because of it. We need a reader device with a screen that doesn't harm the health of our eyes. . . . And the prices of the most reader devices are expensive. I hope that someday we would have a reader device with a reasonable price for us as students.

Moreover, in her response and sketch (see Figure 20), Iman also indicated her recommendation to have electronic pen and a screen that mitigates eye strain. She stated,

As students, we need to use an electronic pen to write and highlight on e-books. And we want to use the same pen to easily erase what we wrote or highlighted if we needed to. Because we need to feel like we are using printed books. . . . Another helpful thing to add is a printed book that looks like a screen! With less blue light, you know what I mean? We need to have a screen that considers our eye strain as students. Because we usually spend hours and hours reading and studying.

According to Larry, as a student he, ". . . already use the computer a lot, and I care about my eye strain. So, it would be great to have an electronic screen cover or something that to minimize the intensity of the light." He added, "And the majority of e-books reader devices aren't that affordable. As a student, I need to save my money for other important things."
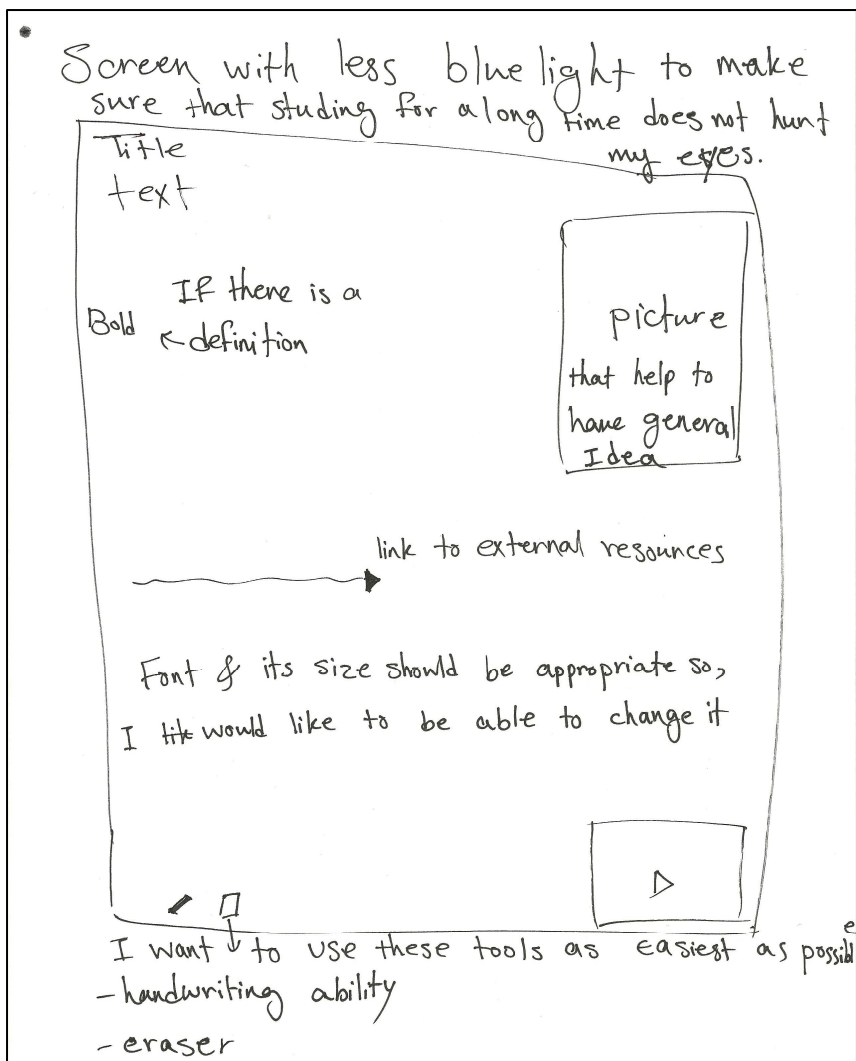
Screen with less blue light to make
sure that studing for a long time does not hurt
my eyes.

Title
text

Bold   If there is a
       ← definition

picture
that help to
have general
Idea

link to external resources

Font & its size should be appropriate so,
I would like to be able to change it

▷

I want to use these tools as easiest as possible
- handwriting ability
- eraser

Figure 20. Recommendations visualized in a sketch by Iman.

As for Qiu, he preferred to share his needs as a teacher to better support his

students' learning. He explained,

> I want to tell you what I need to see in e-books devices as a teacher instead. I've
> always wanted to read e-books with my students in the classroom through a one
> big screen that could be hanged on the wall. Or maybe have a table that has a
> screen where students can read e-books and do exercises together.

Lastly, I summarized the significant findings reported in this chapter in Table 21. The table shall serve readers as a tool to grasp the main findings in organized and timely manner.

Summary

This chapter reported and explained the findings of this research based on the five major themes and 16 sub themes that emerged from the 20 graduate students' interpretations of their experiences with the use of e-books for learning, perceptions toward e-books impact on learning, and recommendations of changes to e-books to better supporting their learning. The five major themes are: (a) all students valued e-books, but nearly all students still prefer printed books, (b) e-books can enhance learning, but can hinder learning as well, (c) the impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books, (d) students preferred to use the given e-book to the given printed book, and (e) changes to e-books recommended by students to better support learning. The inductive relationship of the 16 sub themes and the five major themes are demonstrated in Table 6. In addition, some direct quotes from interviews transcripts, field notes, artifacts, and research journals were utilized to report the findings of this research within the framework of the five major themes and the 16 sub themes. The reported findings provided a significant contribution to answer the subsidiary research questions, as well as the main research question: How do students describe the use of e-books through their experiences? Finally, this chapter is concluded with Table 21 that summarizes all significant findings in this research. The following chapter is comprised of a discussion, research implications, and recommendations for future research.

Table 21

Summary of the Significant Research Findings in Chapter IV

Themes	Significant Findings
All students valued e-books, but nearly all students still prefer printed books	• All students valued 16 advantages offered by e-books. Cheaper than printed books, offer immediate accessibility, and easy to carry were the advantages mentioned the most. Nineteen students indicated that they prefer to use e-books to printed books when they study. Only one participant prefers to use printed books, despite the fact that he valued e-books' lower cost, because he likes the feeling of having the printed book in his hands. • All 20 students indicated their use of 10 features available in e-books. Keyword search, highlighting, notes adding, and bookmarking were the features mentioned the most. • Eighteen students indicated that they like to search for external recourses (e.g. images, videos, additional information, and translations) mostly through YouTube, Google Images, Google, and Google Translate while they are reading e-books in order to obtain a better understanding of the material. Especially when reading complicated content or the e-book didn't provide enough information. Students felt "lazy", and "less interested" to search for additional resources on the Internet while reading printed books, but they felt more motivated to do so while reading e-books.

Table 21 (continued)

Themes	Significant Findings
	• All 20 students valued the ability to easily share e-books and thoughts and opinions about them with friends, classmates, educators, family members, and colleagues through the Internet, and also believed on the positive impact of it on ones' learning. Students perceived sharing e-books as efficient, motivating, and easy, whereas sharing or discussing printed books with others as, not that efficient or easy, limited to a few numbers of books, and requires a face-to-face meeting. However, it is important to denote that there were situations where students illegally shared e-books with others.
	• When learning matters, 13 students shifted their preference to printed books even though they indicated their preference to use e-books earlier in the interview. They provided 21 reasons that could explain the alteration in their preferences. I like the feeling of the printed book in my hand, I like to handwrite write my notes on printed books, I'm more used to printed books, and I feel more comfortable, when I hold printed books were the most common responses.
E-books can enhance learning, but can hinder learning as well	• All 20 students indicated that they believe e-books enhance learning. Students listed 17 reasons that could justify their enhancement perceptions. The most given reasons were: because e-books offer immediate accessibility, save time and effort, ease of translations, and accessibility to external resources.

Table 21 (continued)

Themes	Significant Findings
	• 17 students indicated that e-books could hinder learning and listed 11 reasons that could justify their hindrance perceptions. The most given reasons were: when a student feels more used to printed books, feels uncomfortable using e-books, has a lack in technological knowledge, and feels distracted by e-books.
The impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books	• All 20 students indicated they felt comfortable and confident when using e-books and believed feeling comfortable and confident are essential parts of any learning process.
	• Five students believed students' positive experiences with e-books influence them to read more e-books, and vice versa.
Students preferred to use the given e-book to the given printed book	• Three students chose to use the given e-book for general reading and the given printed book if they were required to comprehend the material. Students favored the given printed book for the same reasons they indicated during the first phase interview. It is important to denote that students stated they liked the e-book more and while they were skimming through it, they expressed positive comments, facial expressions, and body gestures.

Table 21 (continued)

Themes	Significant Findings
	• 17 students chose to use the given e-book for all studying purposes even if they were required to comprehend the material. Students listed 35 reasons for why they liked the given e-book more than the given printed book. The most mentioned reasons were, the e-book: has demonstrative media, has interactive tests, is more interactive, and not overwhelming like the printed book. • All 20 students valued demonstrative media delivered in the given e-book. They provided positive responses toward interview questions related to the visuals available in the e-book, as well as 16 justifying reasons. The most given reasons were: the media features explain processes in motions and with audios which is better than only reading text and viewing still images, reinforce learning through multiple channels (eyes and ears), explain complicated concepts better than the printed book, and reinforce the ability to retrieve comprehended information. • All 20 students valued the features available in the given e-book and the embedded definition was the most mentioned feature. Students also listed 13 reasons that could justify their positive perceptions towered these features. The reasons mentioned the most were: these features decrease the need for external resources or help and save time and effort.

Table 21 (continued)

Themes	Significant Findings
	• Nineteen students liked the self-test available in the given e-book and listed seven justifying reasons. The reasons mentioned the most were, the test: provides immediate feedback, motivates users to check their learning and identify their weakness, saves time and effort, and grabs attention to important information.
Change to e-books students recommend to better support learning	• All 20 students recommended 27 changes they would like to see in e-book's layout and functionality to better support their learning. Having more demonstrative media, tests with instant feedback, direct links for references and external resources, able to handwrite notes, and embedded definitions with vocal pronunciation and images to further explain the meaning were the changes that recommended the most. It's important to denote that students also recommended providing social interaction opportunities and allowing users to share written notes with others online.
	• Eleven students recommended changes they would like to see in e-book's reader hardware to better support their learning and goals. The most recommended changes were: has an electronic pen, has a screen mitigating eye strain, and resembles printed books.

CHAPTER V

DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

This chapter is comprised of: a discussion of the reported research findings, research implications for educators, students, developers of e-book readers, e-book authors, e-book publishers, and technology production companies, recommendations for future research, and a conclusion. The majorities of prior studies on e-books were conducted quantitatively in order to investigate whether readers prefer to read e-books or printed books. Furthermore, researchers have not yet qualitatively explored the root causes of readers' positive and negative perceptions toward the use of e-books, which indicate the criticality of conducting this research. In this research, interpretations of 20 graduate students about their experiences with the use of e-books for learning were qualitatively explored and organized into five major themes and 16 sub themes. All the themes addressed the main research question: How do students describe the use of e-books through their experiences? Furthermore, every major theme is aligned with, and answered, one supporting research question. The following are the supporting research questions followed by the contributory major themes, denoted with (❖) symbol, along with their sub themes, denoted with (•) symbol:

Q1 What format, e-books or printed books, do students prefer to use when they learn?

❖ All students valued e-books, but nearly all students still prefer printed books

• Students valued the advantages offered by e-books

- Students valued features provided in e-books

- Students valued the ability to search for external resources through the Internet in e-books

- Students valued the ability to easily share e-books and exchange their thoughts and opinions about e-books through the Internet

- Most students shifted their preference to printed books when learning mattered

Q2   How do students describe the use of e-books in terms of learning enhancement and hindrance?

- ❖ E-books can enhance learning, but can hinder learning as well

- Enhancement perceptions

- Hindrance perceptions

Q3   How do students describe the impact of prior technological experience, knowledge, and confidence on perceptions and decision-making associated with e-books?

- ❖ The impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books

- Students valued being comfortable and confident when using e-books

- Negative experiences with e-books could alienate future uses

Q4   How would students describe the use of the given e-book that contains demonstrative media, embedded features, and tests compared to the given printed book?

- ❖ Students preferred to use the given e-book to the given printed book

- Use of the e-book for general reading and the printed book when learning mattered

- Use of the e-book even when learning mattered

- Students valued demonstrative media provided in the e-book: 3D images, animations, and audio narrations

- Students valued features provided in the e-book

- Students valued self-testing approach and its' immediate feedback provided in the e-book

Q5   What changes to e-books do students recommend to better supporting their learning?

❖   Changes to e-books recommended by students to better support learning

- Changes associated with e-book's layout and functionality

- Changes associated with e-book's reader hardware

Discussion

The discussion of the research findings is based on the five major themes and the 16 sub themes emerging from the 20 graduate students' interpretations of their experiences with the use of e-books for learning. The following paragraphs discuss the significant findings and critical issues associated with them along with the support of relevant literature.

All Students Valued E-books, But Nearly
All Students Still Prefer Printed Books

Students valued the advantages offered by e-books. Nineteen participants indicated that they prefer to use e-books to printed books when they study. All participants valued a number of advantages offered by e-books. The three most advantages mentioned were e-books: are cheaper than printed books, offer immediate accessibility, and easy to carry. These advantages are aligned with the reported findings by DeNoyelles et al. (2015). According to the result conveyed from their study, e-books'

lower cost was the top factor motivating graduate students to e-books use adoption from 2012 to 2014. The cost effectiveness factor followed by the ability to access e-books anywhere and to store many e-books on one device, were the most important factors influencing e-book adoption by graduate students. Moreover, in their study, Alhammad and Ku (2016) reported that students favored the immediate accessibility e-books have. They also found that when e-books are more cost effective, compared to their printed copies, students tend to feel more motivated to use them.

In this research, it was anticipated that the cost effectives factor would influence students to use e-books more than printed books. As Li (2013) stated, "Ebooks may cannibalize print book sales because they are cheaper and more convenient to read" (p. 2). Annand (2008) also reported that a number of researchers pointed out that e-books are more accepted when their costs are lower than other print-based learning resources.

In addition to its lower cost, students valued e-books' immediate accessibility, and the fact that they are easier to carry compared to printed books. These two advantages are correlated with one another and pertain to the constructivist learning approach (Piaget, 1973). They are also consistent with my prediction that because e-books have flexible accessibility through an easy to carry reader device, students could feel more motivated to obtain information and knowledge at times and locations that are convenient to them. As a result, students are offered flexible opportunities to construct their own meanings and understanding from the experiences of reading e-books. As Iman stated, "E-books . . . help me to study anytime and anywhere I want." She added, "And I travel all the time between the United States and Iran and I can't carry even one printed

book with me. But I can carry as many e-books as I want in my laptop." Frances also

stated,

> E-books are . . . easier to access compared to printed books. I can read e-books anywhere, i.e., in the class, at home, at my work, while sitting in my car waiting for something or someone, and even in the doctor's office. And as a student, I don't want to carry around all the heavy printed books wherever I go.

Consistently, Annand (2008) reported that university students favored the

flexibility that e-books' accessibility offer and perceived e-books as extremely portable

especially for students who frequently travel with laptops. In addition, Ebied and Rahman

(2015) believed that because e-books offer easy accessibility, university students could

feel motivated to learn more by uploading e-books and reading them anytime and

anywhere.

Students valued features provided in e-books. According to the findings of the

research, all 20 students indicated their use of 10 features available in e-books. Keyword

search, highlighting, notes adding, and bookmarking were the four features mentioned the

most. Some students referred to theses features as the ones with the most contribution to

their learning. This part of the findings is consistent with previous research's indications

that e-books have features (e.g., key words search capability, highlighting, notes adding,

word definition, bookmarks) that would augment functions performed by students while

they are reading (Lam et al., 2009; Mock, 2004; Tosun, 2014). It also corresponds to

Simon's (2001) reported findings. He reported that university students considered the

ability to look up words, bookmarking, highlighting, and annotation as important features

in e-books. Furthermore, the four features, keyword search, highlighting, notes adding,

and bookmarking, were addressed by Turner (2005) as advantageous for students.

According to Simon (2001), "In order for e-books to gain widespread acceptance as an educational tool, they must reproduce the many easy-to-use features of a printed book" (p. 5). Simon (2001) further stated, "Once users are convinced that e-books can successfully reproduce familiar features they have come to expect from the printed medium, they can begin to look toward enhanced utility" (p. 5). As aligned with the statements addressed by Simon (2001), students indicated that the use of these features increased their comfort level. They felt comfortable because these features helped them to do activities they usually do when reading printed books. In fact, some students limit their use of e-books to the ones that have features because these features reinforce their adaptation to e-books use.

Students valued the ability to search for external resources through the Internet in e-books. It had been anticipated that students feel motivated and interested to explore additional information while reading e-books more than when reading printed books. According to the findings of the research, 18 students indicated that they have obtained better learning opportunities by searching for external recourses while reading e-books. Furthermore, students pointed out that they felt more motivated to access external information while reading e-books. On the other side of the spectrum, they felt "lazy" and "less interested" to search for additional information on the Internet while reading printed books. In fact, some students perceived the option of searching for external information through the Internet while reading printed books as "complicated" and might cause students to lose their "concentration" on the material.

In addition, students indicated that they like to search for images, videos, additional information, and translations mostly through YouTube, Google Images,

Google, and Google Translate while reading e-books in order to obtain a better understanding of the material. The findings support other researchers' indication that the web-based contexts provided in e-books could augment students' opportunities to learn new knowledge (Lam et al., 2009; Mock, 2004). Furthermore, when students were asked about the reasons for why they search for external resources while reading e-books, they provided several reasons that are consistent with learning theories discussed in the literature.

According to students, they searched for external material (e.g., images, videos, and additional information) mostly because of four reasons: help them understand the material better, facilitate learning when the content is too complicated, help when the e-book didn't provide enough information, and increase their ability to recall learned information. Following the information processing approach (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Lohr, 2007; Norman & Bobrow, 1975; Waugh & Norman, 1965), fulfilling learners' need to view material such as images, videos, and additional information, could foster their ability to successfully process the information, transform it to long-term memory, and be able to retrieve it in the future. Moreover, when the information processing theory was discussed in the literature in Chapter II, it was predicted that using the web search available in most of e-books devices to search for additional resources, images, and videos could lead to a successful processing of information.

Furthermore, cognitive load theory believes that considering human cognitive system's architecture could reinforce the occurrence of effective learning (Harasim, 2012; Lewis, 2008; Lohr, 2007; Paas et al., 2003; Sweller, 1988). Humans' working

memory is often limited to a certain number of elements and it may lose important elements of perceived knowledge when it is complicated or overwhelming. Hwang et al. (2013) believed that efficient access to information could optimize learning and reduce intrinsic cognitive load. Therefore, it was anticipated that the efficient accessibility to additional materials offered by e-book reader devices could reduce cognitive overload and expand the capacity of working memory. Corresponding to the cognitive load theory perspective, students provided reasons such as: when the content is too complicated, to give their brain a break, to reduce their cognitive overload, and to scaffold their understanding to explain why they like to search for external materials while reading e-books.

In addition, to better understand the material, to feel more able to remember the information, and to support visual and auditory learners are three reasons indicated by students that are supported by dual coding theory (Paivio, 1990) and cognitive theory of multimedia learning (Mayer, 2001). According to dual coding theory (Paivio, 1990) and cognitive theory of multimedia learning (Mayer, 2001), when the information provided to learners incorporate several encoding systems (vocal and visual/text), learners could have greater opportunities to facilitate and retrieve the content when they need it.

Students valued the ability to easily share e-books and exchange their thoughts and opinions about e-books through the Internet. Social constructivism highlights the value of constructing understanding of individuals' knowledge and experiences that could be influenced by social networks (Vygotsky, 1978). Following the social constructivism theory, e-books offer a greater opportunity to easily share e-books and exchange thoughts and opinions about them through the Internet. Therefore, social

interactions occur when students develop meaning for the content provided in e-books and of the experience of reading e-books while interacting with others (Alhammad & Ku, 2016). In addition, some e-books provide social features where meaningful interaction among users could be easily accomplished (Vassiliou & Rowley, 2008). According to Roschelle et al. (2007), the features embedded in tablets and e-book reader devices could influence human communication, instruction, and active engagement.

According to Alhammad and Ku (2016), unlike printed books, "The convenience of sharing e-books immediately through the Internet motivates students to construct and gain knowledge whenever and wherever they can" (p. 3). In addition, Khanna (2015) believed that because students can share e-books with their peers and educators can ask questions regarding the content online, they could go beyond highlighting and adding notes. Other e-books foster users to discuss the material in associated forums or discussion boards. It was predicted that e-books' readers could help one another to construct knowledge by discussing ideas and asking questions through these forums.

Moreover, the findings of the research reveal that all the 20 students valued the ability to easily share e-books and exchange their thoughts and opinions about e-books through the Internet. Students also believed on the positive impact of sharing e-books or ideas about them with friends, classmates, educators, family members, and colleagues. They perceived sharing e-books as efficient, motivating, and easy. On the other hand, students perceived that sharing or discussing printed books with others as, "not that efficient or easy," "limited to a few numbers of books," and "requires a face-to-face meeting." However, it is important to note that students might exceed legality restrictions

by printing e-books. Students also have shared e-books illegally in order to "share the cost" and "save money."

All 20 students provided positive responses when asked whether they believe that the ability to easily share thoughts and opinions about e-books through the Internet contributes to individuals' learning. They believed that the idea of sharing and discussing e-books online could solidify existing knowledge, help with gaining new knowledge from different perspectives, add value to one's learning, and help with the ability to remember shared or discussed information. For example, Larry believed that providing people with accessibility to knowledge, ". . . combined with other's opinions and different perspectives would solidify their existing knowledge." As another example, Frances stated,

> If you can't understand a concept that you can address immediately, someone can assist you with gaining that knowledge in a different way and change your understanding of it. . . . If you are able to interact and share as you are processing the information, you are going to understand it better and keep it for so much longer. I mean when you have a conversation about a piece of information, it is going to have a value to you. Where as if you are reading a printed book by your own at your home, it would not be that meaningful.

In fact, some students reflected on their own experiences where they learned new knowledge by sharing and discussing e-books with their classmates and friends. For example, Jamal had an experience with a classmate where they had a difficult time trying to understand some concepts in a face-to-face class. After the class, his classmate sent him some e-books via email and discussed these concepts online and eventually, "helped each other to fully understand these concepts." And when Wang reflected on his experience as an online student and stated, "To be honest, I've learned a lot from other students' opinions and not only from the program instructors." Finally, in consistent with

the prediction that e-books users can help one another to construct knowledge by discussing ideas and asking questions through associated forums or discussion boards. The findings of this research reveal that students taught each other, learned from one another, asked questions, and addressed others' questions through forums or discussion boards that were linked to the material provided in e-books.

Most students shifted their preference to printed books when learning mattered. Because of the various features and fruitful characteristics provided in e-books, it was predicted that students would value the use of e-books for learning. However, according to other research, while some students prefer reading e-books for numerous advantages, some students still hold negative opinions toward e-books and prefer reading printed books (Annand, 2008; Pledger, 2010; Woody et al., 2010). According to Woody et al. (2010), despite e-books' easy accessibility, the results of their study delivered evidence for what appears to be an aversion to e-books by students. As also stated by Tosun (2014), "Even though students have the opportunity to access technology anytime and anywhere they want, there is still a preference for reading printed books" (p. 25). Tosun's (2014) study was conducted on 258 university students and the findings revealed that more than 79% of students don't like to use e-books because they aim to protect their eye health, they like holding the printed book in their hands, and it feels more portable and easier to read printed books (Tosun, 2014). Similarly, Annand (2008) also found that students faced difficulties reading e-books because of eye strain incidents that negatively affected their experiences and drove them to prefer print-based materials.

In addition, Gregory (2008) believed that along with the growing number of e-books usage and productivity, students' negative opinions toward e-books are increasing. In Pledger's (2010) study, 53% of participated students conveyed their preference to read printed books to e-books. According to studies investigated e-books and printed books reading by students, the findings conveyed that students preferred to read printed books to e-books (Annand, 2008; Gürcan, 2005; Pledger, 2010). Although the majorities of previous studies examined readers' preferences of reading e-books or printed books, and these studies have not yet considered exploring the root causes for their preferences.

According to the findings of this research, when students were asked if they still prefer to use e-books if they were required to fully comprehend the information, like studying for an exam, 13 students who previously indicated their preference to use e-books shifted their preference to printed books. Students provided 21 reasons that could explain the shift in their preferences, such as "I like the feeling of the printed book in my hands," "I like to hand write my notes on printed books," "I'm more used to printed books," and "I feel more comfortable when I hold printed books" were the most common responses. The fact that students shifted their preference to printed books is consistent with what indicated by pervious researchers (Annand, 2008; Gregory, 2008; Gürcan, 2005; Pledger, 2010; Tosun, 2014; Woody et al., 2010). In this research, students indicated three reasons, out of the 21, that aligned with findings reported by Tosun (2014) and Annand (2008). These reasons were: "the light of the screen hurts my eyes," "I like the feeling of the printed book in my hands," and "it feels more easer to use printed books."

In this research, students provided eight reasons behind their preference to use printed books and not being ready to shift their preference to e-books. These reasons were: "I like the feeling of the printed book in my hands," "I'm more used to printed books," "I feel more comfortable when I hold printed books," "I like flipping the pages," "I like the smell of printed books," "feels more personal," "fits my studying style," and "I like to feel the texture of printed pages." Thus, students preferred to use printed books because they are more used to them and they need to feel more comfortable when learning matters. They also like to do activities (e.g., hand write, draw, highlight) they usually like to do on printed books while studying. Students provided three reasons as examples: "I like to hand write notes on printed books," "I like to draw on printed books," and "I like to highlight on printed books."

The fact that students shifted their preference to printed books because they need to feel more comfortable when learning matters and do activities they like to do while studying is consistent with the self-efficacy theory. Self-efficacy focuses on people's actions and perceptions that are often based on their feelings and beliefs about their own capabilities (Bandura, 1997). In this research, students provided six reasons that reflect their beliefs of their own capabilities when it comes to studying using printed books. These reasons were: "I feel able to focus on the content when I use printed books," "I can better locate the information in printed books," "It feels more easier to use printed books," "I can better locate myself in printed books," "I feel I can better recall information when I use printed books," and "I feel more confident about my ability to understand the content when I use printed books." Based on all previously addressed reasons, because students are more used to printed books, their confidence and

competence levels toward their own learning capabilities increase when using printed books.

Furthermore, according to the self-efficacy perspective, human's feelings and beliefs about their own capabilities are influenced by several factors and mastery experience is one of them (R. M. Ryan & Deci, 2009). Mastery experience is associated with one's previous knowledge and experiences. Hence, when students successfully use e-books, it is anticipated that they would have high self-efficacy feelings and confidence toward using them. However, when students face difficulty with the technology, it is anticipated that they would have low self-efficacy feelings and feel insecure when using e-books. Eventually, future use of e-books might be diminished. Students provided four reasons that support this anticipation. They were: "the light of the screen hurts my eyes," "e-books reader battery might go out of charge," "the pages in e-books reader might freeze," and "printed books make me feel more secure."

E-books Can Enhance Learning, But
Can Hinder Learning As Well

Enhancement perceptions. All 20 students denoted that they believe e-books enhance learning. Two students associated learning enhancement with the technological knowledge. In other words, they believed e-books enhance learning if e-books users know how to use the e-book device, otherwise it will lead to the contrary, which is consistent with the self-efficacy perspective. According to Bandura (1997), previous knowledge and experiences are associated with the self-efficacy theory. When an individual knows how to perform a task and has successfully performed a task before, it is anticipated that he/she would have high self-efficacy feelings on doing it again. Individuals who are confident about their abilities to perform a task because of their

previous knowledge and positive experiences are expected to successfully obtain optimal outcomes and vise versa (Bandura, 1997; R. M. Ryan & Deci, 2009).

In this research, students listed 17 reasons that could justify their enhancement perceptions. The four most given reasons were, because e-books offer: immediate accessibility, save time and effort, ease translations, and accessibility to external resources. E-books immediate accessibility and accessibility to external resources are discussed in the previous section with the support of relevant literature (Alhammad & Ku, 2016; Annand, 2008; Atkinson & Shiffrin, 1968; Boradbent, 1984; ; DeNoyelles et al., 2015; Ebied & Rahman, 2015; Harasim, 2012; Hwang et al., 2013; Lam et al., 2009; Lewis, 2008; Lockhart & Craik, 1990; Lohr, 2007; Mayer, 2001; Mock, 2004; Norman & Bobrow, 1975; Paas et al., 2003; Paivio, 1990; Sweller, 1988; Waugh & Norman, 1965). These two reasons are also aligned with what is discussed in the two sub themes findings in the first major theme: students valued the advantages offered by e-books and students valued the ability to search for external resources through the Internet in e-books.

The other two reasons: e-books save time and effort and ease of translation are correlated and could be classified under convenience category. Students indicated that e-books could enhance learning because of some of the features and characteristics (e.g., keyword search, embedded word definition application, and save notes and compile) that save their time and effort and help them to obtain needed information immediately. Students also indicated that the ease of copying words and pasting them in translation websites such as Google Translate is another learning enhancement aspect available in e-books, but not in printed books. Students believed that printed books couldn't reach e-books' level of convenience and may distract their learning goals. As Maimunah stated

when explaining the value of the keyword search feature in e-books, "I lose my thoughts and learning motives when I spent so much time and effort looking for a piece of information in a printed book."

These reasons indicated by students support the prediction that e-books are advantageous learning tools that foster fruitful learning experiences through the use of features available in them. In addition, the reasons are consistent with what was reported by Simon (2001), Turner (2005), and Tosun (2014). According to those researchers, features provided by e-books (e.g., search for specific terms or pages, annotation, immediate definition, and copy material) are important features that could enhance learning activities performed by students.

Hindrance perceptions. Seventeen students indicated that e-books could hinder learning and listed 11 reasons that could justify their hindrance perceptions. E-books could hinder students learning when a student feels more used to printed books, feels uncomfortable using e-books, lacks in technological knowledge, and feels distracted by e-books were the four most given reasons. The first three reasons: feeling more used to printed books, feeling uncomfortable using e-books, and lacking in technological knowledge are consistent with what the self-efficacy theory implies (Bandura, 1997). Precisely, they are correlated with two of the four self-efficacy beliefs sources addressed by R. M. Ryan and Deci (2009): (a) mastery experience, (b) vicarious experience, (c) social persuasions, and (d) physiological reactions.

Feeling more used to printed books and feeling uncomfortable using e-books fall in the physiological reactions source. Accompanied by individual's mood, physiological and emotional states such as feeling unconfident and uncomfortable, indicate information

about efficacy beliefs status. Positive moods and emotional states augment self-efficacy. Conversely, self-efficacy beliefs could be diminished by negative moods and emotional states such as feeling unconfident, uncomfortable, or despondent. In this research, students believed that e-books could hinder students' learning when they feel more used to printed books or feel uncomfortable using e-books because these negative moods and emotional states could be regarded as debilitating. Furthermore, lacking in the technological knowledge is another reason indicated by students that could be categorized under the mastery experience source of self-efficacy beliefs. Simply put, success increases self-efficacy and failure decreases it. In this research, students believed that when students lack the required technological knowledge of reading e-books, they would not be able to successfully use e-book reader devices, then, they would develop doubt feelings on their technological capabilities. Hence, students' learning would be hindered by their failure (R. M. Ryan & Deci, 2009).

Finally, feeling distracted by e-books was also one of the mostly mentioned reasons by students. This reason is consistent with O'Brien (2011) findings. In this research, students believed that reading e-books on an e-book reader device that offers Internet accessibility might hinder students' learning by distracting their attention to do unrelated activities (e.g., checking unrelated websites, watching unrelated YouTube videos, checking Facebook or Twitter). O'Brien (2011) reported that university students, "believe online activities distract them from studying, lead to procrastination, and displace time that would have otherwise been spent on academics" (p. 97). In other words, while students spent time on the Internet for academic purposes, they would go on Facebook and on other recreational Internet sites (O'Brien, 2011).

**The Impact of Prior Technological
Experience, Knowledge, and
Confidence on Learning and
Decision-Making Associated
with E-books**

Students valued being comfortable and confident when using e-books. All 20

students believed on the importance of feeling comfortable and confident when using e-

books to ensure successful learning. Feeling comfortable and confident is strongly

associated with the self-efficacy theory. Bandura (1997) stated when explaining self-

efficacy point of view, "Perceived self-efficacy refers to beliefs in one's capabilities to

organize and execute the courses of action required to produce given attainments" (p. 3).

R. M. Ryan and Deci (2009) also expressed,

> Of all the beliefs that people hold about themselves and that affect their day-to-
> day functioning, and standing at the core of social cognitive theory, are self-
> efficacy beliefs, which can be defined as the judgments that individuals hold
> about their capabilities to learn or to perform courses of action at designated
> levels. In essence, self-efficacy beliefs are the self-perceptions that individuals
> hold about their capabilities. (p. 791)

According to self-efficacy research considering learning and use of computers,

students with high degrees of self-efficacy, increased by positive emotional states (i.e.,

feeling comfortable and confident), in relation to the use of e-books could obtain better

outcomes and higher degree of satisfaction (Campbell & Hackett, 1986; Compeau &

Higgins, 1995; Kissinger, 2013; Waycott et al., 2005; Wood & Locke, 1987). Finally, in

Kissinger's (2013) study on college students using e-books, all students expressed

feelings and perceptions of high self-efficacy along with their anticipation to successfully

use e-books for learning.

Negative experiences with e-books could alienate future uses. This section of

the findings is also consistent with the self-efficacy theory point of view (Bandura, 1997).

Precisely, the mastery experience, one of the four self-efficacy sources addressed by R. M. Ryan and Deci (2009), is associated with one's previous knowledge and experiences. In this research, five students believed on the impact of prior experiences with e-books on decision-making associated with future use of e-books. In other words, they believed students' positive experiences with e-books influence them to read more e-books, and vice versa. Hence, students' beliefs are evidences as to what was predicted in this research.

It was predicted that when e-books users have successfully used e-book readers before, they would have high self-efficacy feelings and confidence toward reading e-books in the future. However, when they use e-book readers and face difficulty with the technology, it is anticipated that they would have low self-efficacy feelings toward reading e-books and eventually prevent future uses. In fact, during the interviews conducted in this research, one of the participants responded by associating an interview question with the self-efficacy theory. When Larry was asked: "Do you believe that feeling comfortable and confident when using e-books is important to ensure individuals' learning?," he explained,

> It is important for students to feel comfortable and confident. I think it goes back to the self-efficacy theory where you do things that you're more likely to do successfully. And when you feel confident that you can do something, you're probably going to do it. If students had bad experiences with e-books or did not use them successfully, like could not access them, they won't be able to learn. And they won't use them in the future because they didn't feel comfortable nor confident and did not learn as successfully as they usually do when they read printed books.

Students Preferred to Use the Given
E-book to the Given Printed Book

   Use of the e-book for general reading and the printed book when learning

mattered. Only three students out of the 20 preferred to use the given printed book to the

given e-book when they are required to comprehend the material, like studying for

exams. They are from the same group of participants who shifted their preference to

printed books during the first phase interview when they were asked if they still prefer to

use e-books when they are studying for an exam. Students favored the given printed book

for the same reasons they indicated during the first phase interview. For example,

according to students, they feel more used to printed books, they like holding the book in

hands, they have personal preference towards printed books, they feel more comfortable

reading the printed book, and they trust the printed book more. As stated previously,

shifting preferences from e-books to printed books corresponds to what indicated by

pervious researchers (Gregory, 2008; Gürcan, 2005; Pledger, 2010; Tosun, 2014; Woody

et al., 2010). Moreover, because students are more used to printed books, their comfort

level and trust toward their own learning capabilities increase when using printed books.

This phenomenon is aligned with the self-efficacy theory (Bandura, 1997; R. M. Ryan &

Deci, 2009).

   Woody et al. (2010) conducted a study to investigate what factors influence

students' preference to e-books. They reported that despite the effective visual and

interactive elements in e-books, students do not prefer reading e-books to printed books.

Similarly, the findings of this research reveal that the three students chose to use the

given printed book, yet, I noticed that while they were skimming through the e-book,

they expressed positive comments, facial expressions, and body gestures. In fact, students

provided clear statements, like "I liked the e-book more," "It was fun and not overwhelming like the printed book," "the e-book is great and full of advantages," and "it was more interactive." These statements indicate their appreciation of some aspects available in the e-book. Hence, despite the different advantages and interactive elements in e-books, some students do not prefer reading e-books to printed books.

Use of the e-book even when learning mattered. According to the observational findings of the research, all participants expressed positive attitudes toward the given e-book, and 17 of them chose to use the given e-book to the given printed book for all studying purposes. Students listed 35 reasons for why they liked the given e-book more than the given printed book. The four most mentioned reasons were, the e-book: has demonstrative media, has interactive tests, is more interactive, and is not overwhelming like the printed book. I believe that the two reasons: the e-book has demonstrative media and more interactive are correlated. Students referred to the interactivity as having images, animations, and audios that interact with ones' touch and demands.

The fact that all 20 students valued the demonstrative media (i.e., still images, 3D images, animations, and audios) available in the e-book corresponds to several learning theories and other researchers' point of view. According to the information processing theory (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Lohr, 2007; Norman & Bobrow, 1975; Waugh & Norman, 1965) the use of visuals, images, and videos embedded in a material increases learners' attention, influences their engagement, and fosters their ability to successfully processes the information. In addition, dual coding theory (Paivio, 1990) proposes that when both verbal and pictorial representations are processed in memory, the chances of understanding the content and

retrieval are higher because of the fact that more than one way of representations is provided to represent the same information (Fleck et al., 2014). Finally, according to the multimedia learning theory (Mayer, 2001), multimedia learning is the alternative to purely verbal presentations where individuals learn from both words and pictures instead of learning from the words alone. Having visual and verbal memories meaningfully interact together will extend memory and enhance learning (Alhammad & Ku, 2016; Mayer, 2001; Rupley et al., 2015).

Consistenting with the information processing theory, dual coding theory, and multimedia learning theory, the findings of this research reveal that students valued the demonstrative media provided in the e-book and its positive impact on one's learning. For example, students stated: "The e-book was more helpful and narrowed. I mean, in certain parts, I felt like the e-book was talking to me saying: This is what you read and this is how the heart works, and the animations explained it very well," "These animations can be helpful when a student tries to understand complicated ideas," "I liked being able to just click on an animation while I'm reading the e-book and feel more engaged with learning," and "The animations and videos in the e-book explain everything in motion, which made understanding the content easier."

Another reason for why students liked the given e-book more than the given printed book was because the e-book has self-tests with immediate feedback. According to Griffin et al. (2012) and Dunlosky (2013), the self-testing approach could be considered as one of the effective learning strategies that would boost learning. The self-testing approach offers learners opportunities to obtain meaningful learning by testing their own comprehension of the material along with immediate feedback. In this research,

12 students listed the self-test and its immediate feedback as a reason for why they liked the given e-book more. In addition, the observational data reveal that students expressed positive attitudes toward the use of embedded test while skimming through the e-book.

The reasons addressed by students to explain their preference to the given e-book (i.e., the e-book has demonstrative media, has interactive tests, and is more interactive) have their roles in optimizing learning and reducing the cognitive load. Those reasons also influence students to perceive the given printed book as overwhelming. The cognitive load theory focuses on the mental energy of the cognitive information processing and its reaction to various loads. It also highlights the value of delivering information that fits as much as possible learners' way of thinking and cognitive structure (Harasim, 2012; Lohr, 2007).

As explained by Isabella, "When you gave me the e-book, I went from (I'm super overwhelmed) to (I actually can learn this) with all of the interactivity, images, videos, and embedded definitions . . . I mean, I went from feeling (this is over my head) to like (I can probably learn this)." According to Benjamin, the printed book, ". . . presented a lot of information on each page, which was pretty distracting. On the other hand, the e-book was more helpful with all of these interactive images and it was just easier to read through it." Dana also explained,

> The printed book showed a lot of information on every page and it scattered my understanding. . . . But . . . I was able to focus more on the content when I was reading the e-book. The test with the immediate feedback was helpful. . . . And the pictures were big and with high resolution. And the simulations were very helpful. I was able to see a process happening in motion and hearing someone explaining it in the e-book. It is definitely better than only reading it and imagining it through a printed text.

Furthermore, these students' perceptions correspond to previous research. Fleming and Levie (1993) believed providing demonstrative media and feedback to learners would influence their optimal load. In addition, according to Sweller's (2010) modality effect, using both modes (auditory and visual) processors instead of one can expand the capacity of working memory. It is important to note that the working memory is limited, and cognitive load theory explained that cognitive overload might occur when learners are exposed to complex materials where they feel overwhelmed. Conversely, the given e-book has interactive demonstrative media (audios and visuals) and interactive tests with immediate feedback which led students to perceive the e-book as not overwhelming compared to the given printed book.

Students valued demonstrative media provided in the e-book: 3D images, animations, and audio narrations. All 20 students valued demonstrative media delivered in the given e-book. They provided positive responses toward interview questions related to the visuals available in the e-book, as well as 16 justifying reasons. The four most given reasons were the media features: explain processes in motions and with audios which is better than only reading text and viewing still images, reinforce learning through multiple channels (eyes and ears), explain complicated concepts better than the printed book, and reinforce the ability to retrieve comprehended information. These four reasons are very relevant and correspond to four learning theories, (i.e., cognitive load theory, information processing theory, dual coding theory, and cognitive theory of multimedia learning).

The main focus of cognitive load theory is in understanding the processes of the mind and what happens between the input and the output in order to be able to transfer or

transmit the message accurately (Harasim, 2012). In other words, cognitivists were interested in facilitating learners' optimal load by paying attention to the mental efforts caused by received elements (Sweller, 1988). As stated previously, Fleming and Levie (1993) believed providing demonstrative media is a strategy that could promote the development of meaningful information and influence learners' optimal load. Sweller's (2010) modality effect believes that using auditory and visual modes processors instead of one can expand the capacity of working memory and eventually reduce the cognitive overload. Hence, it was anticipated that the use of the demonstrative media provided in e-books parallels learners' different ways of thinking and helps them understand complex materials. Students indicated reasons that support my anticipations and coincide with the literature.

From the information processing theory perspective, including visuals, images, and videos in a material expand learners' attention and promote their ability to successfully processes the information and recall it from memory as well (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Norman & Bobrow, 1975; Waugh & Norman, 1965). Fleck et al. (2014) stated, "Following the information processing approach, learning and memory is enhanced when the student is provided with multiple mediums for data input, thus creating more meaningful connections" (p. 32). According to students in this research, the media features available in the e-book: explain processes in motions and with audios which is better than only reading text and viewing still images, reinforce learning through multiple channels (eyes and ears), explain complicated concepts better than the printed book, and could reinforce learners' ability to retrieve comprehended information in the future.

In addition, dual coding theory (Paivio, 1990) implies that the chances of understanding information and retrieval become higher when both verbal and pictorial representations are processed in memory, because of the fact that more than one way of representations is provided on the same information (Fleck et al., 2014). In line with dual coding hypothesis, students indicated that the media features facilitated their understanding of complicated concepts through multiple channels. Students also believed the media features could influence their ability to recall comprehended information.

According to Rupley et al. (2015), dual coding theory and multimedia principle ". . . form the foundation for proposing a multi-coding theory centered around Multi-Touch Tablets and the newest generation of e-textbooks" (p. 1). In this research, reasons addressed above to justify why students valued the demonstrative media provided in the given e-book, correspond to the cognitive theory of multimedia learning and its multimedia principle (Mayer, 2001). Mayer (2001) opposes the idea of presenting purely verbal presentations where individuals learn only from written words. In contrast, his multimedia learning theory emphasizes on learning from both words and pictures where visual and verbal memories meaningfully interact together to extend memory and obtain successful learning (Alhammad & Ku, 2016; Mayer, 2001; Rupley et al., 2015). According to Mayer (2001), "In the strictest interpretation of the delivery media view, a textbook does not constitute multimedia because the only presentation device is ink printed on a paper" (p. 5). On the other hand, Mayer (2003) also stated, "When the media consists of spoken text and animation, there is a strong multimedia effect" (p. 132).

The given e-book offered students multiple representations of information (text, still and moving images, animations with audios, etc.), which is parallel with Mayer's

multimedia learning and students' reasons are parallel with the hypothesized outcomes of the cognitive theory of multimedia learning. Students' reasons also correspond to the findings of previous research (Ebied & Rahman, 2015; Fleck et al., 2014; Mayer, 2003), which found that students perceived the use of multimedia as helpful, beneficial, motivating, and led to a successful learning. Azmi and Moradny (2010) also concluded that the static and animated images available in e-books have a positive constructivist effect on the achievement and the learning efficiency among graduate students (Alhammad & Ku, 2016).

Students valued features provided in the e-book. All 20 students valued the features (i.e., embed definitions, highlighting with different colors, glossary, keyword search, notes adding, notes searching, flash cards, and underling) available in the given e-book. The embed definitions was the most feature mentioned by students. In addition, students listed 13 reasons that could justify their positive perceptions towered all of these features. The two reasons mentioned the most were, these features: decrease the need for external resources or help, and save time and effort.

The two reasons addressed above could also explain why students favored the word definition feature. According to students, they liked to click on the bold words in the e-book and have the definition popped up while they are reading. To them, it was more helpful and better than going back and forth between an external translator (i.e., Google Translate) and the e-book.

The features and reasons provided by students support my prediction that e-books features are advantageous tools that could facilitate learning and optimize learning process, and ultimately influence students to value the use of e-books more than printed

books. In addition, previous research (Tosun, 2014; Turner, 2005) highlighted the value and importance of e-books features for students that could augment reading functions. As Turner (2005) stated when explaining the advantageous aspects available in e-books, "Another advantage of e-books to students is the capability to click on any word the learner does not understand and immediately the definition of the word appears" (p. 19). Finally, the fact that students liked the given e-book more than the given printed book because it includes features that decrease the need for external resources or help and save time and effort, indicate that they perceived these features as easy to use. This part of the findings corresponded to Simon's (2001) suggestion that e-books could get a widespread acceptance as supportive tools in the educational field when they incorporate easy-to-use features.

Students valued self-testing approach and its' immediate feedback provided in the e-book. Nineteen students liked the self-test available in the given e-book and mentioned seven justifying reasons. The four reasons mentioned the most were that the test: provides immediate feedback, motivates users to check their learning and identify their weakness, saves time and effort, and grabs attention to important information. The two reasons, the test motivates users to check their learning and identify their weakness, and saves time and effort, are correlated with one another. Some printed books offer self-testing opportunities, yet they cannot reach the convenience level of e-books' interactive self-tests that offer immediate feedback to explain what the correct answer is as far as one click. In their responses, students indicated they often don't feel like they want to do tests in printed books due to the fact that the answers are often located in a different page in the book or even in another separate book. Consequently, when the self-test is not time or

effort consuming and is more interactive, students tend to feel more motivated to take a part in it. Similarly, Hecking et al. (2014) considered online self-tests that can be automatically evaluated as a strategy that motivates students to participate in active learning.

The reasons addressed by students support my prediction that learners are more likely to choose reading e-books that offer easy to use self-tests with immediate feedback because they get a chance to test their comprehension and understanding of the most important concepts in the content. In other words, the ease of such a learning opportunity could motivate students to check their understanding, and yet increase their preference to e-books more than printed books. Furthermore, students' reasons correspond to the behaviorist learning technology and its self-testing approach (Dunlosky, 2013; Griffin et al., 2012; Harasim, 2012; Kamarulzaman, Shaari, 2015), as well as to the cognitive load theory (Fleming & Levie, 1993).

According to Kamarulzaman and Shaari (2015), drill and practice learning technique is well correlated with the behaviorist learning theory (Harasim, 2012). The most prominent advantage of the drill and practice and the self-testing approaches is offering learners opportunities to absorb information through repetitive activities along with immediate feedback. It is an advantageous approach for learners and content developers (i.e., e-books authors) as learners' attention can be directed to the most important concepts through carefully developed testing items (Kamarulzaman & Shaari, 2015). According to previous research (Dunlosky, 2013; Griffin et al., 2012), self-testing could be considered as one of the learning strategies that is correlated positively with students' successful learning. Students highlighted that they liked the self-test in the e-

book because of its immediate feedback and how it grabs learners' attention to important information. Following the cognitive load theory, Fleming and Levie (1993) considered providing feedback to learners as a strategy to support the optimal load and the development of meaningful information.

Changes to E-books Recommended by Students to Better Support Learning

   Changes associated with e-book's layout and functionality. All 20 participants recommended 27 changes they would like to see in e-book's layout and functionality to better support their learning. The changes recommended by students the most were, having more: demonstrative media (e.g., still images, 3D images, animations, and audios), tests with instant feedback, direct links for references and external resources, ability to hand write notes, and embedded definitions with vocal pronunciation and images to further explain the meaning. In addition, it is important to discuss two interesting changes (i.e., provide social interaction opportunities and be able to share written notes with others online) recommended by students. Students' sketches also include all of the recommended changes and explain how they could be incorporated with e-books' content. Moreover, students' recommendations are relevant to what was indicated by previous research and correspond to all seven learning theories discussed in the literature: behaviorist learning theory (self-testing; Dunlosky, 2013; Griffin et al., 2012; Harasim, 2012; Kamarulzaman & Shaari, 2015), cognitive load theory (Fleming & Levie, 1993; Harasim, 2012; Hwang et al., 2013; Sweller, 1988), information processing theory (Atkinson & Shiffrin, 1968; Boradbent, 1984; Fleck et al., 2014; Lockhart & Craik, 1990; Lohr, 2007; Norman & Bobrow, 1975; Waugh & Norman, 1965), social constructivism theory (Alhammad & Ku, 2016; Roschelle et al., 2007; Vassiliou &

Rowley, 2008; Vygotsky, 1978), dual coding theory (Fleck et al., 2014; Paivio, 1990; Rupley et al., 2015), self-efficacy theory (Bandura, 1997; R. M. Ryan & Deci, 2009), and cognitive theory of multimedia learning (Alhammad & Ku, 2016; Azmi & Moradny 2010; Ebied & Rahman, 2015; Fleck et al., 2014; Mayer, 2001, 2003; Rupley et al., 2015).

First, providing more demonstrative media in e-books was the reason mentioned by all of the 20 students. This is a clear indication of the positive impact that demonstrative media (i.e., still images, 3D images, animations, and audios) have on one's learning process, which is consistent with what was indicated by previous research and with the viewpoints of four learning theories: cognitive load theory, information processing theory, dual coding theory, and cognitive theory of multimedia learning. As stated previously, the cognitive load theory focuses on facilitating learners' optimal load by considering the mental efforts caused by received information. In other words, cognitivists believed providing both auditory and visual information instead of one can increase learners' working memory and ultimately reduce their cognitive overload (Fleming & Levie, 1993; Harasim, 2012; Sweller, 1988). In terms of the information processing theory point of view, including visuals, images, and videos when delivering a material could augment learners' attention and support their ability to successfully processes the information and retrieve it in the future (Atkinson & Shiffrin, 1968; Boradbent, 1984; Fleck et al., 2014; Lockhart & Craik, 1990; Lohr, 2007; Norman & Bobrow, 1975; Waugh & Norman, 1965).

From the dual coding theory (Paivio, 1990) perspective, when both verbal and pictorial representations are presented at the same time and processed in memory, the

chances of understanding information and recalling it are higher than one way of representations on the same information (Fleck et al., 2014; Rupley et al., 2015). Similar to the dual coding theory point of view, the cognitive theory of multimedia learning (Mayer, 2001) also emphasizes on learning through more than one way of representations (words and pictures) where visual and verbal memories meaningfully interact together to expand memory and obtain successful learning (Alhammad & Ku, 2016; Mayer, 2001; Rupley et al., 2015).

Second, another idea recommended by students is developing e-books that include tests with instant feedback. This recommendation highlights the positive effect that self-tests have on one's learning along with its immediate feedback. It also corresponds to the behaviorist learning theory and the self-testing approach, and to the cognitive load theory as well. As discussed in the previous section and from the behaviorists perspective, self-testing could be considered as one of the learning strategies that is correlated positively with ones' successful learning since it can direct learners' attention to the most important concepts in the presented material and allow them to absorb information through repetitive activities along with immediate feedback (Dunlosky, 2013; Griffin et al., 2012; Harasim, 2012; Kamarulzaman & Shaari, 2015). Consistenting with the cognitive load theory, providing feedback to learners was considered as a strategy to enhance learners' optimal load and their processing of meaningful information (Fleming & Levie, 1993).

Third, providing direct links for references and external resources is another change recommended by students. Students indicated their needs to have efficient access to additional information while they are reading e-books. According to the information

processing approach (Atkinson & Shiffrin, 1968; Boradbent, 1984; Lockhart & Craik, 1990; Lohr, 2007; Norman & Bobrow, 1975; Waugh & Norman, 1965), meeting learners' need to explore additional information could promote their ability to successfully process the information, transform it to long-term memory, and be able to recall it when they need it. Moreover, following the cognitive load theory perspective, offering learners an efficient access to information, such as direct links that take them to certain information immediately, could reduce learners' intrinsic cognitive load and eventually optimize their learning (Hwang et al., 2013).

Fourth, students also expressed their need to hand write their notes on the e-book while they are reading. From this recommendation, it could be denoted that typing notes might interfere with students' preferences and beliefs about their abilities to successfully type notes in an e-book, save them, and read them whenever they need to. Thus, when learning matters students prefer to use printed books because they feel more comfortable when they can hand write their notes. Because human nature strives to the need of feeling comfortable when learning matters in order increase the chances of obtaining learning goals. This recommended change is associated with the self-efficacy theory because it could positively influence students' feelings and beliefs about their own capabilities while reading e-books (Bandura, 1997; R. M. Ryan & Deci, 2009).

Fifth, students prefer to have definitions embedded instead of using external translators. They also need to have an advanced explanation of the unknown words (i.e., through vocal pronunciation and images). This advanced feature is relevant to what indicated by previous research (Simon, 2001; Turner, 2005). According to Simon (2001), when e-books include easy-to-use features, they could be perceived as supportive tools in

the educational field. Turner (2005) also considered the ability to click on any word in an e-book that learners do not understand and show the definition of the word as an advantage for students. The advantage of having advanced explanation of unknown words through vocal pronunciation and images is aligned with what was proposed by Paivio's (1990) dual coding theory and Mayer's (2001) cognitive theory of multimedia learning. They believe learning through more than one way of representations (words and pictures) expand learners' memory and help them obtain successful learning.

Finally, students recommended developing e-books that support social interaction opportunities and the ability to share written notes with others online. These two recommendations are very relevant to the social constructivism theory (Vygotsky, 1978) and could be considered as indicators of positive impact of social interactions through e-books on one's learning especially when it comes to online classes where face-to-face interactions are unattainable. Requiring e-books that include social interactions features for students in online courses will add to their learning by enhancing social experiences where they can easily discuss e-books' content and then help one another to construct understanding (Vassiliou & Rowley, 2008). Social constructivism emphasizes on the importance of constructing understanding of knowledge and experiences that are influenced by social networks (Vygotsky, 1978). In addition, as explained by Roschelle et al. (2007), human communication, instruction, and active engagement could be influenced by social interaction features embedded in tablets and e-books reader devices. Through these recommendations, students strived to express their needs to easily interact with others while reading e-books and explore different perspectives in order to help one

another to construct knowledge and develop meaning of the content and of the experience itself (Alhammad & Ku, 2016; Vassiliou & Rowley, 2008).

Changes associated with e-book's reader hardware. Eleven students recommended changes they would like to see in e-book's reader hardware to better support their learning and goals. The three most recommended changes were: has an electronic pen, has a screen mitigating eye strain, and resembles printed books. Regarding the electronic pen, students mentioned that they are aware of the electronic pens available in the market, but they want it to be a part of the e-book reader. Moreover, students' sketches explain how some of the recommended changes could be accomplished when developing an e-book reader device. The two recommendations, has an electronic pen and resembles printed books, are very relevant and could be considered as an evidence that some students are attached to the feelings they have when reading printed books and they want to attain the same feeling when reading e-books. In fact, two students, Jamal and Mishary, drew very similar sketches that reveal their needs to have an e-book device that looks exactly like a printed book.

These changes are corresponding to the self-efficacy theory. Self-efficacy believes that individuals' perceptions are often based on their feelings and beliefs about their own capabilities (Bandura, 1997). By recommending these changes (has an electronic pen and resembles printed books), students reflected on their feelings and beliefs that they are more capable to obtain successful learning when they read an e-book that looks like a printed book. Therefore, they believed that they need to have an e-book device that looks like, feels like, and functions like a printed book.

Finally, another recommended change by students is having an e-book reader device that has a screen mitigating reader's eye strain. This recombination is consistent with the concluded findings of previous research (Annand, 2008; Tosun, 2014). As stated previously, Annand (2008) found that students faced difficulties reading e-books due to eye strain incidents that negatively disturbed their reading experiences. In addition, the findings in Tosun's (2014) study revealed that university students expressed they did not like to use e-books for several reasons and to protect their eye health was one of them.

Implications

The primary focus of the research questions was to explore graduate students' interpretations of their experiences with the use of e-books for learning as well as distinguish factors (i.e., reasons, prior technological experience, knowledge, confidence, and changes to e-books) that influence their preference to use e-books in order to increase e-books' future usage as educational tools. The findings of the research revealed a variety of implications to educators, students, developers of e-book readers, e-book authors, e-book publishers, and technology production companies for delivering effective e-books for students. The findings also could contribute to stakeholders' understanding towards the root causes for students' preference and reluctance to the use of e-books and what changes they need to see in e-books in order to use them more when they aim to learn.

First, this study revealed that students expressed positive perceptions and attitudes towards using e-books for learning. Precisely, students communicated various factors in e-books (e.g., have demonstrative media, cheaper than their printed format, offer immediate accessibility, save time and effort, interactive, have helpful features such as embedded definitions and keyword search, allow accessibility to external resources, offer

interactive self-tests with immediate feedback, reduce cognitive overload, can be shared and discussed with others through the Internet, etc.) that could influence them to use e-books more often and help them obtain better learning outcomes. These findings suggest educators to consider students' perceptions to review and select e-books that incorporate the factors communicated by students when requiring them to read e-books for classes. Students also are encouraged to purchase and utilize e-books and e-book reader devices that allow them to practice these factors in order to increase the chances of achieving better learning outcomes.

Second, social interaction opportunities do have some merits, suggesting educators and students to communicate online among themselves and with others while reading e-books for classes. Educators are mostly recommended to consider the social interaction opportunities with students and among them while reading e-books when teaching online classes. Developers of e-book readers, e-book authors, e-book publishers, and technology production companies are also encouraged to provide social features embedded in the e-book where meaningful interaction among users could be easily accomplished. Third, in order to increase e-books' usage as an educational tool, stakeholders are encouraged to attend to students' perceptions and to the influential factors specified by them (e.g., provide multiple representations of information, support incorporating demonstrative media, allow readers to access additional resources while reading e-books, and include self-testing opportunities) when designing, developing, and offering e-books and e-book reader devices to the market.

Fourth, some students raised concerns regarding eye strain when reading e-books, educators are encouraged to inform students about simple ideas (e.g., protective screen

covers and glasses) to mitigate eye strain. Fifth, it is important for e-book authors, e-book publishers, and technology production companies to consider the reasons (i.e., e-books are expensive, e-book reader device screen caused eye strain incidents, etc.) that influence students to illegally share or print e-books in order to prevent such illegal activities.

Sixth, the findings from this study should enhance stakeholders' understanding of the root causes for students' reluctance to the use of e-books from the self-efficacy theory (Bandura, 1997) point of view. Students shifted their preference from e-books to printed books because they are more used to printed books and their comfort level and trust toward their own learning capabilities increase when using printed books. They also believed that e-books could hinder learning because of those feelings, along with lacking the required technological knowledge. In addition, students perceived feeling comfortable and confident when using e-books as essential parts to obtain a successful learning. They also believed that positive prior experiences with e-books influence them to read more e-books, and vice versa.

This part of the findings suggests educators to contemplate students' hindrance perceptions, prior experiences, feelings, and beliefs about their own capabilities when requiring e-books for classes. They are also recommended to influence students' low self-efficacy beliefs toward e-books through positive, influential, and encouraging verbal messages that can help them make the extra effort to successfully use e-books, and result in the continued development of technological knowledge and of students' personal efficacy (R. M. Ryan & Deci, 2009). In addition, educators are suggested to fulfill the lack of students' technological knowledge by providing students with trainings and

classes that could teach them how to obtain successful use of e-books, and lead to ongoing development of technological skills. Finally, developers of e-book readers, e-book authors, e-book publishers, and technology production companies should be encouraged to increase attention to students' hindering perceptions and attend to the fact that some students are more used to printed books when designing, developing, and offering e-books and e-book reader devices to the market.

Seventh, this study explored, through interviews and artifacts, the changes students need to see in e-books in order to increase the chances of e-books acceptance by them. Students' recommendations and visions of the ideal e-book may be applied by developers of e-book readers, e-book authors, e-book publishers, and technology production companies when designing, developing, and presenting e-books to the market. Stakeholders should also be encouraged to review students' sketches as an additional source of insight because they comprise all of the recommended changes during the interviews and explain how they could be incorporated with e-books' content from students' point of views. Finally, it is important to note that stakeholders are highly advised to consider students' recommendations due to the fact that they correspond to the seven learning theories (behaviorist learning theory (self-testing), cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning).

Recommendations for Future Research

This research focused on 20 graduate students' interpretations of their experiences with the use of e-books for learning. This research also aimed to explain the reasons influencing graduate students' decision to use e-books or printed books, how they

perceive e-books impact on their learning, how they perceive the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, how they interpret their experiences with the use of a given e-book, and what recommendations of changes to e-books students recommend to better supporting their learning. In addition, this research explored students' interpretations, perceptions, and attitudes toward e-books through seven supportive learning theories to the constructivism learning approach. Based on the findings, additional amplifications, explorations, and investigations in several future research areas are recommended:

1. Exploring and comparing students' experiences and attitudes towered using e-books and printed books for online courses.

2. Comparing students' perceptions toward e-books' advantages versus printed books advantages.

3. Including participants pursuing undergraduate and graduate degrees from different majors to compare their experiences, perceptions, and attitudes toward using e-books for learning.

4. Exploring how children perceive using e-books for learning and compare the differences between adults and children.

5. Exploring how educators perceive using e-books in their classes and compare the differences between educators and students.

6. Focusing in detail on how students use e-books and the features (i.e., keyword search, highlighting, notes adding, bookmarking, etc.) they perceived as important for their learning. It's recommended to utilize an embedded tracker in the e-book reader

device to track and observe students' use of e-books in order to obtain data as accurate as possible.

7. Examining in detail how e-books distract students from learning and what activities they did in the e-book reader device instead of reading e-books. In order to obtain such data, it's recommended to utilize an embedded tracker in the e-book reader device to track students' activities that shows what they did and for how long.

8. Investigating the correlation of e-books' features (i.e., embedded definitions, keyword search, highlighting, notes adding, bookmarking, etc.) and students' academic achievement since they perceived them as important for their learning.

9. Exploring the impact of student-student and student-educator social interactions through e-books required for classes on students' academic achievement.

10. Investigating the relationship and impact of influential verbal messages (e.g., educators' encouraging messages to students) and trainings on e-books users' competence and personal efficacy beliefs toward obtaining successful uses of e-books.

11. Investigating the impact of demonstrative media provided in e-books on students' academic achievement and on their information processing outcomes.

12. Examining the influence of the self-tests embedded in e-books on students' academic achievement.

13. Exploring the impact of delivering an e-book that meets all the visions students have about e-books' ideal layout and functionality on students' learning and students' preference to e-books.

14. Researching the possibility of delivering an e-book reader device that look like a printed book and meets the visions students expressed about their ideal e-book reader device.

Conclusion

The nature of this phenomenological research allowed me to explore and understand 20 graduate students' interpretations about their experiences with the use of e-books. The purpose of this research was to explore graduate students' interpretations of their experiences with the use of e-books for learning, reasons that influence their preference to use e-books or printed books when they learn, perceptions toward e-books impact on learning, perceptions toward the influence of prior technological experience, knowledge, and confidence on opinions and decision-making associated with e-books, interpretations of their experiences with the use of a given e-book, and recommendations of changes to e-books to better supporting their learning. As a result of my prolonged research actions where I planed, read, reviewed, mused, prepared, interviewed, interacted, explored, observed, transcribed, analyzed, synthesized, and decided, I reported five major themes regarding the phenomenon explored in this research that compiled: (a) all students valued e-books, but nearly all students still prefer printed books; (b) e-books can enhance learning, but can hinder learning as well; (c) the impact of prior technological experience, knowledge, and confidence on learning and decision-making associated with e-books; (d) students preferred to use the given e-book to the given printed book; and (e) changes to e-books recommended by students to better support learning.

The research findings correspond to seven learning theories pertaining to the constructivist learning approach: behaviorist learning theory (self-testing), cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning. Furthermore, the findings were developed based on the five major themes and their derivative 16 sub themes, and adequately answered the main research question as well as the five supporting research questions (see Table 5). It can be concluded that graduate students:

- Like to use e-books, but when learning matters they still prefer printed books because they are more used to them.

- Like to use features available in e-books (i.e.,keyword search, highlighting, notes adding, and bookmarking).

- Like to search for external recourses (e.g., images, videos, additional information, and translations) through different websites while reading e-books in order to obtain a better understanding of the material. However, they feel "lazy" and "less interested" to search for additional resources on the Internet while reading printed books.

- Believe on the positive impact of sharing e-books and communicating their thoughts and opinions about e-books with others through the Internet. But, they perceive sharing or discussing printed books with others as not that efficient or easily, limited to a few numbers of books, and require a face-to-face meeting.

- Believe e-books can enhance learning, but they can hinder learning as well.

- Believe feeling comfortable and confident are essential parts of learning through e-books.

- Believe positive experiences with e-books influence users to read more e-books, and vice versa.

- Like to use e-books that incorporate demonstrative media (i.e., still images, animations, audios, etc.), supportive features (i.e., embed definitions, highlighting with different colors, glossary, keyword search), and self-tests even when learning matters.

- Have visions concerning e-books' layout, functionality, and reader device they would like to see in e-books in order to best support their learning and increase e-books acceptance in the educational field.

From the research findings, implications were developed and recommendations were shared with educators, students, developers of e-book readers, e-book authors, e-book publishers, and technology production companies. The findings contributed to these stakeholders' understanding of the root causes of students' preference and reluctance to the use of e-books as well as e-books' impact on their learning. In addition, the research implications prompted the need for developing and offering e-books that are more cost effective, allow accessibility to additional resources, embed social interaction features, integrate supportive features, as well as demonstrative media and self-testing opportunities. Moreover, when it comes to requiring students to use e-books, it's essential to increase attention on their prior experiences with e-books, and their feelings and beliefs about their own capabilities toward them. Lastly, students expressed, through interviews and artifacts, various changes they would like to see in e-books that could be

beneficial when designing, developing, and offering e-books or e-books reader devices to the market.

I am thrilled that the outcomes of my exploration of this phenomenon offer contribution to the field of educational technology and, largely, promote education. One of the major influences I had when deciding to explore the topic was setting out research endeavors that are not trivial. Yet, I aimed to explore, understand, reflect, and encourage the first steps toward change that could fulfill students' needs and promote learning. Finally, many areas of potential research were specified, each likely to contribute to the field of education, educational technology, psychology, higher education, teaching and learning methods, technology uses in education, academic libraries, electronic libraries, information technology, and to the publishing industry.

Summary

This chapter discussed the reported findings of the research based on the 5 major themes and the 16 sub themes that emerged from the 20 graduate students' interpretations of their experiences with the use of e-books for learning. Relevant literature and a theoretical lens pertains to the constructivist learning approach and comprised of several learning theories (i.e., behaviorist learning theory (self-testing), cognitive load theory, information processing theory, social constructivism theory, dual coding theory, self-efficacy theory, and cognitive theory of multimedia learning) were utilized to support and justify the significant findings of the research as well as critical issues associated with them.

Based on the research findings and discussion, implications were structured and suggestions were shared with educators, students, developers of e-book readers, e-book

authors, e-book publishers, and technology production companies to augment their understanding of the root causes of students' preference and reluctance to the use of e-books, of e-books impact on learning, and of changes to e-books to which we should increase attention in order to offer e-books that better support learning. This chapter also suggested recommendations for further explorations and investigations developed based on the findings of the research. Finally, succinct summary paragraphs regarding my personal reflections and this research concluded this chapter, and the entire dissertation.

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APPENDIX A
RECRUITMENT EMAIL

Dear fellow students,

My name is Rasha Alhammad, a graduate student in the Educational Technology Department at the University of Northern Colorado (UNC). I'm currently working on a research study for my Ph.D. dissertation that focuses on graduate students' experiences and attitudes toward using electronic books (e-books) for learning.

If you are a graduate student at UNC and you have used at least one e-book for learning purposes during the last two years, you might be eligible to participate in this study.

As a participant in this study, you will participate in a semi-structured (face-to-face) interview. The interview will consist of no more than 29 questions and will last for no more than 120 minutes. Your personal information will be treated in complete confidence. At the end of the data collection session, you will be given a $15 Starbucks gift card as an appreciation for your participation in the study. To participate or for further questions, please contact me via: (xxx) xxx-xxxx or xxxxxxxx@bears.unco.edu

Thanks,

Rasha

APPENDIX B

INFORMED CONSENT FORM

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH
UNIVERSITY OF NORTHERN COLORADO

Project Title: Click, Explore, and Learn: Graduate Students' Experiences And
                            Attitudes Toward Using E-books For College-Level Courses

Researcher: Rasha Alhammad, Ph.D. Student
                            University of Northern Colorado.
Phone Number: (xxx) xxx-xxxx
E-mail: xxxxxxxx@bears.unco.edu

Researcher's Advisor: Dr. Heng-Yu Ku
                            University of Northern Colorado.
E-mail: xxxxxxxx@unco.edu

The purpose of this study is to investigate graduate students' experiences and attitudes toward
using electronic books (e-books) to learn and how it supports or hinders their goals. If you choose
to participate in this study, I will schedule a time at which we can sit down for data collection.
The predicted time for full session is no more than 90 minutes. Time and location will be
determined with you based on your convenience. The following will occur at the interview:

1.   First, I'm going to interview you. The interview consists of no more than 36 questions (8
        demographic questions and 29 opened-ended questions) developed to provide deep
        understanding of your experiences. In addition, you will be asked to provide information
        regarding your gender, age, ethnicity, nationality, the degree you are pursuing, the
        program you are studying in, how long you've been using e-books, and e-book reader
        device you usually use.

                                                                   _____
                                                                   (initials here)

2.   Second, you will be given a printed book (comprised of 20 pages) to skim through for no more than five minutes. When you are finished, you will say, "I'm done." Then, you will be given an electronic version of the same content of the printed book (comprised of 15 pages) to skim through for no more than five minutes. When you are finished, you will say, "I'm done." Then I will continue interviewing you.

3.   Finally, you will be given a blank sheet of paper and a pen and will be asked to draw a sketch of the ideal e-book layout you believe will best support your goals. During the interview, I will collect observational data to support the interview data. I will ask you to review the transcript immediately after the interview to make any required changes before conducting data analysis.

Confidentiality will be maintained for your responses. I will be the only person who will examine your responses. Your responses will be audio-tape recorded and later transcribed. I will also write down field notes regarding my observation.

Data will be saved in a password-protected thumb drive and will be stored in a locked secure cabinet that is separated from any identifying information. Identifiable data will be destroyed immediately after the study is completed. Consent forms will be stored for three years following the end of data collection. Results of the study may include quotations from your responses. Your name will be coded to protect your identity. The interview is not different from what you would expect in your daily university activities. There is no risk to being in this study other then what occurs in every day educational conversations. At the end of this interview, you will be given a $15 Starbucks gift card as an appreciation for your participation in this study.

Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected. Having read the above and having had an opportunity to ask any questions, please sign below if you would like to participate in this research.

A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

Participant's Signature: _____ Date: _____

Researcher's Signature: _____ Date: _____

                                                                                          _____
                                                                                          (initials here)

APPENDIX C

INTERVIEW GUIDE

INTERVIEW GUIDE

1. **BREAKING THE ICE**

   (1)   Greetings

   (2)   Acknowledgement - Thank you for participating . . .

   (3)   A brief description of the activities (purpose, procedure, methods, etc.)

   (4)   A reminder of the tape recording and confidentiality

   (5)   Signing the Consent Form

2. **DEMOGRAPHIC QUESTIONS**

   Please fill out this form that includes general demographic questions.
   (1)   How old are you? _____

   (2)   Circle your gender: Male   Female

   (3)   What is your ethnicity? _____

   (4)   What is your nationality? _____

   (5)   What degree are you pursuing? _____

   (6)   What program are you studying in? _____

   (7)   How long have you been using e-books? _____

   (8)   What are the technology devices that you usually use to read e-books?

   _____

3. **(PHASE ONE) INTERVIEW QUESTIONS**
   (1)   Tell me about your experience with the use of e-books.

   (2)   Where do you usually read e-books? Why?

   (3)   When you are studying, do you prefer using e-books or printed books? Why?

(4)   Based on your experiences, do you believe that e-books enhance learning? If yes, how? If no, why not?

(5)   Based on your experiences, do you believe that e-books hinder learning? If yes, how? If no, why not?

(6)   Based on your experiences, do you feel comfortable and confident when you use e-books? If yes, how? If no, why not?

(7)   Do you believe that feeling comfortable and confident when using e-books is important to ensure individuals' learning? If yes, how? If no, why not?

(8)   Have you ever shared e-books, or parts from them, with others through the Internet? If yes, how? If no, why not?

(9)   Have you ever shared your thoughts and opinions about e-books (recommendations, complains, descriptions, etc.) with others via the Internet? If yes, how? If no, why not?

(10)   Do you believe that the ability to easily share e-books through the Internet contributes to individuals' learning? If yes, how? If no, why not?

(11)   Do you believe that the ability to easily share thoughts and opinions regarding e-books and their content through the Internet contributes to individuals' learning? If yes, how? If no, why not?

(12)   When reading e-books, what features do you usually use that you believe they contribute to your learning? (For example, glossary, key words search, adding notes, word definition, visual search, video search, printing, etc.).

(13)   Do you believe these features help you feel more confident and comfortable when you use e-books? If yes, how? If no, why not?

(14)   While reading e-books, have you ever searched for external resources (e.g., images, videos, etc.) that could explain the content? If yes, how and why? If no, why not?

(15)   Would you use e-books for reading that requires information comprehension (like studying for an exam)? If yes, how? If no, why not?

(16)   Is there anything else you would like to share about e-books?

4.   (PHASE TWO) INTERVIEW QUESTIONS

(A)   Please skim through the chapter in this printed book for no more than five minutes. When you are finished, please say, "I'm done."

(B)   Please skim through the chapter in this e-book for no more than 5 minutes. When you are finished, please say, "I'm done."

(1)   Which format do you like the most? And why?

(2)   How would you compare the use of e-book to the use of printed book?

(3)   Do you find the printed book helpful in terms of facilitating the content? If yes, how? If no, why not?

(4)   Do you find the electronic book helpful in terms of facilitating the content? If yes, how? If no, why not?

(5)   What do you think of the visuals (images, animations, narrated animations, videos, audios, etc.) provided in the electronic book?

(6)   How do you perceive theses visuals? Were they helpful in terms of facilitating the content? If yes, how? If no, why not?

(7)   How do you perceive the features available in the e-book? Were they helpful in terms of learning? (for example, glossary, key words search, adding notes, word definition, visual search, video search, printing, etc).

(8)   Do you believe the test provided at the end of the chapter in the e-book would contribute to individuals' learning? If yes, how? If no, why not?

(9)   Do you believe it is better for students, when they aim to learn, to use this e-book including the features and the visuals available in it? If yes, why? If no, why not?

(10)   Would you use this e-book for reading that requires information comprehension? (like studying for an exam) If yes, why? If no, why not?

(11)   Is there anything else you want to share about this e-book?

5.   (PHASE THREE) INTERVIEW QUESTIONS AND ARTIFACTS

(1)   What changes would you like to see in e-books so it will best support your learning?

(2)   What changes would you like to see in e-books devices so it will best support your learning?

At last, please take this blank sheet of paper and this pen and draw a sketch of the ideal e-book layout that you believe will best support your goals in terms of learning. The changes could be on the e-books software, reader device, or both.

6.   CONCLUSION

Let me see if I can summarize what I've heard you saying. Did I summarize your thoughts very well? Did I misunderstand anything? What else would need to include in a summary? I want to thank you for sharing your thoughts and feelings with me. This has been valuable information for me.
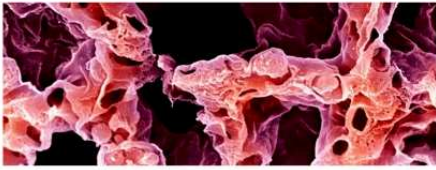
APPENDIX D

SCREENSHOTS OF THE E-BOOK MATERIALS

Adapted from *Life on Earth: Animal Physiology*, by M. Ryan et al., 2010, Watertown, MA: Digizyme, Inc., pp. 87-101. Copyright © 2016 by Apple Inc. Adapted with permission.

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SECTION 2

The Physiology of Breathing

The tiny air sacs in the lung, called alveoli, are delicate even on the scale of red blood cells, some of which can be seen here. Oxygen and carbon dioxide diffuse freely across these thin walls. The magnification is 2,200X.

How much oxygen does the body need? We can find out by measuring what goes in and out of the lungs each day. A moderately active human inhales about 11,000 liters of air per day (388 cubic feet). Air is 21% oxygen, meaning humans

inhale 2,235 liters of oxygen (80 cubic feet). The air we exhale has only 16% O_2, with the missing 5% replaced by exhaled CO_2. Five percent of 11,000 liters is 550 liters of gaseous oxygen—the amount your body requires per day for

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metabolism. In liquid form, that is 0.6 liters of pure oxygen per day. In other words, a part of your diet that you may not have noticed is a large drinking glass of liquid oxygen per day.

You don't ingest any liquid oxygen at all, of course, but you do ingest that amount of oxygen molecules by breathing it in through your lungs.

Air enters the body through the nose and mouth when a large dome-shaped muscle below the lungs, the **diaphragm**, contracts and flattens out, increasing the volume of the chest cavity above it. Increased volume of a closed air space equals lower pressure, and atmospheric pressure responds to the temporary vacuum in the chest cavity by rushing in through the nose and mouth and passing on to the **pharynx** at the back of the throat. A flap of tissue in the pharynx channels air to the **trachea** or food to the **esophagus**. Involuntary muscular control of the pharynx during swallowing prevents food and liquid from being inhaled into the trachea.

In the trachea, mucus traps particles, and cilia sweep the mucus up to the pharynx, where it is usually swallowed, keeping the respiratory passageway clean and clear for breathing.

The trachea branches into two large tubes called bronchi that each connect to one of the lungs. The large **bronchi** (singular, bronchus) branch into smaller bronchi, which branch into even smaller **bronchioles**, which continue branching until they finally terminate in clusters of microscopic

Figure 17.5 Vessels and Airways of the Lung
Resin cast of the human lung showing bronchi and bronchioles (yellow), airways (white), arteries (red), and veins (blue).

Figure 17.6 The Blood-Air Interface
Grape-like clusters of alveoli are lined with capillaries.

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air sacs, 150 million of them, called **alveoli** (singular, alveolus). Surrounding each alveolus is a lacy network of capillaries.

Gas Exchange

At the walls of the alveoli, we have arrived at the gas exchange surface for oxygen absorption. The very thin layer of tissue between alveoli and capillaries offers little obstruction to gas transfer. Gaseous oxygen in the lung dissolves into the warm sheen of moisture on the alveoli wall efficiently enough that one can imagine a cloud of oxygen molecules passing like smoke through a screen—a very fine screen, but porous enough to diffusing oxygen that the cloud of oxygen molecules quickly reaches the adjacent capillary. At the same time, a cloud of carbon dioxide is diffusing away from the capillary into the cavity of the alveoli.

The direction of the flow of gases is controlled by the concentrations of each gas at the gas exchange surface and the air pressure, which rises and falls in the lung airways with the contractions of the diaphragm. The concentration of oxygen in blood returning to the lung is lower than that in blood that
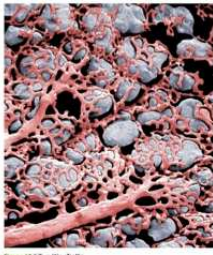

Figure 17.7 Two-Way Traffic
In capillary networks around alveoli, venous blood gives up carbon dioxide, which is exhaled, and absorbs oxygen, which is transported through the heart and pumped throughout the body.

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leaves the lung because oxygen has been drawn off by tissues during the blood's route through the circulatory system. Therefore, when alveolar oxygen diffuses in the direction of lower concentration, it arrives in the blood.

And now something quite interesting happens. In red blood cells, protein molecules called *hemoglobin* rapidly bind oxygen, lowering the concentration of oxygen in the immediate surroundings. In other words, oxygen diffuses into the capillary where the concentration of oxygen is lower in front than behind, but the concentration of oxygen in the capillary doesn't rise at the same time, because the oxygen is quickly tucked away in hemoglobin. So more oxygen diffuses into the capillary, to be bound by hemoglobin. At the same time, carbon dioxide diffuses out of the capillary and into the air spaces of the alveoli.

One of the most valuable properties of hemoglobin is its ability to change the effective solubility of oxygen in blood. When the cells in blood are filtered out, the fluid left behind is called **plasma**. The solubility of oxygen in plasma is rather poor. When red blood cells packed with hemoglobin are present, the solubility of oxygen is 80 times higher. Hemoglobin easily increases the amount of oxygen blood

can carry. As we will see, it does considerably more. In the final section of this chapter, we will see that hemoglobin has the very useful property of releasing the oxygen it has bound *just where it is needed most*. Before we see how that works, we'll consider the features of the system that moves the blood around.

Interactive 17.1 Breathing
Contraction of the diaphragm ventilates the lungs and flushes the microscopic alveoli with air. At the gas exchange surface, clouds of oxygen saturate the hemoglobin in red blood cells and plumes of carbon dioxide are released. A selective view of uptake and release is shown above at right. In the lung, the entire volume is filled evenly with air under increasing and decreasing pressures.

SECTION 3

Reaching the Periphery

In this color-enhanced and highly magnified image, human red blood cells are red, lymphocytes are yellow, leukocytes are blue and platelets are green.

The circulatory system is an elaborate circuit of pipes and a pump. The pipes are sturdy vessels called **arteries** that lead away from the pump, and less sturdy but still durable **veins** that lead back toward the pump. The pump, of course, is the heart.

The human heart is actually two distinct pumps that happen to be situated in one muscular organ. The pump on the right side takes in oxygen-depleted blood from the periphery and pumps it on a short route to the lungs, where the blood is rejuvenated with oxygen. This route is called the **pulmonary circulation**.

Interactive 17.2 The Human Heart
Blood channels through the heart propelled by the coordinated pumping activity of four chambers.

The blood flows back to the pump on the left side of the heart, this one considerably more robust that the first one. You may have noticed that the heart is not symmetrical, like a valentine heart. The left side of the heart is thicker and more muscular than the right side to meet a more demanding task, pumping blood all the way through the *periphery*, which is the word biologists and cardiologists use for the outlying parts of the body. This route is called the **systemic circulation**.

The heart works like any simple pump, taking in fluid, blocking backflow, and then pushing the fluid forward. In both sides of the heart, blood arrives in a chamber called the **atrium** (plural, atria). When the atrium is filled, a flap of tough tissue called a valve opens, releasing the blood to the **ventricle** below it. As the powerful muscles of the heart begin to squeeze, the valve between atrium and ventricle is forced closed by the pressurized blood, and the blood is then forced through large exit vessels. With each heartbeat, fresh volumes of blood are taken in through the atria, and then forced out through the ventricles.

The contractions of the four-chambered heart are highly coordinated. Heartbeats are triggered by a cluster of noncontracting cells in the heart itself, in the right atrium, called the sino-atrial node, or the pacemaker. This cluster of cells sends out a wave of electrical excitation that travels to the opposite atrium, initiating a contraction of the atria. After a slight (tenth of a second) delay, the signal is relayed to the ventricles, completing the **cardiac cycle**.

Blood

Oxygenated blood exits the left ventricle of the heart through the largest blood vessel in the body, the aorta. Blood pressure is at a maximum at the aorta. A healthy aorta is rather elastic, stretching with the rush of incoming blood and smoothing out the pressure pulse as blood travels the length of the aorta into the abdomen. Arteries and their counterparts for carrying deoxygenated blood, veins, have similar construction, with a lining of **endothelium** on the inside surrounded by a layer of smooth muscle that can control the diameter of the vessel, all contained within a skin of connective tissue.

Figure 17.8 Major Arteries and Veins of an Adult Male
Not shown are the capillaries that thread through most of the rest of the body's volume.

Figure 17.9 Cross Section of Red Blood Cells in a Capillary
Blood cells are tightly packed as they squeeze through capillaries.

Arteries branch into arterioles, which form smaller branches leading to capillaries, vessels so small that at their narrowest, blood cells pass through them single file. An important principle for the oxygen-delivering function of the circulatory system is seen in the way arteries branch. At each branch, the cross-sectional area of the branched vessels is larger after the branch than before. In other words, as the blood vessel gets longer and forms more branches, capacity for volume of flow gets larger. Since the amount of blood flowing through the circuit is the same, that means flow through the smaller vessels is slower. At the point where arteries and veins meet in networks of capillaries called **capillary beds**, the artery has branched many times, the total cross-sectional area of the vessels through which the blood is flowing has increased enormously, and flow through the capillary bed is very slow. This has

Figure 17.10 Meal Delivery
Plasma is the fluid portion of blood after all cells have been filtered out. Shown on the left is plasma drawn from a volunteer before a meal, and on the right is the volunteer's plasma after a heavy meal of fast food. The role of blood in nutrient transport is plainly visible.

Figure 17.11 Components of Blood

TYPE	PERCENTAGE OF BLOOD VOLUME	FUNCTION
Red Blood Cells	45	Oxygen transport
White Blood Cells	1	Immune response
Platelets	1	Blood clotting
Plasma	53	Fluid portion of blood; contains sugars, fat globules, proteins, salt, antibodies, hormones, clotting factors, vitamins, minerals, and dissolved blood gases (oxygen and carbon dioxide)

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critical importance for the gas-exchange function of blood circulation. Slow-moving blood cells packed with oxygenated hemoglobin have more time in the capillary beds to release their bound oxygen.

The complete circuit of blood through the circulatory system takes about one minute. During the first few seconds after leaving the heart, blood is rushing through large arteries, then still speeding through arterioles, with essentially all of its bound oxygen moving with the flow. Blood spends a few more seconds moving through lesser vessels, but as it reaches the smallest vessels, the capillary beds in active tissue, it is moving, relatively speaking, at a crawl. And we are now back to gas-exchange, with hemoglobin emitting clouds of oxygen molecules amidst a cloud of carbon dioxide produced as a metabolic waste product by the surrounding tissue. And here we see the versatility of hemoglobin as the carrier of oxygen, able to bind it in one location and release it at another.

Movie 17.1 Arteries and Veins
Arteries carry oxygenated blood away from the heart to the periphery, and veins collect the blood at capillary beds and return it to the heart. Valves in veins contribute to systemic circulation; when veins are squeezed by muscle contraction, valves prevent backflow while allowing forward flow.

How Hemoglobin Works

Oxygen transported by hemoglobin binds to a heme molecule in the center of each hemoglobin subunit.

Hemoglobin is a macromolecule formed of four subunits. Within each subunit is an iron-containing structure called *heme* that participates in the binding of oxygen. The critical feature of hemoglobin is that its binding of oxygen is reversible, depending on surrounding conditions, especially acidity. In the lungs, at pH 7.4, heme binds oxygen avidly (from the Latin word for greedy). In active tissue, the presence of carbon dioxide lowers the pH to a more acid 7.2. At this pH, the protein subunits of hemoglobin undergo a small but important change in shape. (It is quite common for

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protein shapes to be affected by pH.) The change in shape causes hemoglobin to cling to oxygen less avidly.

In this graceful system, it is the signal that oxygen is needed—the presence of carbon dioxide in elevated concentrations—that also causes oxygen to be released from hemoglobin. As mentioned earlier, carbon dioxide is formed at a one-to-one rate as oxygen is consumed by aerobic metabolism. High carbon dioxide means actively metabolizing tissue. Carbon dioxide (CO_2) affects the acidity nearby by reacting with water (H_2O) to form carbonic acid (H_2CO_3). Carbonic acid sheds a proton to form bicarbonate ion (HCO_3^-) and H^+. The elevated level of H^+ lowers the pH. Hemoglobin moving through the acidified environment then releases oxygen, while also binding much of the H^+, which decreases the surrounding acidity.
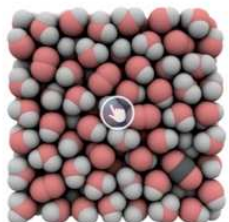

Interactive 17.3 Hemoglobin
Hemoglobin binds oxygen in the lungs and releases it in the peripheral tissues.

There are 250 million hemoglobin molecules in a red blood cell, each carrying four oxygen molecules. In very active tissue, hemoglobin may leave almost half of its bound oxygen in a capillary bed. A cloud of billions of oxygen molecules diffuses away from the capillary each second as red blood cells pass through.

The final part of the circuit is the transport of carbon dioxide back to the gas exchange surface in the lung. Carbon dioxide, as mentioned, is much more soluble in water than oxygen, and some is swept along in the blood. Some binds nonspecifically to amino groups on the surface of hemoglobin. Some is transported as bicarbonate ion.

Back in the capillaries surrounding the alveoli of the lung, the chemical reactions affecting carbon dioxide are reversed. In the less acid environment of the lung, bicarbonate ion is converted back to carbonic acid, which is converted back to CO_2, which is exhaled.

Interactive 17.4 Carbon Dioxide
Carbon dioxide reacts with water to form carbonic acid and then bicarbonate.

RESPIRATION AND CIRCULATION

Review

Circulatory systems deliver oxygen to tissues where it is consumed, and remove carbon dioxide, the waste product of oxygen metabolism. In lungs, gas exchange occurs by diffusion between air taken into lung chambers and blood flowing through capillaries surrounding the air chambers. Gas exchange surface areas are massively increased by folds and pockets on a microscopic level, which greatly increases the surface area available for diffusive exchange.

Humans inhale 11,000 liters of air per day, including 2,235 liters (80 cubic feet) of oxygen. Air in the lungs is exchanged when contraction of the diaphragm increases the volume of the chest cavity, lowering the pressure and drawing in air. Air passes through the pharynx and trachea to large airways called bronchi. The bronchi branch into smaller passages called bronchioles, which terminate in alveoli, tiny membrane-lined air sacs surrounded by capillaries.

Capillary walls are porous to the diffusion of oxygen and carbon dioxide. The gases move in the direction of lower concentration. Oxygen-poor blood is enriched by oxygen in the lung; in oxygen-poor tissues, oxygen is transferred in the direction of lower oxygen concentration, toward the tissue.

Review 17.1

Question 1 of 4
Carbon dioxide is removed from the body by which system(s)? (Select all that apply.)

- A. excretory system
- **B. circulatory system**
- C. respiratory system

Check Answer

Blood contains hemoglobin, which increases the capacity of the blood to hold dissolved oxygen by 80 times. Hemoglobin binds oxygen with high avidity in the pH of the lung. In the tissue, pH is lowered by the presence of CO_2, and the lower pH causes hemoglobin to bind oxygen less tightly. This mechanism allows hemoglobin to pick up oxygen where it is plentiful and release it where it is needed.

Systemic arteries carry oxygen-enriched blood away from the heart. Veins carry oxygen-depleted blood from the tissues back to the heart. Oxygen-depleted blood enters the right atrium, channels to the right ventricle, and is pumped on a short route to the lung, where it picks up oxygen and flows back to the heart. This circuit is called the pulmonary circulation. Oxygen-enriched blood is then pumped throughout the body by the powerful contractions of the left ventricle. This route is called the systemic circulation.

Arterial vessels branch into smaller vessels, but the cross-sectional area of the vessels becomes greater with each branch, meaning blood flows more slowly in smaller branches. In the smallest blood vessels, called capillaries, blood cells travel in single file, moving slowly enough to allow time for diffusive exchange of oxygen and carbon dioxide between blood and tissue.

Review 17.2

Question 1 of 3
What is the maximum number of molecules of oxygen bound by a molecule of hemoglobin?

- A. 2
- B. 4
- C. 6
- D. 8

Check Answer

Carbon dioxide dissolves in blood plasma 20 times better than oxygen. Most carbon dioxide is transported as bicarbonate ion, formed when carbon dioxide reacts with water. Protons (hydrogen ions) released during these reactions causes pH to drop in working tissue. Lower pH makes hemoglobin more likely to release its bound oxygen, resulting in a self-regulating system that delivers oxygen where it is needed.

The reaction of carbon dioxide and water runs in reverse at the higher pH and lower carbon dioxide concentrations in the lung, and released carbon dioxide diffuses into the lung and is exhaled. Hemoglobin changes to its oxygen-ready shape, and the high concentration of oxygen causes hemoglobin to bind oxygen for delivery to the peripheral tissue.

Project-Based Learning: Exercise can transform the ability of the body to transport oxygen. Trained athletes can have twice the cardiac output, or amount of oxygen delivered, compared to individuals who get little exercise.

APPENDIX E

SCREENSHOTS OF THE ANIMATIONS PROVIDED
IN THE E-BOOK

Adapted from *Life on Earth: Animal Physiology*, by M. Ryan et al., 2010, Watertown, MA: Digizyme, Inc., pp. 90-98. Copyright © 2016 by Apple Inc. Adapted with permission.

Breathing
Exchanging CO₂ and O₂ at three scales

Heart Anatomy & Function
Pulmonary and systemic circulation

The heart is a muscular pump that contracts 7 billion times in a lifetime. The right ventricle takes in oxygen-depleted blood from the body and pumps it out to the lungs. The left ventricle receives oxygenated blood from the lungs and pumps it back out to the body.

Oxygen Transport
Select lung or muscle to see the reversible binding of oxygen

Carbon Dioxide and pH
Select lung or muscle to see how carbon dioxide affects pH

APPENDIX F

**SCREENSHOTS OF THE SELF-TESTING APPROACH
PROVIDED IN THE E-BOOK**

Adapted from *Life on Earth: Animal Physiology*, by M. Ryan et al., 2010, Watertown, MA: Digizyme, Inc., p. 99. Copyright © 2016 by Apple Inc. Adapted with permission.

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Question 1 of 4

Carbon dioxide is removed from the body by which system(s)? (Select all that apply.)

○ **A.** excretory system
○ **B.** circulatory system
○ **C.** respiratory system

Check Answer

Question 2 of 4

Drag the labels to their targets in the order in which blood flows through the heart, starting when oxygen-depleted blood enters the heart.

| Left atrium | Left ventricle |
| Right ventricle | Right atrium |

Check Answer

Question 3 of 4

Compared to the arteries, the total cross-section area of capillaries in the circulatory system is

○ **A.** larger.
○ **B.** smaller.
○ **C.** identical.

Check Answer

Question 4 of 4

How do the chambers of the heart connect to each other?

○ **A.** atrium to atrium
○ **B.** ventricle to ventricle
○ **C.** atrium to ventricle

Check Answer

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3 out of 4 Answers Correct

Go back to review incorrect answers and try again, or start over and clear all answers.

Start Over