EFFECTS OF E-BOOK FORMATS ON UNDERGRADUATES' LEARNING OF STATISTICS

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LEARNING OF STATISTICS

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ABSTRACT

Universities are trending towards electronic books (e-books) as instructional materials, displacing the traditional printed books. However, there is an incomplete body of knowledge on which preferred presentation formats in e-books by students, particularly in statistics learning. As a result, this study was conducted to investigate the effects of three different e-book formats, namely, text and static image (T&S), text and animation (T&A), and text and multimedia (T&M) e-book formats in a first year undergraduate statistics unit. The e-books were designed according to Baddeley and Hitch's (1974) information processing theory, Paivio's (1986) dual-coding theory and Mayer's (2001) multimedia principles. The Waterfall model was applied as a guide to develop and deploy the e-books into website. The e-book was based on an introductory statistics unit under the Bachelor of Commerce program in Swinburne University of Technology (Sarawak campus) in Malaysia. The experiment also assessed whether a relationship exists between the level of cognitive load, self-efficacy, statistics anxiety, individual's learning style as well as gender and computer use experience, in which may influence the academic achievement. A quasi-experimental design was adopted where the study was conducted using Non-Equivalent Group, Posttest-Only Design. The participants were divided into three tutorial groups, with control group assigned with T&S e-book. 89 participants responded and completed all the treatments over 12 weeks. Data were gathered employing questionnaires using both quantitative and qualitative techniques. Results indicated that the T&S e-book format showed higher cognitive load and the participants obtained lower scores in examinations compared to T&A and T&M e-book formats, but no significant difference was found between the T&A and T&M e-book formats. Both self-efficacy and statistics anxiety was found to have no effect on any of the e-book format. Results from hierarchical multiple regression analysis revealed that gender, computer use experience and learning styles imposed no significant effect on participants' level of cognitive load, level of self-efficacy, level of statistics anxiety and achievement within the control and treatment groups. Cognitive load was found to have a weak negative relationship with achievement. In addition, there was an inverse relationship between self-efficacy level and statistics anxiety. Research into the preferred e-book format and effective way of presenting information in e-book imparts instructors and e-book course designer with information to enhance students' learning.

ABSTRAK

Tren universiti kini adalah ke arah pengunaan buku-buku elektronik (e-buku) sebagai bahan pengajaran menggantikan buku-buku cetakan tradisional. Walau bagaimanapun, pengetahuan tentang format penyampaian e-buku yang digemari oleh pelajar, terutamanya dalam pembelajaran statistik masih belum mantap. Oleh yang demikian, kajian ini dilaksanakan untuk menyelidik kesan tiga bentuk penyampaian e-buku yang berbeza, iaitu teks dan imej statik (T&S), teks dan animasi (T&A) dan teks dan multimedia (T&M) dalam pengajaran statistik untuk pelajar pra-siswazah tahun pertama. Tiga format e-buku ini telah direkabentuk mengikut teori pemprosesan maklumat Baddeley dan Hitch (1974), teori dwipengkodan Paivio (1986) dan prinsip mulitmedia Mayer (2001). Model Waterfall telah digunakan sebagai panduan semasa pembangunan dan pementasan e-buku ke laman sesawang. E-buku ini berdasarkan kepada unit pengenalan statistik di bawah program Ijazah Sarjana Muda Perdagangan di Swinburne University of Technology (Kampus Sarawak), Malaysia. Eksperimen ini juga menilai sama ada wujud hubungan antara tahap bebanan kognitif, keupayaan diri, kebimbangan statistik, gaya pembelajaran individu serta jantina dan pengalaman menggunakan komputer yang mungkin mempengaruhi pencapaian akademik. Rekabentuk eksperiman kuasi telah digunakan dan kajian telah dijalankan dengan menggunakan Reka bentuk PascaUjian Kumpulan Bukan Setara. Peserta kajian telah dibahagikan kepada tiga kumpulan tutorial dengan kumpulan kawalan diagihkan kepada e-buku T&S. Seramai 89 peserta kajian melengkapkan semua rawatan dalam masa 12 minggu. Data dikumpul menggunakan soalselidik merangkumi teknik kuantitatif dan kualitatif. Dapatan kajian menunjukkan bahawa kumpulan e-buku T&S menghadapi tahap bebanan kognitif lebih tinggi dan skor yang lebih rendah dalam peperiksaan berbanding dengan e-buku T&A dan T&M, tetapi tidak ada perbezaan yang signifikan ditemui antara e-buku T&A dan T&M. Keupayaan diri dan kebimbingan statistik tidak memberikan kesan ke atas mana-mana bentuk e-buku. Dapatan analisis hierarki regresi berganda menunjukkan bahawa jantina, pengalaman menggunakan komputer, dan gaya pembelajaran tidak memberikan kesan yang jelas terhadap tahap bebanan kognitif, tahap keupayaan diri, tahap kebimbangan statistik dan pencapaian dalam kumpulan rawatan dan kawalan. Terdapat hubungan negatif antara bebanan kognitif dan pencapaian. Di samping itu, terdapat hubungan songsang antara tahap keupayaan diri dan kebimbangan statistik. Kajian tentang format e-buku yang digemari dan cara berkesan untuk menyampaikan maklumat dalam e-buku dapat membantu pengajar dan pereka e-buku menambahbaik pembelajaran di kalangan pelajar.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AC	Abstract Conceptualisation
AE	Active Experimentation
CE	Concrete Experience
CL	Cognitive Load
CLT	Cognitive Load Theory
CTML	Cognitive Theory of Multimedia Learning
E-book	Electronic Book
HTML	Hyper Text Markup Language
KLSI	Kolb Learning Style Inventory
LS	Learning Style
LSE	Learning Self- Efficacy
LSI	Learning Style Inventory
MOHE	Malaysia of Higher Education
OUM	Open University Malaysia
PPSUQ	Post-Study System Usability Questionnaire
RO	Reflective Observation
SA	Statistics Anxiety
SAS	Statistics Anxiety Scale
SE	Self-Efficacy
T&A	Text and Animation
T&M	Text and Multimedia
T&S	Text and Static Image
UM	Universiti Malaya
UNIMAS	Universiti Malaysia Sarawak
UPM	University Putra Malaysia
USM	Universiti Sains Malaysia

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter provides an overview and introduction to the research. It describes the background of the study, problem statement, research objectives, research questions, research framework, significance of the study, limitations of the study, assumptions of the study and definitions of research terms. It concludes with a summary of the chapter.

1.1 Background of the Study

Rapid technological advancement and its applications in education over the past decade have changed the way instructors deliver and learners acquire information (Foasberg, 2011). Information is no longer restricted to only printed textbooks as in the past. Printed textbooks have been gradually replaced with electronic books (e-books).

The e-book can be defined as a book presented in electronic or digital format, either on dedicated e-book readers such as the Apple I-Pad (Smith & Kukulska-Hulme, 2012) and Amazon Kindle E-book Reader (Lebert, 2009), or undedicated devices such as a tablet PCs, laptops, desktop (Genuth, 2008; Lebert, 2009) or mobile phones (Uluyol & Agca, 2012).

The e-book is considered an emerging form of technology and is currently of particular interest to all level of education especially in the context of e-learning (Appleton, 2005; Baumann, 2010; Foasberg, 2011; Lonsdale & Armstrong, 2010; Miller, 2010; Rao, 2003; Rothman, 2006; Wong, Liong, Lin, Lower, & Lam, 2011). Appleton (2005) observed, “With printed textbooks being well integrated into traditional teaching and learning in higher education, the next obvious resource to embed into e-learning would be the e-book” (p. 56). Rothman (2006) agreed, “If ever a promising technology existed for education, and e-learning in particular, it would be e-books” (p. 1).

Major corporations and publishers have also expressed an interest in promoting and supplying electronic versions of higher education books. For instance, McGraw-Hill Education publishes 95% of their titles both in electronic and hardcopy forms (Warren, 2009). Most recently, in 2013, McGraw-Hill launched its SmartBook, an interactive and adaptive e-book for tablets, desktops and laptops with voice instruction, offering tutoring and highlighting information to ease learning (Empson, 2013). In addition, Kno (www.kno.com), an education software company, is promoting its newest software of KnoMe for e-book, where students can “check-in frequently to see near real time stats on their study behaviour, interaction levels, time management and personal progress” (Trew, 2013, para 2). This software also includes social sharing with peers to allow group sharing and discussion through e-books. Thus, e-books are positioned for rapid growth as digital texts and software for e-books have become prevalent (Trew, 2013).

Universities are extolling the adoption of e-books, which appear to be displacing the printed textbook, most notably in e-learning. For example, Ghaebi and Fahimifar (2011) noted that there are a number of universities which undertook the initiative to move toward becoming a ‘bookless’ institution of higher learning. It helped to keep educational information as up-to-date as possible and distributed worldwide via Internet with ease. In 2002, university libraries in Malaysia began adopting e-books as part of their library collection. The first library to use e-books was the Open University of Malaysia (OUM) in June 2002, followed by Universiti of Malaya (UM), Universiti Sains Malaysia (USM), and Universiti Putra Malaysia (UPM) in 2008 (Ismail & Zainab, 2005; Letchumanan & Tarmizi, 2011). Although traditional textbooks are still currently needed by colleges and universities, the pace of change from textbooks to e-books is quickening as more university libraries start to add e-book databases; this represents a new direction in educational resources. In line with this, the Malaysian Ministry of Higher Education (MOHE) is financially supporting the subscription of university libraries to e-book providers. For example, the MOHE allocated more than RM1.04 million to help local universities to subscribe to netLibrary in 2010 (Letchumanan & Tarmizi, 2011).

Besides education, e-books have predominantly been used in the commercial sector as evidenced by the report from the International Digital Publishing Forum (www.idpf.org). The wholesale revenue of e-books in the United States increased from US$ 165.8 million in 2009 to US$ 304.6 million in 2010 (IDPF, 2012). Amazon.com, which currently dominates the e-book market, sold more e-book titles for its Kindle e-reader device compared to printed books (BBC News, 2012). The trend clearly suggests that e-books are gaining huge popularity and becoming an alternative format for information delivery.

The first discussion of e-book development as an alternative to traditional print began nearly 40 years ago, in 1971, through Project Gutenberg, a digital library for books from the public domain. At present, the project offers more than 30,000 free public domain e-books through the Internet (Foasberg, 2011; Lonsdale & Armstrong, 2010). With the development of dedicated e-book devices and the spread of the Internet in the 1990s (Baumann, 2010), more books were published in both printed and digital formats.

Given that e-books are published digitally, Clyde and Delohery (2005) indicated that e-books can be presented in different presentation formats, even though static images and text are the most frequently used presentation format in e-books. This is clarified by Ghaebi and Fahimifar (2011), who suggested that e-books could be divided into different kinds of formats, namely, electronic textbooks, electronic static picture books, electronic animated books, electronic talking books, electronic multimedia books, electronic intelligent books and electronic space books. Among these formats, the most prevalent e-books in academic libraries are electronic textbooks, electronic animated books and electronic multimedia books (Foasberg, 2011). However, Wong et al. (2011) suggested that e-books can be customized by instructors. Ghaebi and Fahimifar (2011) supported by asserting that the use of animation and multimedia in e-books could also be an advantage.

Furthermore, the e-book could offer dynamic visual and verbal formats such as animation and multimedia instead of depending heavily only on text and static image (Li, Chen, & Sheng, 2013; Richardson, Smith, Lenarcic, McCrohan, & O'Hare, 2010; Warren, 2009). Dynamic visual and verbal formats which include static words, images, audios, videos, and animations could have the potential to encourage students to move beyond being passive learners and participating in the creative and constructive aspects of learning (Baumann, 2010; Lai & Newby, 2012; Sharp, 2005). The application of dynamic visual and verbal formats is possible in the e-book because it was created using special compiling software. For example, the Hyper Text Markup Language (HTML) compiler enables the e-book to act like a web page, making it possible for the user to click and be taken instantly to another page or section of an e-book. With the HTML compiler, various links could be created between animations, audios, videos formats to make the learning experience more comprehensive (Lai & Newby, 2012).

Empirical research has provided support for the advantages of dynamic visual and verbal formats over leaner formats such as text and static images for learning (Despotakis, Palaigeorgiou, & Tsoukalas, 2007; Guan, 2009; Kim & Gilman, 2008; Tversky, 2011) and the design rationales that conform to theories (Sweller, 2010). For this study, the underlying theories for developing the dynamic visual and verbal formats for the e-book or e-book formats include Atkinson and Shiffrin's (1968) information processing theory, Baddeley and Hitch's (1974) working memory theory, Paivio's (1986) dual-coding theory, Mayer's (2001) multimedia principles and Chandler and Sweller's (1991) Cognitive Load Theory (CLT). The reason for choosing these related theories as the theoretical framework for this study is that information presented in text, graphic, animation and multimedia forms has a big impact on cognitive load (Lin & Dwyer, 2010; Mayer & Moreno, 2003; Meissner & Bogner, 2013).

Knowledge of the structure and functionality of the working memory increases understanding of the process and limitations of resources in cognitive load (Ayres & van Gog, 2009; Bethel & Borokhovski, 2010). Baddeley and Hitch (1974) and Paivio (1986) posited that separate channels (in the working memory) for visual and verbal information processing have limited resources to process information. When learners have a working memory with a limited capacity when dealing with new information, learning will be hindered and this is one of the assumptions of CLT (Sweller, 2010).

One solution to the limited capacity of working memory is the distribution of information across the working memory (Sternberg & Sternberg, 2012). The multimedia principle explains how to reduce unnecessary cognitive loads, so that a learner is able to have a deeper learning experience by presenting information using dual channels (visual and verbal) rather than a single channel (Mayer & Moreno, 2003). In this case, the information presented through dual channels refers to the combination of visual information such as simulated graphics with corresponding verbal information (spoken or narrated) or in other words, animation and multimedia formats. It should be noted that the development of the e-book format in the context of statistics education for this research has carefully incorporated all these theory considerations.

The use of technology in teaching and learning in the field of statistics is still new but has been gaining momentum in recent years (Ashcraft & Moore, 2009; Neumann et al., 2011). Statistics courses are usually of concern among undergraduate students (Liu, Onwuegbuzie, & Meng, 2011; Perepiczka, Chandler, & Becerra, 2011), this may be caused by students' phobia of statistics, fear of failure and low self-confidence in computing statistics (Mills & Raju, 2011). Hence, researchers have tried to incorporate technology to enhance the teaching and learning of statistics (Everson & Garfield, 2008; Neumann et al., 2011; Schou, 2007; Wang, Vaughn, & Liu, 2011); the use of animation and multimedia is most prevalent (Neumann et al., 2011). Although tools such as graphing calculators and statistics software packages are used to help students in learning statistics (Handal, Cavanagh, Wood, & Petocz, 2011), Ooms and Garfield (2008) suggested that some of the statistics textbooks could be digitized and supplemented with more interactive elements in the form of web-based and computer simulation tools which can help students to visualize and understand abstract concepts in statistics. For the purpose of this study, a printed statistics textbook was scanned and uploaded through websites as an e-book. Flash animations, audios and videos were embedded into the e-book as it is believed that animation and multimedia could enhance interaction and stimulate interest among students when learning statistics (Neumann et al., 2011).

One of the reasons why statistics has been identified as a persistent difficulty among students is the anxiety faced by the students. The existence of anxiety about statistics appears to be indisputable where statistics frequently causes feelings of extensive worry, intrusive thoughts and tension among students (Ashcraft & Moore, 2009). Others have suggested that the use of technology in statistics can help to reduce anxiety in students and improve their attitudes toward statistics (Legum, Schmitt, Murray, O'Bryant, Owens-Southall, Byrnes, & Jeter, 2011; Neumann et al., 2011; Wang et al., 2011). For example, Wang et al. (2011) assert that when students use animation and multimedia interactivity in learning statistics, their confidence level increases and thus anxiety decreases. Similarly, Neumann et al. (2011) integrated a variety of technologies into their statistics instruction, including virtual simulations using animations and multimedia. The results showed that students experienced less anxiety and were more motivated in learning. Although the use of different presentation formats helps to reduce statistics anxiety among students, very little research is found in the context of an e-learning environment especially using the e-book and this is addressed in the present study.

Many studies emphasize the importance of exploring learner characteristics towards the usage of information technology in e-learning (Abulibdeh & Syeh Hassan, 2011; Compeau & Higgins, 1995; Tsai, Tsai, & Hwang, 2010). One such characteristic is self-efficacy. Self-efficacy can be summarised as the confidence in one's own abilities to achieve an outcome (Bandura, 1977). Self-efficacy has been shown to be an important characteristic that influences the use of information technology (Abulibdeh & Syeh Hassan, 2011) and a strong predictor of achievement (Vuong, Brown-Wilty, & Tracz, 2010). For example, in an e-learning environment, Kilic-Cakmak (2010) found that learners with a higher level of self-efficacy used computers more often, were able to control their learning effectively, experienced less anxiety and achieved higher scores. Another example from Tsai et al. (2010) showed that learners with higher self-efficacy have more positive attitudes in using technology when it comes to learning compared to those with lower self-efficacy. Thus, self-efficacy can be used to explain how students use technology in e-learning. This study hopes to find whether self-efficacy has a significant influence in relation to the usage of the e-book and statistics anxiety.

Since e-books can be presented in different formats, it is necessary to know how each individual processes and comprehends the information during the learning process. Learning style is also a factor contributing to learners' preferences towards different forms of presentation formats for information. A large volume of research indicates that there are some styles preferred by students when learning (Clump & Skogsberg, 2003; Felder, 1996; Lu, Jia, Gong, & Clark, 2007). Some students prefer to focus on operations and data, some feel more comfortable with theories and models, and others prefer visual forms of information such as pictures, tables and graphics while some learn better with spoken and written information. Felder (1996) categorized these groups of students into different learning styles. Hence, in order to create different types of formats in e-books, it seems essential to consider students' learning styles (Mupinga, Nora, & Yaw, 2006) in order to sustain their interest in e-books. Based on this, the present study is designed to find out not only the effects of different media presentation formats in e-books but also whether and how individual with learning styles interact with the e-books, focusing on the Kolb Learning Styles. This study is designed to find out not only the effects of different e-book formats but also whether and how individual with learning styles interact with the e-books.

Moore and Kearsley (2005) suggested that the identification of students' demographic characters could be important considerations in ensuring their success in e-learning. The identification of the impact of various characteristics such as gender, age, work experience, ethnicity and computer experience need to be the focus when attempting to understand learners (Smith & Ragan, 1999). A number of studies have shown that demographic has a significant influence in e-book usage for teaching and learning. For example, Ismail and Zainab (2005) reported that there were significant differences between the frequency of e-book use and gender, between past usage of e-book and preference for electronic textbooks and reference books, but age was found not to be a factor. Kang, Wang, and Lin (2009) evaluated the usability of e-books and gender distribution, and noted that female respondents recorded a higher reading performance than male respondents while reading from e-books. Mayer (2001) also pointed the importance of demographic characteristics when designing e-learning technologies, because it would seem a challenge to develop e-learning technologies that achieve effective learning for all. In relation to computer use experience, it was assumed that participants who had more experience in using computers would able to learn the materials online comfortably. It was perceived that the increase in the number of years in computer usage will gradually increase the experience and expertise among the users (Amadieu, Tricot, & Mariné, 2010).

The use of technology in e-learning can have a positive effect on students' achievement. A number of researchers have found that technology in e-learning leads to greater levels of learning and achievement among students than traditional face-to-face classes. For example, in the studies exploring the use of web-based learning and face-to-face learning in an introductory statistics course, it was found that students achieved better with web-based learning than traditional classrooms (Wang et al., 2011; Zhang & Zhou, 2003). Amaral, Garrison, and Klentschy (2002) found that the use of online discussions in e-learning had a positive impact on achievement in science and mathematics. Although studies indicate that the use of technology in e-learning can improve student achievement in statistics courses, this result might not extend to learning statistics from an e-book.

Other than e-learning, many researchers have conducted various experiments and have identified the factors that may enhance students' learning achievement. Ashcraft and Moore (2009) and Lu et al. (2007) reported that there was a significant relationship between learning styles and students' learning achievement in online settings. Putwain, Sander, and Larkin (2012) and Vuong et al. (2010) predicted that high self-efficacy levels lead to better academic achievement. Studies by Macher, Paechter, Papousek, Ruggeri, Freudenthaler, Harald, and Arendasy (2012) and Onwuegbuzie et al. (2010) showed statistics anxiety has a negative influence on academic achievement. Other researchers found that cognitive load has a strong inverse relationship with students' academic achievement (Lee & Rha, 2009; Meissner & Bogner, 2013; Yeh, Tseng, Cho, Barufaldi, Lin, & Chang, 2012). However, little is known about the relationship between e-book format and cognitive load, the level of the students' self-efficacy, statistics anxiety level and their learning styles towards learning achievement.

The transition from printed textbooks to e-books is inevitable. Researchers take a view on possible rich media place in e-books and are taking a new approach to enhance e-books so students can use e-books to learn effectively.

1.2 Problem Statement

Lebert (2009) claimed that there has been a massive growth in e-books and believed that e-books is becoming more prevalent. The importance of the e-book cannot be over-emphasized because it may be the most significant tool in the e-learning environment (Baumann, 2010; Lonsdale & Amstrong, 2010; Neumann et al., 2011).

Despite a great amount of writing devoted to different presentation formats used pervasively in education (Guan, 2009; Kim & Gilman, 2008; Kuhl, Scheiter, Gerjets, & Gemballa, 2011; Rieber, 1990), there are debates still on which format can enhance learning. For example, Kim and Gilman (2008) reported that students improved their level of English proficiency when they used learning materials in graphic and text formats rather than learning with just text format. On the other hand, Despotakis et al. (2007) stated that animation helped students' comprehension and Guan (2009) observed that students performed better in examinations when they learnt through a multimedia format. These research studies indicate that the different formats yield different results in learning, leading Kuhl et al. (2011) to believe that there is a challenge to determine which format will be accepted and used by students. Therefore, the problem addressed in this study is the lack of empirical knowledge related to e-book formats to facilitate statistics learning among undergraduate students.

Furthermore, the existing focus on e-book research includes analysing the use and usability of e-books, level of satisfaction and awareness of e-books, how and why user use them, usage and attitude towards e-books, patterns of use of e-books and e-book projects such as Virtual Book or Hyper-Textbook projects (Ghaebi & Fahimifar, 2011; Letchumanan & Tarmizi, 2011). Although literature related to e-books describes a number of studies and research efforts such as those conducted by Baumann (2010), Foasberg (2011), Letchumanan and Tarmizi (2011), Mercieca (2003), Miller (2010), Nelson (2008), Warren (2009) and Wong et al. (2011), little research has been found on e-book users who with experience using different e-book formats, such as text, static images, animation and multimedia.

Existing research suggests that cognitive load may occur when information is presented in different formats (Lin & Dwyer, 2010; Mayer & Moreno, 2003) because working memory and information processing ability are needed. Although theories such as the information processing theory, dual-coding theory, multimedia principles and cognitive load theory provide the foundation for designing e-book formats (text, animation and multimedia) in order to reduce the level of cognitive load, there is a still lack of literature to support the formats which reduce cognitive load and promote a meaningful learning in statistics.

In order to create a learning environment using the e-book in statistics learning, it seems essential to consider students' statistics anxiety (Everson & Garfield, 2008), and self-efficacy (Tsai et al., 2010). Most studies have focused primarily on measurement of and factors contributing to statistics anxiety (Everson & Garfield, 2008; Onwuegbuzie & Wilson, 2003) and self-efficacy (Abulibdeh & Syeh Hassan, 2011) but few studies have been found on how to reduce the anxiety of learning statistics and the impact of self-efficacy on e-book usage among undergraduate students.

Educators have long accepted the notion that learners have preferred learning styles. However, the debate on whether or not learning styles has an impact to learning is still going on. The lack of rigor is problematic in relation to learning styles and research examining the role of learning styles in e-book presented in different formats is limited.

Another consideration in this study is to analyse the background of the participants (Kang et al., 2009) such as gender and computer experience and their learning outcomes or achievement. As discussed earlier, with the rapid increase in number of e-books in higher education, learners are increasingly likely to have access to e-books to support their learning. To help users, especially those who have had low levels of computer experience, it has been suggested that they be assisted through the provision of visual and multimedia formats in e-books (Li et al., 2013). However, the answer on which formats are preferred by learners in e-book is still vague.

Hence, to fill in the gaps in the literature, the study attempts to investigate the effects of three types of e-book formats. The manipulation of the e-book is reflected in how to use a graphic calculator (Ti-83 model) for an introductory statistics course, with each e-book presenting the instructional material using a different format: Text and Static Image (T&S), Text and Animation (T&A) and Text and Multimedia (T&M). This research study also investigated the experiences of students' cognitive load, self-efficacy and statistics anxiety moderated by their learning styles, gender and computer experience when using different e-book formats. Lastly, in an effort to gain a better understanding of the students' learning, the study also measured students' learning achievement.

1.3 Research Objectives and Research Questions

Based on the problem statement, the research objectives and research questions are stated below:

Investigate the effects of the three e-book formats on the level of Cognitive Load among the students in the statistics subject;

(RQ1) Are there differences in the level of Cognitive Load as perceived by the students in the statistics subject for the three e-book formats?

Investigate the effects of the three e-book formats on the level of Self-Efficacy among the students in the statistics subject;

(RQ2) Are there differences in the level of Self-Efficacy as perceived by the students in the statistics subject for the three e-book formats?

Investigate the effects of the three e-book formats on the level of Statistics Anxiety among the students in the statistics subject;

(RQ3) Are there differences in the level of Statistics Anxiety as perceived by the students in the statistics subject for the three e-book formats?

Investigate the effects of the three e-book formats on the students' achievement;

(RQ4) Are there differences in the students' achievement in the statistics subject for the three e-book formats?

Investigate the effects of the three e-book formats on Cognitive Load; the level of Self-Efficacy; the level of Statistics Anxiety; and Achievement with Gender, Computer Use Experience and Learning Styles as the moderators;

(RQ5) Are the effects of the three formats of e-book on Cognitive Load, the level of Self-Efficacy, the level of Statistics Anxiety and Achievement moderated by Gender, Computer Use Experience and Learning Styles?

1.4 Research Framework

The study first attempted to identify the relationships between cognitive load self-efficacy level, statistic anxiety level and achievements (dependent variables) of the students between T&S, T&A, T&M (independent variables) as designed for the commerce students. It then investigated the influences of the learning styles, gender and computer use experience (moderating variables) of the students towards the relationships stated as above.

The research framework of the study is shown diagrammatically in Figure 1.1. The screenshots for the e-book formats are shown in the Definition of Terms in Section 1.8.

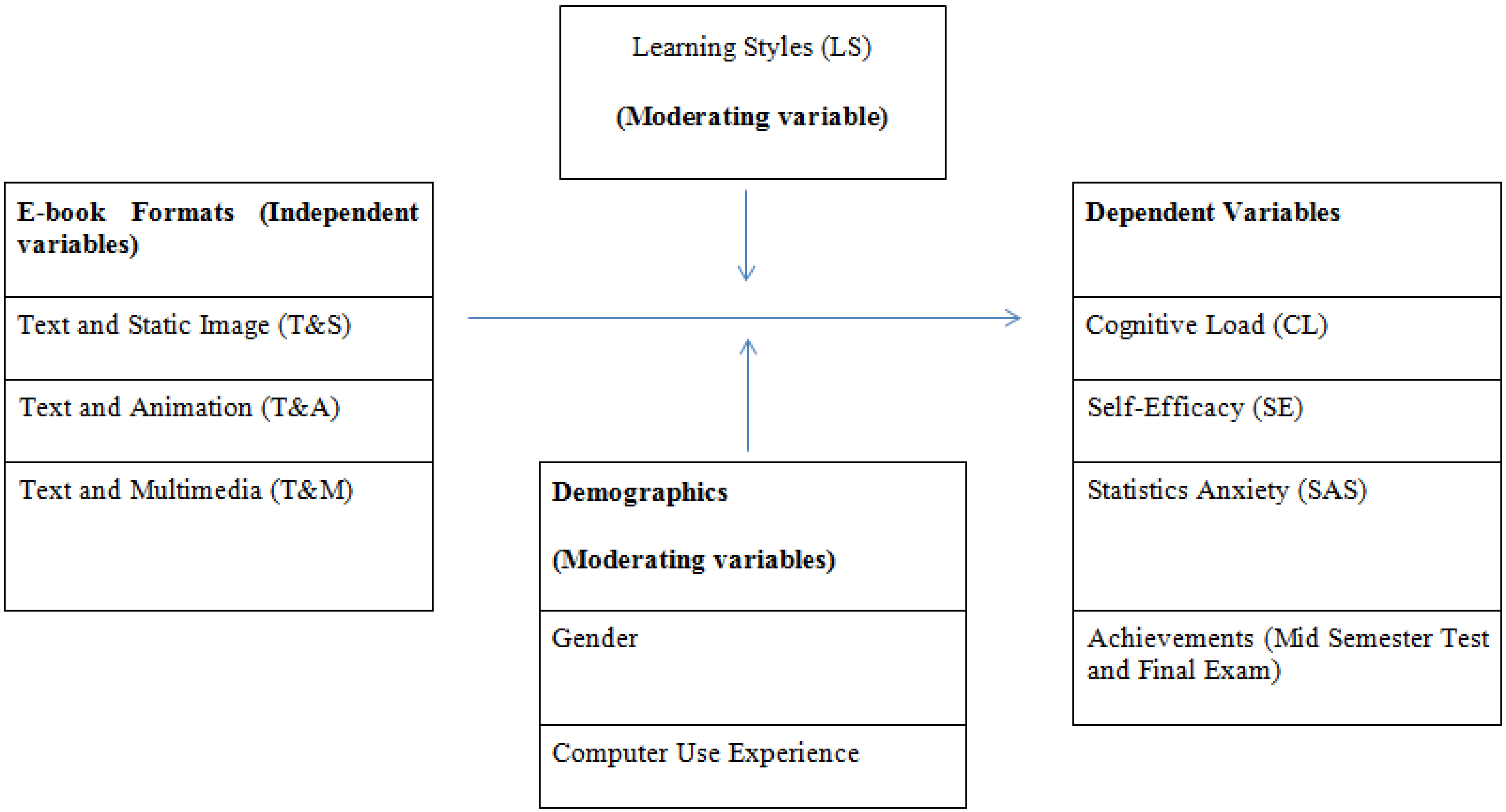


Figure 1.1: Conceptual framework of the study

1.5 Significance of Study

In relation to the contribution to the literature, to practice and to practical guides in the design and development of the e-book, the significance of this study is discussed. There have been a number of studies and papers written and made regarding the evolution of e-books including electronic formats in word processing documents, PDF format and hypermedia (Baumann, 2010; Mercieca, 2003; Sharp, 2005). Though difficult to justify which e-book format is preferred, this study is worth the effort, according to research in the area especially in applying suitable presentation formats in teaching and learning (Lai & Newby, 2012).

1.5.1 Contributions to the Literature

As was evident from the literature, only a few research studies have been carried out on the usage of e-books in teaching and learning in Malaysia (Ismail & Zainab, 2005; Letchumanan & Tarmizi, 2011). However, many local universities have started using e-books in libraries. The challenge is on ensuring how well students will use e-books as a new learning tool in e-learning and what preference they have on types of presentation formats. This area has not been well-researched and investigated in depth in Malaysia. By studying the outcomes of this research, it is hoped that the barriers to the successful adoption and development of e-books may be identified.

There have been studies using text, images, animation and multimedia to investigate aspects of learning (Legum et al., 2011; Neumann et al., 2011; Wang et al., 2011) and development of different presentation formats (Lai & Newby, 2012; Li et al., 2013; Mason, Tornatora, & Pluchino, 2013) but no study has focused specifically on the usage of e-books in statistics learning and the relationship between learners' level of cognitive load, statistics anxiety, self-efficacy and learning styles through e-book delivery.

1.5.2 Implications for Practice

There is a lack of literature investigating the teaching and learning of statistics at the university level, especially in the Malaysian context. Therefore, this study could contribute to existing literature on improving teaching and learning in statistics and the findings of this research study could also have implications on the practicality of using e-books to stimulate learning of statistics.

Participants' perceptions about their own cognitive load, self-efficacy level, statistics anxiety level and learning styles using the e-book format for higher education could inform future educators of the possible ways in understanding students' learning. Cognitive load, self-efficacy, statistics anxiety level and learning styles have been examined in traditional learning environments; however, studies on these variables are still rare especially in the context of using the e-book. Furthermore, the findings of the study relating to the effects of cognitive load, self-efficacy level, statistics anxiety level and learning styles in e-book on statistics could instil confidence and understanding in educators about adapting positive attitudes in teaching of statistics and better achievement for the learners in statistics.

Finally, examining the interaction of variables such as students' gender and computer use experience could help universities to identify technological resources to support learning. For example, universities could establish specific ways to motivate all students (male or female) or target specific courses to be integrated with technology to advance student learning.

1.5.3 Implications for Practical Guides in the Design and Development of the E-book

Previous studies on e-book mainly focused on users' perception towards e-book usage and contained limited literature attributed to the design and use of e-book presentation formats in e-learning. A significant contribution of this study is to design an innovative and dynamic application of e-books and the results of this study can be of an experimental evaluation of the effects of e-book or media choice of learning namely T&S, T&A, and T&M integrated in a local Web site. This would therefore, contribute to the development of another learning tool in an e-learning environment which consists of custom-designed media experiences of text, animation and multimedia.

In addition, by examining students' learning achievement, the administrators can make better projections about the development of technology in e-learning and become a starting point for future projects. Therefore, this study was not only designed to explore the essential elements for student use of e-books in higher education, but also designed to examine the relationship between the field of dependence-independence, and student achievement in learning.

This study also attempts to lay the groundwork for future research. A well-developed e-book with different presentation formats could potentially benefit teaching and learning. It could also be useful for evaluation studies and improvement of any media presentation format, particularly in e-books.

Finally, the study was significant in that it gathered empirical information on individuals' learning patterns as a result of differing treatments (T&S, T&A, and T&M) in e-book formats.

1.6 Limitations of the Study

There are several limitations identified in this study.

Firstly, this study only focuses on undergraduate students from an Australian branch campus university in Malaysia, Swinburne University of Technology (Sarawak Campus) in Kuching, Sarawak. The sample may not be representative of all undergraduate students of all private and public universities in Malaysia. The results of this study may not be applicable to all educational institutions considering the variability of student populations and demographics.

Further, the participants are students enrolled in the HMB110 Quantitative Analysis unit, an introductory statistics unit for first year undergraduate students on the

Bachelor of Commerce programme. This means that the findings of the study may not be generalizable to other students in Swinburne.

This study applies the quasi-experimental research design. In general, a natural limitation of static group comparisons and non-equivalent Posttest-Only Control group designs is that participants are not randomly assigned to the treatment or to the control group. The researcher is unable to randomly assign participants to the tutorial groups. Students self-select their tutorial groups based upon preference and slot availability. In accordance with the university's policy, the study was also limited in regard to the sample size selection as the number of students allowed in a tutorial class is a maximum of 30 students only.

The e-book formats (text, statics graphics, animation and video features) are tailored for learning introductory business statistics and using Ti-83 graphic calculator in statistics. Because there is a large variety of courses and units available that might be developed into e-books, the findings of this study might not be generalizable to other types of e-books. The e-books could be viewed via computers in the laboratories in the University, personal computers and laptops. The study does not, however, involve the use of any e-book reader software or devices, although it is possible to view the e-books via portable devices such as smart phones and tablet devices such as iPad.

The period of the study is also restricted to only one semester (12 weeks). Throughout the semester, the participants in each tutorial class are assigned to one type of e-book format. For additional practice, the participants are allowed to use e-books outside the allocated tutorial sessions so they can further practice using e-books in their own time. The researcher was not able to control how often or how long the participants used e-books. Moreover, the period of one semester might not be sufficient to see the whole learning progress for the participants.

Student participation in e-books may not only depend on the preferred learning style, but on other variables such as motivation, personality, individual experiences, or environmental factors (such as time, place and noise). Students may not respond according to their personality but they may answer questions based on what they deem socially desirable. As a result, students' responses may be biased towards what they think makes them appear in a preferred situation; they may be reluctant to admit bad habits or inappropriate attitudes. To limit this, the researcher has taken steps to minimize these challenges by encouraging them to answer the questions sincerely and assuring them that the data would be kept strictly confidential.

In addition, participants may also respond differently when taking part in this research study because of the 'novelty effect'. The idea of using an e-book to learn statistics is a novel experience for the participants. Participants may be excited by the e-book which may indirectly influence the study result.

Another limitation of this study was that it will not gain input from stakeholders beyond students such as the faculty, publishers, university leaders, employers of alumni. The study only focused on the students enrolled in the first year statistics unit under Bachelor of Commerce programme and did not involve any external parties, inside and outside the university. The only external influence is the ethics clearance of this study granted by Swinburne's Human Research Ethics Committee (SUHREC) and the research committee at the Faculty of Cognitive Sciences and Human Development (FCSHD), Universiti Malaysia Sarawak (UNIMAS).

1.7 Assumptions of the Study

This research is conducted on students enrolling in a statistics unit and it is assumed that the students had limited prior knowledge on business statistics and no prior experience in using Ti-83 graphic calculator in statistics. There are around 8% of the participants or 7 participants who repeated the unit during the research study but it will not affect the results as e-book is not used in the previous semester. It is also assumed that the all participants enrolled in the HMB110 Quantitative Analysis possessed similar characteristics in terms of age, level of education, statistics knowledge and level of learning experience. With this, it is assumed that the control and treatment groups for the quasi-experimental research design should be similar, with respect to the participant demographics.

The study assumes that all the answers completed by the three groups of students are fairly in similar in terms of statistics knowledge and their perceptions. The results of this study and data analysis used assume that students answered all questions independently and honestly. Besides, the findings of the data are a collective result, not as individuals and would not have any effect on their grades.

Participation is voluntary and there is no coercion towards their decision to participate in this study. To achieve a high response rate, all students are required to use the assigned e-book formats and attempt the questionnaires and two posttest components (Mid Semester Test and Final Examination).

There is a possibility that participants in the study seek external help from other sources or work in teams when using the assigned e-book. The participants may have compared their e-book formats with those from other tutorial groups. Since the researcher has no control over this situation, it is assumed that participants in the study will genuinely use the assigned e-book formats to learn how to use Ti-83 graphic calculator individually. The participants are reminded from time to time to use the assigned e-book formats throughout the semester.

Experimental biases can equally occur for participants and for researcher. To reduce participant bias, participants are informed that the research study is concerned with cognitive load, statistics anxiety, self-efficacy and learning styles in general when using the e-books. The investigation of e-book format preferences and their achievement are not mentioned. To reduce researcher bias, the role of the researcher is restricted to technical support and interactions with participants are kept to a minimum during the experiment period.

It is assumed that the content of all three e-book formats were maintained and consistent with the learning objectives of the unit. In terms of posttest, the participants in all control and treatment groups were given the same amount of time to complete. The only difference was the design of the three different presentation formats, embedded by animations, videos and audios.

1.8 Definition of Terms

For the purpose of this study, several terms are used:

Achievement

In the literature, there does not appear to be one specific or universal definition of ‘academic achievement’ (DeTure, 2004; Fan & Chen, 2001). For the purposes of this study, it is defined as what the students have accomplished by the execution of the e-book formats in the statistics unit. In this study, the participants are assessed after the treatment, and their achievement are measured by their posttest scores in the Mid Semester Test and Final Examination on the unit. The Mid Semester Test and Final Examination are developed by the lecturer teaching the unit. The Mid Semester Test are based on Chapter 1 and Chapter 2 of the unit while the Final Examination re based on Chapter 3 to Chapter 8 of the unit.

Cognitive Load

‘Cognitive load’ can be defined as the informational load that is being processed in the working memory (Agostinho et al., 2011; Bethel & Borokhovski, 2010; Paas, van Gog & Sweller, 2010). In this study, cognitive load refer to a certain amount of information that can be processed in the working memory at one time by the participants while studying on the course, HMB110 Quantitative Analysis, an introductory statistics unit, in three types of e-book formats without overloading their processing capacity.

Computer Use Experience

In this study, ‘computer use experience’ is defined as basic computer skills possessed by users when using a computer during a significant period of time (Amadieu et al., 2010). In this study, computer use experience is measured by the number of years that the users had used a computer.

E-book

The e-book can be defined as a book converted into digital form, or digital reading material (Rao, 2003), with text and images, animation, multimedia such as video and audio displayed on a desktop, note-book computer, or portable device, or formatted for display on dedicated e-book readers (Baumann, 2010). For the purposes of this study, a printed textbook on HMB110 Quantitative Analysis, an introductory statistics unit is converted into electronic form and enhanced with animation and multimedia functionalities. The e-books are developed by the researcher based on the learning theories discussed in the literature. Using the Waterfall model, the e-books are designed and deployed into websites and can be viewed by participants via a desktop or laptop computer. In this study, portable device or e-book readers are not considered as there are limitations to the software usage.

E-book Format

‘E-book format’ can be defined as the applications, dedicated and non-dedicated hardware and software which include the proprietary closed sourced configuration that are related to allow e-book formats to function (Lebert, 2009). The e-books for this study are developed in three formats namely T&S, T&A, and T&M. Section 3.5 explains the development of the T&S, T&A and T&M e-book formats in details.

Learning Styles

‘Learning style’ is defined as how a person perceives, processes, stores and recalls information of what he/she is are attempting to learn in a complex manner (Lu et al., 2007). In this study, the Kolb Model of learning styles is used in which learning styles can be classified as concrete experience or abstract conceptualization, active experimentation or reflective observation.

Self-efficacy

‘Self-efficacy’ refers to the personal judgment that someone makes about how confident they feel about their ability to accomplish a task. In this study, e-book self-efficacy refer to the judgments an individual makes about how confident he/she feels (Hung, Chou, Chen, & Own, 2010) about their ability to use e-book to learn statistics and to use Ti-83 graphic calculator. It is measured using Neill’s (2008) learning self-efficacy instrument.

Statistics Anxiety

'Statistics anxiety' is defined as the feeling of anxiety encountered when taking a statistics course or doing statistics subject, which include gathering, processing and interpreting data (Everson & Garfield, 2008). In this study, statistics anxiety was measured using questionnaires adopted from Vigil-Colet, Lorenzo-Seva, and Condon (2008).

Text and Animation (T&A)

For this study, 'animation' is defined as a simulation of movement created by displaying a series of pictures, or images (Lai & Newby, 2012). In other words, animation involves a visual communications medium where visual images appear to move or change. In this study, T&A consists of readable data together with a series of simulation of the steps using the Ti-83 graphic.

Text and Multimedia (T&M)

Multimedia is defined on a combination of text, audio, animation, video, still images and interactivity content which refers to different signs and signals (Mayer, 2009). In this study, the multimedia materials represent the usage of Ti-83 graphic calculator in the form of text, audio, animation and video.

Text and Static Image (T&S)

Text is a human-readable sequence of characters with words that can be encoded into computer-readable formats (Mason et al., 2013). In this study, text is also distinguished from non-character encoded data, such as still graphic images or pictures of Ti-83 graphic calculator will be used.

1.9 Summary

This chapter introduced the background of the study and the problem statement. The study was intended to investigate the effects of e-book formats on cognitive load, the level of self-efficacy, the level of statistics anxiety and achievement. The research objectives, questions and framework were discussed. The significance of the study was discussed with reference to the implications for practice, reference to the contribution to literature and the definition of terms. The next chapter provides the literature review relevant to the study.

CHAPTER 2

LITERATURE REVIEW

2.0 Background

This chapter reviews the literature pertinent to the study encompassing the e-book's history, characteristics and formats, literature on information processing, dual-coding theory, multimedia learning, cognitive load and the effect of students' cognitive load, self-efficacy level, statistics anxiety level, achievements, learning styles, gender and computer use experience towards e-book format usage.

2.1 History and Overview of the E-book

In the past, printed books, the television programmes and videotapes were the main media to present educational content. However, these types of media cannot provide the ability to interact with the learner and provide feedback. Typically, it is a one-way provider of information. Gradually, these traditional media lost their importance as they were replaced by computer and Internet-based tools of learning (Sharp, 2005).

Ever since there have been computers and the Internet, the idea of the electronic book (e-book) has not been new. The first discussion of thee-book as an alternative to traditional print began in the 1990s, with the development of many dedicated e-book initiatives and the increase of Internet usage, which focused on e-mail and electronic newsgroups at that time (Lebert, 2009).

One of the earliest efforts, Project Gutenberg, at the University of Illinois offered the contents of book titles in the public domain, keyed into electronic format and made available for free on the Internet (Lebert, 2009), and now surpasses 30,000 e-books. Five years after Project Gutenberg, the Oxford Text Archive was created and funded by the Arts and Humanities Data Service in the United Kingdom (Vassiliou & Rowley, 2008). The purpose of the archive was to "collect, catalogue, preserve, and distribute the electronic products of research and scholarship in all areas of textual, literary, and linguistic studies" (Text Encoding Initiative, 2013, para 1). In recent developments, these discussions have expanded to include journals, newspapers, novels, standalone documents in PDF format and electronic textbooks (Baumann, 2010).

In 2004, the Google Books Project was launched with the partnership of five of the world's largest libraries, namely, Harvard University, Stanford University, the University of Michigan, University of Oxford (England) and New York Public Library (Carlson & Young, 2005) to scan more than 150 million print books into e-books (Trachtenberg, Vascellaro, & Efrati, 2010). The project successfully scanned more than 20 million books into e-books by 2012 and offers more than 2 million e-books for free (Howard, 2012). In 2013, Google managed to create a gigantic database, which includes over 30 million e-books (Darnton, 2013), turning Google into one of the largest e-book providers, positioning itself with Amazon.com in the market share of e-books.

Amazon.com, one of the largest booksellers increased its sales of books for its e-reader, the Kindle, for the average Kindle user bought up to four times more e-books than they did before owning the e-book reader (BBC News, 2012). It was forecasted that the e-book market would grow dramatically as learning institutions such as schools, libraries, colleges and universities are heading towards e-books rather than physical textbooks (Foasberg, 2011). As information technologies evolve rapidly on the Web, the shift has led to a recognition of e-books as a new source of information for education (Miller, 2010).

2.1.1 Definition of an E-book

The e-book has been around for at least three decades and has become one of the most important developments in the world of literature since the Gutenberg press and is destined to change the reading habits of many over the next several years (Miller, 2010). However, some confusion persists about what 'e-book' refers to. The term 'book' indicates both the message in words and images and the medium, such as bound paper (Genuth, 2008). Within the context of academic publishing, there has not been an acceptable definition for the term 'e-book' and several attempts have been made in the literature to define 'e-book'.

The first idea of an e-book was discussed by Bush (1945) with the conceptualization of a hypertext engine called Memex. This device worked as a library where the individual could store all their books and communications where the information could be retrieved and read with flexibility. Another early idea was proposed by Kay (1968) where a device called Dynabook fitted the description of a personal laptop, a device that could provide connections to online libraries which enabled the searching and reading of books using a personal computer.

As time passed and more concepts of e-books were developed, Rao (2003) stated that the electronic book consists of electronic files in digital displays. Subsequently, Romana (2012), in his research, defined the e-book as text in digital form, either in digital reading material or an electronic file of text and images exhibited on display mediums, namely, the desktop, note-book computer, portable device or dedicated readers. In relation to this, Rao (2003) mentioned that in order to allow the e-book to function in a proper manner, applications, dedicated and non-dedicated hardware and software would be included.

Kang et al. (2009) defined e-books as books in computer file format which can be read on all types of computers, including handheld devices designed specifically for reading e-books. Moreover, e-books, as unique as the electronic medium itself, may have additional features such as audio, video or live hyperlinks, which are unfeasible in physical books (Smith & Kukulska-Hulme, 2012).

To support Kang et al.'s (2009) definition, Baumann (2010) defined e-book as a book that has been converted to digital form which can be read on a computer, usually through network services or CD-ROM. E-books can be upgraded with the addition of hypertext links, search and cross-reference functions and multimedia.

2.1.2 E-book Research Findings in Education

There are researches that support the notion that e-books can become a promising resource in education (Foasberg, 2011; Lebert, 2009; Warren, 2009). Higher education institutions in Malaysia (Letchumanan & Tarmizi, 2011; Shiratuddin, Othman, Ahmad, & Hassan, 2006) and public libraries (Cavanaugh & Cavanaugh, 2008; Ismail & Zainab, 2005) are beginning to explore the application of e-books and e-book readers in the e-learning environment.

Sharp (2005) explored the use of electronic textbooks in a university setting and concluded that the younger generation will easily adopt e-book concepts especially with the additional features offered by the e-book such as the option to search and highlight texts, bookmark pages and make notations. Moreover, with video and interactive elements embedded in electronic textbook, it will enhance the e-book as a teaching and learning tool. Although Sharp (2005) believed that e-books are the wave of the future in education, he hoped that e-books could be offered free without any restriction in terms of accessibility.

In addition, Clyde and Delohery (2005) examined different types of presentation formats for e-books and expressed concern over reading comprehension issues and difficulties in understanding the content among students while reading in the digital form. The study discussed a number of potential benefits and disadvantages of e-books and concluded that publishers should consider the user-friendliness of e-books.

Abdullah and Gibb (2006), in their research on an online survey of e-book awareness and usage level in a British academic library, reported that e-book awareness and usage was low amongst students. Their respondents commented that e-books were not widely advertised or promoted, which probably contributed to this lack of awareness and non-usage. Nevertheless, despite the low levels of e-book awareness and usage, most of the students indicated their desire to learn more from e-books.

Foasberg (2011) explored the use of electronic textbooks in university settings and found that students preferred additional features offered by e-books than printed textbooks because the e-book contained the options for searching, text highlighting and making notations and bookmark. According to Foadberg (2011), this was one of the reasons why there had been a growing number of e-books in university libraries in the United Kingdom. The article also indicated that both universities and publishers realized the digital content of e-books was a factor for the growing market in higher education but the delivery formats and presentation styles preferred by students remained undetermined. Nelson (2008) was in agreement where his study showed most of the students were using e-books but different presentation styles should be considered in gaining increased usage of e-books in the future. In addition to this, the study conducted by Woody, Daniel, and Baker (2010) disclosed a potential market for e-textbooks. However, e-books have yet to become more student-friendly and that e-books can be improved by adding interesting features such as multimedia display.

Shieh (2009) examined a number of positive aspects of technology as applied to electronic textbooks used in education. One of the aspects of the study indicated that the availability of e-books continued to grow and is becoming available for student usage. The results of the study also saw improvements in reading motivation and skills among the students, which indicated that electronic textbooks have a greater capability to meet student interest and educational needs (Brown, 2009; Sheih, 2009).

Kang et al. (2009) employed experimental design to evaluate the usability of e-books in terms of reading performance and eye fatigue. The authors concluded that reading from e-books caused higher eye fatigue as compared to conventional book. In contrast, students had a higher level of reading performance from the conventional book than e-book. The study also compared gender differences among the participants and noticed that female participants had lower eye fatigue and higher reading performance than male participants.

In line with this, Woody et al. (2010) mentioned that reading pattern and eye movement will have a significant influence on user preferences towards the e-book because users will not read an e-book in the same way as they read a printed book. They argued that e-book readers often skim digital text to search for key terms rather than line by line. Lonsdale and Armstrong (2010) and Miller (2010) also stated that students prefer not to read long passages of text from the e-book on the computer screen especially for prolonged periods of time.

While investigating the preference for printed books as compared to e-books in the recent study by the University of California Libraries among 2569 respondents, 58% of the respondents identified themselves as e-book users, especially for material related to their academic work (Li, Poe, Potter, Quigley, & Wilson, 2011). Despite the high number of e-book users, some of the respondents, particularly undergraduate students, still preferred printed books. The respondents noted that the reasons for low usage of e-books were due to the challenge of reading online for long periods of time and loss of concentration in front of the computer screen (Li et al., 2011).

A recent study by Smith and Kukulska-Hulme (2012) reported that interactive e-books can be developed with online forum postings, blog posts and wikis in iPads to help distance learning students. Their project as part of The Open University's Building Mobile Learning Capacity in the United Kingdom identified innovative uses of e-books and iPads in various learning situations and foresaw the design of new learning materials, activities and programmes in distance learning through e-books.

Hence, when considering the potential for using e-books in education, educators, students, librarians and e-books providers should try to achieve a common understanding of the potential of e-books (Genuth, 2008). Most of the e-book publishers and providers have shown little interest in the needs of users (Baumann, 2010) and it is suggested that e-book developers take consideration of users' perspective into consideration when designing an e-book.

At present, the pace of change from paper book to e-book is quickening (Howard, 2012). Early adopters have begun to utilize the e-book, but many readers are still reluctant to abandon paper books for e-books (Li et al., 2011). Perhaps, as suggested by Baumann (2010) and Neumann et al. (2011), rather than pages of text and static images and graphics, e-books could incorporate video clips, links to websites and more interactive features to allow an effective and efficient way of learning.

2.1.3 Studies on the E-book in Malaysia

Although many libraries in local Malaysian universities have been using e-books, the question on how well students in Malaysia use e-books as a new learning tool has not been well researched.

University libraries in Malaysia began e-book collections in the year 2002. Ismail and Zainab (2005) reported that the students in Universiti Malaya (UM) have positive attitudes towards e-book; however, the level of e-book usage is still low compared to Internet usage. This is consistent with the findings of Baumann (2010) and Li et al. (2011) where the Internet users were found to be aware of e-books but only half had made trial use of them.

According to Ismail and Zainab (2005), the students became aware of the e-book service when they visited the Universiti Malaya Library Website, were referred to it by their lecturers, friends or librarians. About 70% rated the e-book service positively. Those who were users of e-books found e-books easy to use and their usage was mainly for completing assignments or project work. However, findings from Lonsdale and Armstrong (2010), Li et al. (2011), Lebert (2009) and Woody et al. (2010) showed otherwise where some readers still preferred to read from paper textbooks. This is in line with Ismail and Zainab (2005) where they found that e-book usage and functionality were rated reasonably low in Malaysia and many of the local university students still preferred traditional books. This issue was also raised previously by Vernon (2006) who pointed out that feelings about traditional books tend to run deeply making it difficult for people to adjust to and accept new formats. Vernon (2006) suggested that further research should explore the advantages of different media features in the e-book as well as the substitution of electronic texts in place of paper.

In another research study, Chong, Lim, and Ling (2008) discussed the e-book provision program in Multimedia University in Malaysia. In their online survey, 86 respondents participated and revealed that the low acceptance rate of e-book was due to the hardware and onscreen design factors. Their study also reported that the acceptance of e-book was still not at an encouraging level and identified several obstacles such as problems in installing specific a e-book reader, difficulties reading from a computer screen, navigating through the e-book, scanning from the e-book, finding the relevant information downloading problems and slow loading speed.

In a recent study by Letchumanan and Tarmizi (2011) on e-book utilization among mathematics postgraduate and undergraduate students from Universiti Putra Malaysia (UPM), they discovered that most of the participants felt comfortable using e-books because of easy access which reduced physical visits to the library and user-friendly features which offered a comfortable platform to use mathematics e-books. However, the participants did not feel comfortable using e-books fully due to unreliable online service by the university library, eye fatigue while reading from the computer screen, lack of manipulability of online features and insufficient e-book collection in the library. Although the participants showed resistance to use the e-book, they agreed that the librarian, publisher and interface designer of e-books should play important role in overcoming the problems associated with the e-book interface, which was also suggested by Genuth (2008) and Lonsdale and Armstrong (2010).

Hence, as e-book technology improves, a new generation of e-books should offer an improved font and layout, along with the flexibility of instant access to personalized and customizable e-books with different interactive learning tools (Lebert, 2009; Wong et al., 2011) such as multimedia, animations and links. These developments are hoped to increase the usability level and learning among students in institutions of higher learning.

2.2 Characteristics and Formats of the E-book

E-books embrace several distinct characteristics. These characteristics, as suggested by McFall (2005), include:

1) Digital design and organization: for example, font type, font size, colour scheme, text colour correlated with background color, display of illustrations, graphics, images, charts and tables;
2) Command features, navigation format tools and guidelines;
3) Search field features and functions;
4) Built-in dictionaries;
5) Student locus of control: for example, capability to highlight text and/or take notes; and
6) Ability to customize content by combining several different books or information sources to add specificity to the course content.

There are several types of e-books which may require the use of special hardware and/or software (Clyde & Delohery, 2005). An e-book can be downloaded onto a computer, which is typically delivered in or converted to Adobe Acrobat Portable Document Format (PDF) files, Adobe Macromedia FlashPaper formats, and XTML or XML format. The e-book content can also be viewed directly from a website host or application from iPad such as CourseSmart (Baumann, 2010) and often can be read directly from the computer screen (e.g., desktop, laptop, and notebook), although using handheld devices (e.g., Smartphones, Tablets, Personal Digital Assistants, Amazon Kindle, Apple iPad, and Barnes and Noble NOOK touch) to download, store and read e-book content is becoming increasingly popular.

In most cases, the e-book constitutes an exact replica of the hardcopy textbook, although it has the capability of transforming digital narratives into learning via multimedia by combining multiple presentations such as text, graphics, audio and video for content delivery and has become a support within the educational reasons (Negroponte, 1995; Richardson et al., 2010; Warren, 2009; Yager & Szabo, 2011).

Using the e-book as a tool in e-learning, multiple presentations may attract instructors and students in learning (Kim & Gilman, 2008; Guan, 2009). However, not all types of multiple presentations in e-books have a significant influence on learning. For example, Grimshaw, Dungworth, McKnight, and Morris (2007) studied the effects of different presentations on students reading e-books and their results indicated that the type of presentation did not significantly affect the students' reading of the printed book or e-book. Their research further showed that even though technology can offer interesting features online, such features may not always be supportive of learning.

Therefore, in investigating which presentation format would be effective in the development of e-book, a number of researchers highlighted the importance of looking into the uses of common educational technologies such as text-based documents, animation, video and audio elements (Chou & Liu, 2005; Dingler, Lindsay, & Walker, 2008; Woolf & Quinn, 2009; Zheng & Cook, 2012).

2.2.1 Research Findings on Text and Static Image

The effective use of illustrations including pictures, charts, graphs and diagrams is an important part of designing information delivery (Knowlton, 1966). Static visuals of text and graphics are some of the most popular tools in e-learning (Kim &

Gilman, 2008). Static visuals are defined as the display of pictures, diagrams, illustrations, charts or graphs without motion (Despotakis et al., 2007; Guan, 2009; Knowlton, 1966; Levie & Dickie, 1973; Mason et al., 2013; Rieber, 1990; Winn, 1987).

In one of the earliest research studies on text and image context, Spaulding (1955) reviewed 16 research studies using pictorial illustrations conducted between 1930 and 1953. He concluded that text and image context help the learner to interpret and remember the content of the illustrated text but the effectiveness might not always be significant. On the other hand, when Samuels (1970) investigated the effects of pictures on learning to read words, he concluded that most studies show acquisition sight of vocabulary as pictures interfere with learning to read. The majority of the studies indicate that pictures used as aids to printed text failed to facilitate comprehension.

Subsequently, Holliday (1975) and Concannon (1975) also did analyses of the pictorial research and concluded that illustrations using pictures in the context of learning had generally not helped to facilitate learning. However, the findings were refuted by Angeli and Valanides (2004) who conducted a study to investigate learners' problem-solving performance by using text-only and text-and-visual instruction with modelling software. The results showed that instructional materials presented in text and visual format could enhance learners' long-term memory and were better than just text-only instruction. The findings were similar to Kim and

Gilman (2008) and Mason et al. (2013), who suggested that text and pictures may benefit individual learning.

Butcher (2006) extended this research by studying the self-explanations that learners generate when studying text. In this research, college students learned about the human circulatory system by studying text alone, text with simple images or text with complex images. Participants in the simple image with text treatment obtained higher scores on drawing, memory and inference tasks than the group with complex image with text and text only treatments. Butcher's (2006) study concluded that presenting images with text is better than text alone and recommended that the image should contain only relevant information. In the study by Kim and Gilman (2008), the results showed that students learned better when they received graphics and text in their instruction in learning English vocabulary rather than just text instruction.

However, Chang and Yang (2010) noticed that students did not score well in their online test with text and static graphic only a web-based learning. Subsequently, a study by Booth and Koedinger (2011) exhibited that diagrams are not essentially helpful aids to students in understanding algebra in middle school years and suggested that diagrams should be used cautiously with information. A study by Zheng and Cook (2012) also revealed that pictures had no effect on 48 students who took an Educational Psychology course in a large research university in western United States of America.

Nevertheless, a recent study by Mason et al. (2013) reported that students performed better through text and graphics rather than text alone in a science course. In other words, when visual text is presented with graphics, students are able to retain information better than just text.

With the results of previous studies indicating such varied results on the effects of text and static graphics or images on learning and achievement, it was worth examining the effects of text and static images in e-books as an e-learning tool in this study.

2.2.2 Research Findings on Animation

A number of researchers have discussed the benefits of presenting information using animated demonstration as one of the learning tools in an e-learning environment (Despotakis et al., 2007; Guan, 2009; Tversky, 2011). Animation has been found to be effective and helpful in illustrating instructional roles, including attracting and directing student attention. Since the early 1990s, many studies have been conducted to investigate the effects of animation in different instructional delivery environments, including film, television and computer (Park & Hopkins, 1993; Sirikasem & Shebilske, 1991). Furthermore, animation has been found to have positive effects compared to static graphics in some studies (Baek & Layne, 1988; Despotakis et al., 2007; Guan, 2009; Park & Gittelman, 1992; Rieber, 1990; Rieber, Boyce, & Assad, 1990) where various visual contents such as animated illustrations, diagrams and visuals, real-time motion graphics, animated 3-D visualization graphics, and animated interactive maps with blinking dots were studied.

Early studies examining the effects of animated visuals on learning can be found in instructional film research that examined the effects of animated visuals on learning (Lumsdaine, Sultzer, & Kopstein, 1961; May & Lumsdaine, 1958) and reported inconsistent results.

One of the most interesting research studies on the effect of animation on learning was been conducted by Rieber (1989, 1990). The animation research included students across age groups, with realistic instructional content and higher-learning learning outcomes, by using animated graphics only. Rieber (1990) stated that the few serious attempts to study the instructional attributes of animation have reported different results amongst the participants.

The study also showed animated treatments may differentially affect older and younger students and suggested that animation may be most effective in computer-based instruction when used in interactive graphic applications (Rieber, 1990). These include using pictures, animations, spreadsheets, graphs and other external representations in content.

Rieber (1990) summarized the results of all the previous studies investigating the role of animated graphics in computer-based-instruction and made the following recommendations:

1) “animation should be incorporated only when its attributes are congruent to the learning task” (Rieber, 1990, p. 79);
2) “evidence suggests that when learners are novices in the content area, they may not know how to attend to relevant cues or details provided by animation” (Rieber, 1990, p. 82); and
3) “animation’s greatest contributions may like to interactive graphic applications (e.g; interactive dynamics)” (Rieber, 1990, p. 82).

Later, Park and Hopkins (1993, p. 19) identified five important instructional roles of animated visuals:

1) “As an attention guide: the animated visual can serve to guide and direct the subject’s attention;
2) As an aid for illustration: dynamics visuals can be used as an effective aid to represent the structural and functional relations among components in a domain of knowledge;
3) As a representation of domain knowledge: movement and action can be used to effectively represent certain domain knowledge;
4) As a device model for forming a mental image: graphical animation can be used to represent system structures and functions which are not directly observable; and
5) As a visual analogy or reasoning anchor for understanding abstract and symbolic concepts or process: animation can make abstract and

symbolic concepts, such as velocity, become more concrete and directly observable”.

The animated visuals will most likely be effective when both the characteristic of the knowledge and the characteristic of the subjects require one or more of these five instructional roles to be used (Park & Hopkins, 1993). However, they cautioned that animated visual displays do not significantly have superior effect in learning and more studies should be conducted.

Findings by Lowe (2003) on learning with animations show a similar trend. His study found that merely providing a learner with animated pictures does not promote learning by itself. In more complex animations the message was difficult for learners to grasp, especially at a novice level. Hence, he concluded that the message of an animation needs to be clearly shown and that animations should be simple and cover only one message at a time. The findings also asserted that the instructional quality, appropriateness of content structure and students’ attitudes in learning are of great importance for learning. This is supported by a study on the relationship between animation demonstrations with student attitudes (Despotakis et al., 2007). They noticed that the students faced difficulties in learning with inflexible content structure and browsing inefficiencies on the animation demonstration.

Kuhl et al. (2011) reported learners engaged in animated or dynamic and static visualizations tended to use visualizations more often and gained deeper understanding on the physical principles of fish locomotion compared to text only visual. The study suggested that animated visualization promotes better learning.

Despite the widespread use of animation, the research conducted so far has failed to confirm its superiority over static image in improving learning (Catrambone & Seay, 2002; Hegarty, Kriz, & Cate, 2003; Lin & Dwyer, 2010; Szabo & Poohkay, 1996). It has not been demonstrated if or how learners use an animated sequence in the learning process. Kainz, Jakab, and Kardos (2013) conducted a study on designing animation as a tool for improving education and they cautioned that animation cannot be used solely as a tool for learning even though animation may lead to an improvement in learning. The effects of prior knowledge and instructors' ability on the effective use of animated visual displays needs to be considered (Despotakis et al., 2007; Guan 2009; Kainz et al., 2013).

2.2.3 Research Findings on Multimedia

The use of multimedia is increasing in higher education, particularly delivered in e-learning courses over the Internet. With the e-book as one of the tools in e-learning, Baumann (2010) and Miller (2010) suggested it could be integrated with multimedia such as audio and video, hyperlinks and other supporting technologies to motivate e-book users.

According to the results of experiments with students in mathematics, statistics and psychology, to be effective, one should present teaching and learning material using more than one multimedia representation (Mayer, 2010). This refers to the visual (text and animation) and verbal (video and audio) demonstrations.

Previous studies have demonstrated that presenting learners with verbal representations in a multimedia environment is better than presenting a single representation. Mayer (2001) and Eilam and Poyas (2008) have shown that learning with text and pictures or animation and narration in videos is more successful than with a single mode. Both studies have also shown that learning outcomes could be optimized using multimedia, and suggested that learners learn better when verbal information is “presented auditory as speech rather than just visually as on-screen text” (Mayer & Moreno, 2003, p. 4). In addition, Zheng, McAlack, Wilmes, Kohler-Evans, and Williamson (2009) found that students had a better understanding when watching animated images accompanied with an auditory explanation than watching animated images while verbally reading an onscreen-text explanation. Another experiment conducted by Guan (2009), on students’ learning efficiency in scientific information, observed that students earned a higher score in examinations which indicated better learning when they received multimedia instruction. These findings were based on Paivio’s (1986) dual coding theory, as mentioned in Section 2.4.

However, Chen and Sun (2012) and Yeh et al. (2012) commented that using multiple representations in instruction has yielded conflicting results. They suggested that it is difficult for students to see the relationship between the multiple representations used. The multiple usages of multimedia instructions may place a heavy demand on short-term memory and cognitive overload. However, with proper design and use of materials, it may support the learning condition.

2.3 Information Processing Models

Cognitive psychologists began studying the ways how humans and computers process data around 60 years ago and research on information processing was initiated. The study of information processing explores the way humans encode, store, and retrieve information from different levels of memory, helps to interpret cognitive processes (Miller, 2003). These levels range from shallow, sensory information, with a weak memory trace that may be received by short-term memory to a strong memory trace that is stored in the long-term memory and connected with prior knowledge.

There are many models that illustrate how humans process information. The earliest model was Atkinson and Shiffrin's (1968) Theory of Information Processing. This model was based on three stages that relate to the way humans sense, process, and output information through stages of sensory, short-term, and long-term memory.

The information processing model suggests that when we first receive information, it must be encoded. Encoding information is simply a way to code information so that it can be remembered. Once information is encoded, it must be stored in long-term memory so that it is not forgotten and the learner will be able to retrieve it at a later date (Sternberg & Sternberg, 2012).

In the sensory memory stage, the learner receives information and directly must, decide how to handle it so that it can be transferred to the short-term memory or else, it is forgotten. A memory produced in this stage is short; it is important to transfer it into the short-term memory for use. When the speed of content presentation is increased, learners have less time to decide what to learn and this could limit the amount of content remembered (Atkinson & Shiffrin, 1968).

The next stage in the process is short-term memory, also know called as “working memory”. In this stage, information can be used and processed into the long-term memory or forgotten. Baddeley (2002) mentioned that the short-term memory can store several types of information, depending on how meaningful the information is to the learner. However, as new information is seen or heard, it must be rehearsed in order to be remembered (Sternberg & Sternberg, 2012). Otherwise, working memory can become overloaded with content and information is forgotten. Hence, information must be repeated in order to be stored as long-term memory. The last stage is long-term memory where memory can be held for a long period of time. Once knowledge is stored in the long-term memory, the learner can retrieve it later.

Similar to Atkinson and Shiffrin’s (1968) Theory of Information Processing, Baddeley and Hitch (1974) designed a working memory model that showed information processing in three separate components, namely governing central executive and two independent slave systems: phonological loop and visuo-spatial sketchpad. The central executive controls how information units are processed, stored, and retrieved (Baddeley & Hitch, 1974; Baddeley, 2002). The phonological loop is responsible for verbal information processing while the visuo-spatial sketchpad is responsible for visual information processing (Baddeley & Hitch, 1974; Baddeley, 2002). Each operates and functions independently and with limited capacity for storage and processing but is controlled by the central executive (Baddeley, 2002). The significance of this model is that it recognizes the separation of visual and verbal information during the learning process, which suggests an indirect link between the two. Figure 2.1 visualises the working memory model by Baddeley and Hitch (1974).

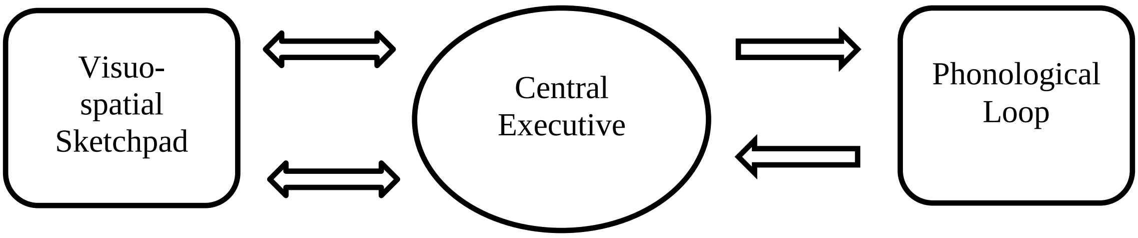


Figure 2.1: Working Memory Model (Baddeley & Hitch, 1974)

2.4 Dual-Coding Theory

Paivio's (1986) dual coding theory was similar to Baddeley and Hitch (1974) where the concept of visual and verbal systems was used. Sadoski, Paivio, and Goetz (1991) explained that memory is organized into verbal (logogens) and visual (imagens) systems that are connected but can act independently, which suggests a dual-coding system. In dual-coding theory, verbal information can be described as text and words while visual information can be described as graphics and images. Learning is improved when verbal information and visual information are integrated and significant interconnections are activated between them (Guan, 2009; Kim & Gilman, 2008; Mayer, 2009; Paivio, 1991). Therefore, through this interconnection, the working memory can be maximized in each mode at the same time (Paivio, 1986). This helps decrease the load on the working memory.

2.5 Multimedia Principle

Mayer (2009) defined multimedia as "presenting both words (such as spoken text or printed text) and pictures (such as illustrations, photos, animation, or video)." (p. 2). For the scope of this research study, multimedia was defined as a combination of text, audio, animation, video, still images and interactivity content which refers to different signs and signals.

Mayer (2001) has applied Baddeley and Hitch's (1974) working memory and Paivio's (1986) dual-coding theory to understand learning from multimedia. From there, Mayer (2005) formed the Cognitive Theory of Multimedia Learning (CTML) which comprises three assumptions:

1) The working memory is made up of a dual modality input channel system;
2) The working memory has a limited capacity, and
3) Learners engage actively in processing learning materials.

Dual modality is described as information that is processed in verbal and non-verbal channels. The underlying assumption is that learning is superior in dual channel representations (verbal and non-verbal) than single channel (Mayer & Moreno, 2003). For example, Tindall-Ford, Chandler, and Sweller (1997) carried out a series of experiments and found that audio-visual representations improved achievement rather than just a visual form. This suggested that learning is improved with dual channel representation. Moreover, CTML assumes that each channel has a certain capacity for information processing in the working memory, where verbal and visual channels can each only process a certain amount of information at one time (Mayer, 2001). Lastly, learners engage in active processing, which include paying attention to features, creating links with prior knowledge and organising new information in order to transfer into the long term memory.

Based on the assumptions, Clark and Mayer (2011) summarised the CTML and developed seven multimedia design principles, five of which are applicable in the design of e-books:

1) Multiple Representation Principle: Learners learn more deeply from a combination of words and pictures than from words alone.
2) Contiguity Principle: When giving a multimedia explanation, words should be located near the corresponding pictures, rather than farther away from them.
3) Split-Attention Principle: Learners learn more deeply when the text are presented with auditory narration rather than written text.

4) Coherence Principle: When giving a multimedia explanation, a damaging effect on learning occurs if interesting but irrelevant words and pictures are added to the learning materials.

5) Personalisation Principle: Students learn better by hearing text in an informal, conversational style compared with a formal style.

According to Clark and Mayer (2011), these principles make effective use of educational technology in teaching and learning. The better these principles are understood, the better the chances of developing successful multimedia instructions that meet students' expectations. In addition, Ayres and Paas (2012) argued that the CTML advocated by Clark and Mayer (2011) is one of the key theories in the field of understanding human mental reason and ability to process information via multimedia instruction. He also noted that CTML provides significant principles and theoretical framework for designing and delivering effective multimedia instruction for students.

Hence, with these multimedia principles, organization and integration of information can be improved and these principles served as a guide for designers to develop tools or materials with multimedia representations that lessen cognitive load.

2.6 Cognitive Load Theory (CLT)

While understanding how visual and verbal information is important for cognitive processes, it is also critical to understand the impact of visual and verbal information on cognitive load. The amount of information being processed in the working memory at one time is referred to as ‘cognitive load’ (Bethel & Borokhovski, 2010; Chandler & Sweller, 1991). Cognitive Load Theory attempts to explain that there is a certain amount of information that can be used and stored in the working memory at one time without exceeding the processing capacity (Bethel & Borokhovski, 2010; Sweller 2010). This theory derives from the information processing model that suggests a human being has a working memory and long-term memory (Agostinho et al., 2011). When cognitive load increases, learning is depressed because the working memory is overloaded. Thus, designers aim to decrease the amount of cognitive load in working memory so that learners understand the content presented and can put it into long term memory (Ayres & van Gog, 2009).

Cognitive load comprises three types of load that are referred to as intrinsic, extraneous and germane (Sweller, van Merrienboer, & Pass, 1998). Each of these types can be manipulated and affects learning differently. According to Paas et al. (2010), a hierarchy of resource allocation occurs, such that intrinsic load is, first, allocated from the working memory. The resources that remain are allocated between germane and extraneous cognitive load, which may result in cognitive overload if excessively high. Intrinsic, germane, and extraneous cognitive loads, along with design recommendations to reduce such cognitive loads, are interpreted as follows.

Intrinsic Cognitive Load

Intrinsic cognitive load refers to the task complexity or level of difficulty related to the mental load imposed by the learning content or element interactivity being learned (Sweller, Ayres, & Kalyuga, 2011). Ayres and van Gog (2009) stated that intrinsic load comprises two components, namely information that has a high element of interactivity with the instructional learning materials and knowledge or skills expertise. They further explained that a high intrinsic load happens when a learning task contains many new or informational concepts that must be processed simultaneously. Early theorists concluded that intrinsic cognitive load could not be directly influenced, instructionally manipulated, or altered by instructional designers, because it pertains to the learning material (Paas et al., 2010; Paas & van Gog, 2006; Sweller, 2003).

However, intrinsic cognitive load can be reduced through low element interactivity, which can be achieved with coordination of information and knowledge, synchronized in the memory at once (Clark, Nguyen, & Sweller, 2006; Sweller, 2010). For example, learning content can be improved by sequencing and segmenting complex tasks into a more manageable series of lessons that can be learned separately. This will cumulatively be reconstructed to form a complex learning task (Pollock, Chandler, & Sweller, 2002). Clark et al. (2006) provided an example of low element interactivity by recommending that students learn foreign language terminology as separate words before applying the words into sentence and paragraph formations.

Germane Cognitive Load

Germane cognitive load or effective cognitive load refers to load that is generated by instructional activities to facilitate the learning objective (Mayer 2010; Sweller 2010). For example, withholding learning aids such as visual simulations in learning forces the students to mentally visualize the processes by themselves, and hence engage in deeper processing. It increases cognitive load but the increase is germane because it is likely to assist learning and better information retention (Paas & van Merrienboer, 1994). When developing instruction, designers are tasked with helping learners to learn new things and assisting them with suitable representations or automation that results in efficient and effective performance outcomes (Clark et al., 2006).

Some researchers proposed certain instructional techniques, such as worked examples and learning aids which can help novices to construct new learning by reducing working memory load (Clark et al., 2006; Sweller et al., 2011) but the instructional techniques should not too easy as it defeats the purpose of information retention. However, according to Sweller (2010) germane load may or may not have a positive impact on learning and it all depends on the presentation of information.

Nevertheless, other researchers indicated that the effectiveness of instructional techniques depends on the students’ motivation and level of expertise (Aryes & van Gog, 2009; Kalyuga, 2009). Aryes and van Gog (2009) explained that motivation helps students to engage in learning and increase germane cognitive load. The student should feel challenged; be the tasks or instructions should neither be too easy nor too boring, as the student will likely to lose interest. On the other hand, Kalyuga (2009) determined that an *expertise reversal effect* occurs when experts are presented with information designed to help novices to learn new things; it will result in a redundancy effect where the overlapping instructional technique conflicts with the expert's prior added working memory or knowledge.

Extraneous Cognitive Load

Extraneous cognitive load is the working memory load resulting from poorly-designed instructional message materials (Chandler & Sweller, 1991; Mayer, 2010). Thus, irrelevant information results in high cognitive processing which leads to learning failure. Disorientation, split attention, and dual-tasking burden are implications of extraneous cognitive load, described as follows.

An adverse effect of extraneous cognitive load, disorientation, is described as the sense of confusion or loss in an online learning space, especially while navigating online (Dias & Sousa, 1997). Disorientated users usually feel confused and bewildered, thereby leading them to frustration, loss of interest, reading disruption, and learning interference that results in performance decline (Sweller et al., 2011). According to Cress and Knable (2003, p. 520), examples of disorientation effects are:

1) when students became confused about their place while navigating through a nonlinear document, because increased working memory

resources are required to process the learning, thereby imposing an extraneous cognitive load, and;

2) when students are unable to construct relationships of the new learning concepts, due to interference in the learning space such as poorly designed hypertext representations, which results in fragmented or disconnected mental models and confused knowledge structures.

Next, split attention occurs whenever students need to simultaneously attend to two or more challenging instructions or activities that typically hinder the learning process (Chandler & Sweller, 1991) and result in higher extraneous cognitive load. For instance, a split attention effect would occur while listening to a lecture and simultaneously taking notes, which diverts working memory resources from processing the information (Clark et al., 2006).

Lastly, a dual tasking burden is another adverse effect of extraneous cognitive load that occurs when attention is divided between or among learning tasks (Clark & Mayer, 2011). Koch and Prinz (2002) contended that "even two very simple tasks may interfere with each other when performed simultaneously" (p. 192). When dual tasking is involved, it takes longer for the memory to process and encode information, which results in interference that significantly affects performance outcomes (Kalyuga, 2009).

Extraneous load is the least desirable of the three load types due to the time wasted filtering through excessive information and the increased load on working memory (DaCosta & Seok, 2010). However, extraneous load can be controlled by excluding unnecessary information and elements. DaCosta and Seok (2010) proposed careful planning of instructions, not only to reduce extraneous load but also consider intrinsic and germane loads as well.

Intrinsic, germane and extraneous cognitive loads are inter-related. When a heavy extraneous cognitive load is added to a heavy intrinsic load, for example, a poorly designed instruction on a difficult topic, the overall cognitive load may exceed the student's working memory capacity. The instruction should highlight the reduction of the extraneous cognitive load caused by the inappropriately designed instruction because this will free the working memory capacity and may permit an increase in germane cognitive load (Sweller et al., 2011). However, it is important to note that the goal of designing instruction materials is not to merely reduce cognitive load entirely, because germane cognitive load should be maintained for information retention (Clark et al., 2006). On the other hand, if intrinsic cognitive load is low, even if extraneous cognitive load is high, the student's working memory capacity is still far from being exceeded. Therefore, to ensure effective presentation of information, the presentation of information needs to be carefully designed so that it is not too difficult but not too easy either for students to achieve meaningful learning.

2.6.1 Measuring Cognitive Load

One of the challenges of cognitive load research is the lack of appropriate methods of measurement (DeLeeuw & Mayer, 2008; Jin & Boling, 2010; Schnotz & Kurschner, 2007; Zheng & Cook, 2012). One widely used questionnaire of measuring cognitive load is Paas's (1992) Mental Effort Rating Scale. In his study, Paas (1992) posited that cognitive load can be differentiated into two separate, yet interrelated, components: mental load and mental effort. According to Paas (1992), mental load is enforced by instructional structure, such as information sequence, whereas mental effort refers to the amount of cognitive capacity that is allocated to the instructional demands, for example, understanding the content presented using different representations. Hence, Paas (1992) Mental Effort Scale was developed to rate students' perceived level of mental effort invested in performing a task and translates their perceived level of mental effort into a self-rated numerical value based on the Likert scale.

The extensive use of Paas (1992) Mental Effort Rating Scale in numerous cognitive load experiments provided evidence of validity and reliability for the instrument. (Clarke, Ayers, & Sweller, 2005; DeLeeuw & Mayer, 2008; Paas, 1992; Paas & van Merrienboer, 1994; Paas et al., 2010; Pollock et al., 2002). For example, in the study of Paas and van Merrienboer (1994) on video and audio instructions, they found the scale's reliability was relatively high with Cronbach's coefficient alpha value (α) of 0.90. They also concluded that the self-assessed mental effort and mental load can be a valuable research tool to assess cognitive load in instructional research. Hence, Paas's (1992) instrument is relevant to this study as the questionnaire has been proven to be valid and reliable instrument.

In another study, Pollock et al. (2002) demonstrated the use of Mental Effort Rating Scale questionnaires in an industrial trade school. The study involved students enrolled in an electrical safety course. Treatment groups were given materials with interactive elements. After going through each treatment, students were asked to rate their mental effort using the same questionnaire and indicated that the scores were useful in understanding the level of cognitive load.

DeLeeuw and Mayer (2008) tested the questionnaire to determine whether their findings would in fact support theory of cognitive load, and be sensitive to the type of cognitive load. In that study, participants studied an instructional unit designed to handle the three types of cognitive processing. The results confirmed that the different questions were in fact sensitive to different types of cognitive load, and this led to a total finding of cognitive load level among the participants. They concluded that the information presentation types measures extraneous load, the mental effort ratings on learning content measures intrinsic load and the difficulty in understanding instructions ratings measures germane load.

As the literature supported the reliability and validity of Paas's (1992) Mental Effort Rating Scale instrument, this instrument is incorporated in this study to test on the level of cognitive load among the students using different e-book formats. Section 3.4.3 explained the modification of the questionnaire for this study.

2.7 Understanding the Waterfall Model for E-book Format Development

One of the primary concerns for the developer of an educational software or website is how to approach the design and development problems (Munassar & Govardhan, 2010). Many models exist in order to develop solutions for designing and development software and websites. One of the earliest and widely used models is the Waterfall model. Firstly proposed by Royce (1970), the Waterfall model was designed to describe a possible software and website development practice, mostly for software engineers, website designers, and programmers. There are several consecutive phases in the Waterfall model that must be completed one after the other and to the next phase after its preceding phase is completed (Bassil, 2012; Frantiska, 2003; Munassar & Govardhan, 2010). The Waterfall model defines five phases: Analysis, Design, Implementation, Testing, and Maintenance. Figure 2.2 depicts the different phases of the Waterfall model.

According to Munassar and Govardhan (2010), the Analysis phase helps to establish the requirements for building the website, including functional and non-functional requirements. For functional requirements, these include comprehensive description on purpose, scope, user characteristics, functionalities, specifications, interface requirements and software attributes. In contrast, non-functional requirements raise the constraints, limitations, and design requirements for website development.

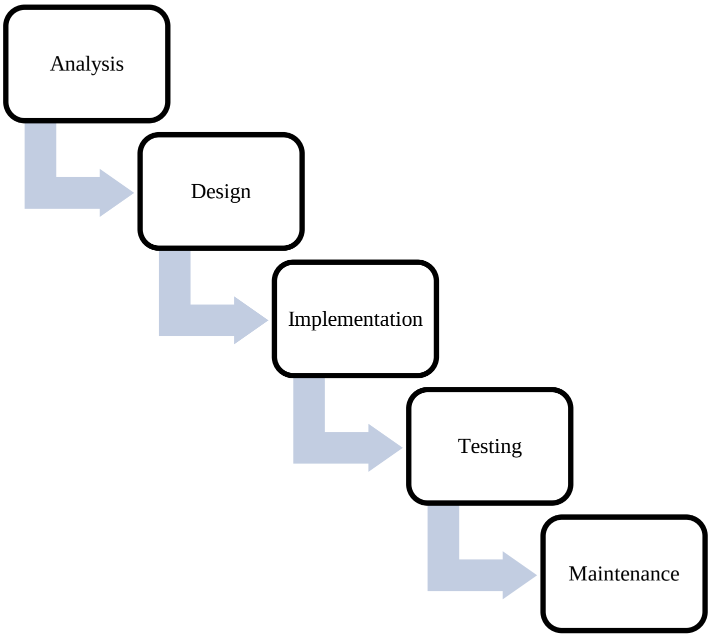


Figure 2.2: The Waterfall Model (Bassil, 2012)

The Design phase is the process of planning and problem-solving especially concept design, and graphical user interface design. This phase serves as input for the next phase of the model.

On receiving the analysis requirements and detailed design specifications, the design work for the website is executed. Real code for website programming is written and compiled into an operational application where text files are created. This is the Implementation phase and is longest phase of the Waterfall model.

After the code is developed, the Testing phase determines whether the website meets the specified requirements and finds any errors present in the design. During this phase, pilot tests on users' acceptance and website usability are done.

The final phase is the Maintenance phase which covers the process of accommodating new requirements for the website, enhancing the website and deploying the website for users.

Many website development firms have adopted the Waterfall model as their prime development framework to plan, build and maintain their websites (Patel & Jain, 2013). Some research studies identified several problems with the model and proposed modifications to the model itself. For example, there is no overlap between the phases as it is difficult to return to an earlier phase in the model for updating, changing, refining and correcting specifications (Munassar & Govardhan, 2010; Patel & Jain, 2013). Furthermore, Bassil (2012) stated his opinion that setting the requirements in the Analysis and Design phases before coding and testing is too idealistic and impractical because actual issues that point out flaws in requirements will be discovered during the Implementation and Ttesting phases. Hence, modified Waterfall models, such as the V-shaped model and Spiral model, were created to overcome the problems with the initial Waterfall model.

Although the Waterfall model has its weaknesses, it is a widely-used model, because it emphasizes important phases of website development (Patel & Jain, 2013). Other web development models such as the Prototyping Model, Rapid

Application Development Model or Linear Sequential Model are not suitable to be used for this study. These models require business modelling and functions to accommodate the needs of customers which are not considered in this study. The Waterfall model is easy to understand and implement, especially for simple website development and maintenance. As suggested by Bassil (2012), the Waterfall model works well on simple, mature or existing requirements for websites, rather than complex websites with multiple integration with databases, software and hardware. Website developers can use this model to plan everything from the very beginning of their website design (Frantiska, 2003).

In addition, the Waterfall model is used in this study because it is instructive and the phases from the model are appropriate for the e-book development. As indicated above, the Waterfall model is easy to use and the process fits well into the development of the e-book formats. Considering that the e-book formats do not need any complex software development and integration with other databases, the V-shaped model and Spiral model are too complicated to manage. In addition, the requirements for the e-book format were already defined and developed, using the existing printed textbook, and hence there was no extra process to change the basic requirements, thus V-shaped model and Spiral model may prove to be too complex. As a result, it seems that the suitable model for e-book format development is the Waterfall model. A more comprehensive description on the application of the Waterfall model for e-book development can be found in Section 3.5.

2.8 Self-Efficacy

Bandura (1977) first published the theory of self-efficacy in the 1970s. Since then, self-efficacy has been researched in many fields and found to be related to emotional problems such as phobia, addiction, depression, lack of social skills, and other studies on teaching and learning (Pajares, 1996).

Self-efficacy refers to the personal judgments that someone makes about their capabilities to perform and accomplish a task (Bandura, 1997; Putwain et al., 2012; Vuong et al., 2010). In other words, it is where one has a degree of control over the means of achieving a goal (Ferla, Valcke, & Cai, 2009).

According to Bandura (2006), self-efficacy affects people's level of motivation, affective states and actions. It also influences the way people think, feel and behave (Pajares, 1996). The more efficacious the individual, the more effort he or she will invest and the longer he or she will persist, especially in the face of difficulties (Bandura, 2006). High efficacious individuals are also more likely to interpret failure due to insufficient effort or situational factors, whereas low efficacious individuals tend to show failure attribute to low ability (Bandura, 1997). With respect to emotion, a low sense of self-efficacy is linked with anxiety and helplessness. People with low self-efficacies have negative thoughts about their performance and personal development. In contrast, a person with a strong belief in him or herself facilitates cognitive processes in multiple contexts which may influence decision-making (Baltes, Hoffman-Kipp, Lynn, & Weltzer-Ward, 2010; Grau, Salanova, & Peiro, 2001).

Understanding the self-efficacy of a learner leads to a key area of research regarding successful e-learning implementation. As Bandura (1986) pointed out, a major aim of research in education is to help to clarify how different types of educational practices and structures affect the development of social competencies among learners. In the long run, learners who have developed a strong sense of self-efficacy are well-equipped to educate themselves when they have to reply on their own initiatives. Therefore, the study of self-efficacy in the e-learning context is of both theoretical and practical significance.

2.8.1 Self-Efficacy in E-learning

Perceived self-efficacy in educational settings is defined as an individual's overall confidence in his/her ability to perform any given task and includes his/her perceived capabilities to achieve designated types of educational performance (Abulibdeh & Syeh Hassan, 2011; Hung et al., 2010; Pajares, 1996; Schunk, 1994; Vuong et al., 2010).

Research suggests that self-efficacy plays a key role in learners' judgements about the usage of new innovations in e-learning (Abulibdeh & Syeh Hassan, 2011; Compeau & Higgins, 1995; Tsai et al., 2010). Students' self-efficacy regarding e-learning may have considerable impacts on their views and learning outcomes in e-learning courses and this leads to considering self-efficacy as a predictor of technology usage in e-learning (Abulibdeh & Syeh Hassan, 2011; Kilic-Cakmak, 2010; Liang & Tsai, 2008; Tsai et al., 2010).

As mentioned before, self-efficacy includes students' ability and skills to complete a task and since e-books in e-learning rely on computers and Internet delivery, Warren (2009) proposed that users of e-books should possess a certain level of basic computer skills and the ability to access and use the Internet. Lack of this prerequisite skill may lead to confusion and frustration for students and decrease their ability to use e-books, and as a result lowered their level of self-efficacy. Hence, students with high self-efficacy in computers and the Internet are assumed to be able to use e-books because they are comfortable with e-books and believe they can acquire information from the e-books based on their ability.

There are a few studies on self-efficacy in the education domain, for example, the influence of self-efficacy in learning (Barling & Snipelisky, 1983), the relationship between self-efficacy and academic achievement and persistence (Lent, Brown, & Larkin, 1993), the effects of self-efficacy to academic performance (Ferrari & Parker, 1992), the role of self-efficacy in self-motivation for academic attainment (Bandura, 1997; Vuong et al., 2010; Zimmerman, 1995), the effects of self-efficacy and online information literacy (Kilic-Cakmak, 2010), gender differences in self-efficacy (Goodwin, Ostrom, & Scott, 2009; Kumar & Lai, 2006), self-efficacy in grade and giftedness (Ferla et al., 2009), self-efficacy in mathematics and statistics performance (Lopez & Lent, 1992; Pietsch, Walker, & Chapman, 2003), the relationships between mathematics self-efficacy, performance and statistics anxiety

(Cooper & Robinson, 1991; Goodwin et al., 2009; Pietsch et al., 2003), and self-efficacy in using the Internet and multimedia (Baltes et al., 2010; Liang & Tsai, 2008; Zheng et al., 2009).

Pajares (1996) addressed how self-efficacy can be a factor in relation to performance and achievement in e-learning. For example, Tsai (2008) indicated that Internet self-efficacy positively correlates with performance in a computer-assisted learning environment. Other researchers revealed that student self-efficacy toward computers is related to their usage and performance in e-learning (Baltes et al., 2010; Kilic-Cakmak, 2010; Liang & Tsai, 2008). In Malaysia, Mahyuddin, Elias, Loh, Muhamad, Noordin, and Abdullah (2006) conducted a study on the relationship of students' self-efficacy and English language achievement and found that students with high self-efficacy in the language will most likely achieve higher scores in the test.

Self-efficacy, in general, has been shown to make an independent contribution to the prediction of achievement. However, studies by Puzziferro (2008) and Abulibdeh and Syed Hassan (2011) found self-efficacy is not a significant predictor for achievement in an e-learning environment. The research findings focusing on the effects of self-efficacy towards achievement were mixed particularly in e-learning context.

2.8.2 Measuring Self-Efficacy

Self-efficacy can be measured at the general level, the domain level, or the task-specific level (Bandura, 1997; Finney & Schraw, 2003). There are a few studies which focus on the general self-efficacy scale (Jerusalem & Mitlag, 1995), State-Trait Anxiety Inventory (Spielberger, 1989), Westside Test Anxiety Scale (Driscoll, 2004), Internet self-efficacy (Liang & Tsai, 2008; Tsai, 2008) and academic self-efficacy (Peschar, Veenstra, & Molenaar, 1999) to name a few. Most of the instruments are used to access a general sense of perceived self-efficacy with the aim of predicting the outcome as well as adaptation of participants after experiencing all kinds of situations.

One of the earliest self-efficacy instruments was the College Academic Self-Efficacy Scale (CASES), by Owen and Froman (1988). According to Choi (2005), the CASES is a self-report instrument to measure academic self-efficacy of college students and their confidence in performing designated academic tasks. In the Choi (2005) study, CASES was not found to be powerful predictor of self-efficacy in academic terms because it focuses on overall confidence to perform given tasks rather than personal ratings of performance. As a result, a more specific measure of self-efficacy in academia should be considered.

Peschar et al. (1999) attempted to provide an instrument which could be used to measure self-efficacy in academia, particularly in middle and high school levels of education. The instrument was reported to have three main dimensions of self-efficacy and self-regulating learning, namely (a) learning strategies; (b) motivation; and (c) self-concept. From the report, the structure of the scales was predefined and Peschar et al. (1999) viewed the subscales to be:

1) learning strategies – scales on memorising, elaboration and control strategies;
2) motivation – scales on instrumental motivation, interest motivation in subject related, action control, effort and persistence in learning, cooperative and competitive forms of learning; and
3) self-concept – control expectation, self-efficacy, verbal self-concept, self-concept in mathematics and overall academic self-concept.

Their preliminary study demonstrated relatively high reliability scales ranging from 0.70 to 0.95 in the Cronbach alphas value (Khmelkov & Davidson, 2012; Peschar et al., 1999). However, Peschar et al.'s (1999) questionnaire possesses a large number of items, making it an excessively long and complicated one to use (Neill, 2008).

Hence, Neill (2008) adapted Peschar et al.'s (1999) instrument and used it to study self-efficacy level among university students. He believes that Learning Self-Efficacy (LSE) is a theoretically more suitable in understanding a university student's level of satisfaction and academic performance. Based on the reliability results of the subscales in Peschar et al.'s (1999) instrument, Neill (2008) selected a few items from each scale for a university setting to form LSE factors. Overall, it contains 14 items within the three factors, namely (a) general self-efficacy in learning with six items; (b) effort and persistence in learning with five items; and (c) control expectation with three items. The responses are made on a 4-point scale ranging from 1-Strongly Disagree to 4-Strongly Agree. In his study, Neill (2008) found the Cronbach alphas to be from 0.76 to 0.90, similar to Peschar et al. (1999).

Although Neill's (2008) LSE instrument is relatively new, it is notable that the instrument contains the main constructs of Peschar et al.'s (1999) long instrument and has been formed to be more appropriate in the context of a university environment (Neill, 2008). It is hope that Neill's (2008) LSE can be of use in an e-learning environment, to be able to predict e-books usage in a university.

2.8.3 Self-Efficacy and Cognitive Load

Ford, Smith, Weissbein, Gully, and Salas (1998) mentioned that self-efficacy impacts the level of cognitive load even after undergoing a difficult training. They found that students with a higher self-efficacy tend to be more motivated in dealing with difficult instructions and more willing to try to solve problems, thus leading to a lower level of cognitive load. In the same way, Joo, Bong, and Choi (2000) conducted a study among 152 high school students in Korea and found that self-efficacy consistently predicted the level of cognitive load under a web-based instruction for a science-based subject. In another study in Romania, Vasile, Marhan, Singer, and Stoicescu (2011) reported that there was a direct correlation between self-efficacy and cognitive load among first year university students.

Studies have documented increases in the self-efficacy of learners who were learning how to use software through instruction that utilized such images and multimedia (Zheng, Miller, Snelbecker, & Cohen, 2006; Zheng & Zhou, 2006) and self-efficacy mediates multimedia (Zheng et al., 2009). It is believed that providing information in multimedia can improve learners' problem-solving skills by (a) promoting their self-efficacy; and (b) reducing cognitive load involved (Zheng et al., 2006; Zheng et al., 2009; Zheng & Zhou, 2006). For example, the study by Zheng et al. (2009) among 222 college students in the context of interactive multimedia instruction found that multimedia helps to reduce cognitive load and improve self-efficacy.

Nevertheless, the association between self-efficacy and cognitive load has not been thoroughly researched. Therefore, the goal of this study is to examine the role of self-efficacy along with the level of cognitive load in different e-book formats.

2.9 Statistics Anxiety

Introductory statistics courses are required for many college and university students and have become an essential part of many programs in higher education (Chiesi & Primi, 2010). The rationale for this is to enable students to handle, use and interpret research or statistical data in their field of study. Despite the importance of statistics, many of these students have a negative perception of statistics (Garfield & Ben-Zvi, 2007; Lovett, Meyer, & Thille, 2010; Mills & Raju, 2011; Onwuegbuzie, 2004; Zeidner, 1991). Perney and Ravid (1990, p. 2) stated that "statistics subjects are viewed by most students as an obstacle standing in the way of attaining their desired degree."

Statistics anxiety has been defined a feeling of extensive worry and physiological emotional reaction when taking a statistics course or doing statistics analyses, which hinder the learning process (Onwuegbuzie & Wilson, 2003). This anxiety leads to avoidance, such as delayed studying or skipping classes, which can lead to lower academic performance.

Another definition by Onwuegbuzie, DaRos, and Ryan (1997) stated that statistics anxiety is defined by four component anxieties, namely instrument, content, interpersonal, and failure anxiety. Instrument anxiety relates to feelings about one's ability to calculate statistical formulas using a calculator or software. Content anxiety relates to how one feels about using and communicating statistics knowledge. Interpersonal anxiety relates to how one feels about interacting with an instructor or peers and failure anxiety relates to feelings about one's academic performance in a statistics class.

According to Everson and Garfield (2008), helping students to cope with the anxiety involves understanding the factors mediating the anxiety itself. The factors contributing to such anxiety are broad. For example, an early study by Forte (1995) found several factors that were applicable to social work students who experienced statistics anxiety. These factors were minimal previous math preparation, late in career introduction to quantitative analysis, general anti-quantitative-bias, lack of appropriation for the power of analytical models, and lack of mental imagery useful in thinking about quantitative concepts. More factors were presented by Onwuegbuzie and Wilson (2003) who classified the statistics anxiety factors into three categories:

1) Situational factors, such as mathematics experience (Baloglu, Deniz, & Kesici, 2011; Pan & Tang, 2005), computer experience (Zimmer & Fuller, 1996), and research experience (Pan & Tang, 2005; Trimarco, 1997);
2) Dispositional factor, such as mathematics self-concept or self-esteem (Zeidner, 1991), self-efficacy (Onwuegbuzie, 2004), attitude toward statistics (Chiesi & Primi, 2010), and;
3) Personal factors, such as learning styles (Onwuegbuzie, 1998; Onwuegbuzie & Wilson, 2003), age (Baloglu et al., 2011; Pan & Tang, 2005), gender (Baloglu et al., 2011) and ethnicity (Onwuegbuzie, 1999).

Another investigation found that the fear of failure and perfectionism were responsible for statistics anxiety (Walsh & Ugumba-Agwunobi, 2002). Pan and Tang (2005) summarized that the factors contributing to statistics anxiety to include math phobia, lack of connection to daily life, pace of instruction and instructor's attitude. Neumann et al. (2011) suggested that incorporating technology in teaching statistics might help to enhance students' comprehension in statistics and reduce their anxiety. However, the extent to which technology should be used is still a question. Therefore, continuing to examine the effects of technological tools in e-learning can be imperative.

2.9.1 Statistics in E-learning

There has been widespread development of educational technology in teaching and learning statistics. With the advancements in the computer and the Internet, statistics has become a discipline that has evolved with technology and can be conducted via e-learning (Johnson & Dasgupta, 2005; Keeley, Zayac, & Correia, 2008; Kim & Gilman, 2008; Neumann et al., 2011).

Such technology, for example, includes the use of graphic calculators and basic statistical computing software in introductory statistics, which in many cases, have primarily used text and static graphic images as a way of presenting information (Keeley et al., 2008). A variety of well-known statistics software packages used by students; for example, Microsoft Excel and SPSS (Garfield & Ben-Zvi, 2007) have shown to be beneficial to students because many software programs provide instant feedback and help them develop their understanding of statistical concepts (Pan & Tang, 2005).

In addition, as suggested by Moore (1997a), the use of animated graphics and multimedia would greatly influence the way of teaching and learning statistics where the statistical materials are built on strong relationships between content and technology. For example, throughout the e-learning course, Meyer and Thille (2006) presented short flash animations with spoken narration and found that students learnt best using both auditory and visual channels in statistics. Another example by Dykeman (2011), who produced a review of how university students learn statistics, noted that a multimedia presentation of content may be an effective tool for fostering students' interest in learning statistics. The use of both animation and multimedia could be more effective than text and graphics in simple analysis software or graphic calculators and this creates opportunities to enhance student learning in statistics. Everson and Garfield (2008) also suggested that the use of animation and multimedia allows greater interactivity and creates a flexible learning environment in which students can become active learners of statistics.

Schou (2007) has suggested that the use of technology in statistics can help to reduce anxiety in students. For example, Johnson and Dasgupta (2005) found that students of introductory statistics faced less anxiety in non-traditional classes which involved computers and animation than the traditional lecture method. Furthermore, DeVaney (2010) incorporated a greater use of computers and developed online statistics courses, and found that students significantly preferred various aspects of the multimedia-enhanced online course when compared to traditional on-campus courses.

Ideally, statistics courses in e-learning can be developed carefully using a large range of presentations but Pan and Tang (2005) commented that the question still remains concerning what and how should text, graphics, animation, and multimedia be integrated into the teaching and learning process.

2.9.2 Measuring Statistics Anxiety

Based on the factors of statistics anxiety discussed previously, many researchers have developed different instruments to measure statistics anxiety. In the early stage, statistics anxiety instruments were derived from measurements of mathematics anxiety assessment. The first few instruments included the Statistics Anxiety Inventory by (Zeidner, 1991), the Statistical Anxiety Scale by Pretorius and Norman (1992) and the Statistics Anxiety Rating Scale (STARS) developed by Cruise, Cash, and Bolton (1985).

The STARS is one of the most known and widely used (Onwuegbuzie & Wilson, 2003). There are six components, namely, worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help and fear of statistics teachers. Watson and Callingham (2003) incorporated the STARS along with a survey of attitudes toward statistics into a multimedia program that aimed at identifying students with statistics anxiety or negative attitudes toward statistics. Despite the outcome of the significance of results using the STARS, it has been argued that the scale is too lengthy and addresses constructs such as attitude or self-concept other than anxiety (Vigil-Colet et al., 2008).

Hence, for this reason, Vigil-Colet et al. (2008) developed a scale, called the Statistical Anxiety Scale (SAS) which is used in Spanish, and derived from the subscales of STARS that are more strictly related to anxiety. There are 24 items (8 items per subscale) in the SAS assessing three different aspects of anxiety, in line with the three subscales of the STARS. The subscales are:

1) Examination Anxiety;
2) Asking for Help Anxiety, and;
3) Interpretation Anxiety.

Vigil-Colet et al. (2008) reported a high reliability for each of the subscales. The SAS scale score correlated well with the Personality Trait Anxiety score and also proved to be a useful analytical instrument to measure statistics anxiety and the negative relationship between statistics anxiety and achievement. In other studies, Hsiao (2010) and Chiesi, Primi, and Carmona (2011) focused on validating Vigil-Colet et al.'s (2008) SAS in Taiwanese, Spanish and Italian educational contexts. Both studies showed a significantly high reliability outcome for all the subscales of the SAS (with alpha values above 0.80), which provided valid evidence based on its internal structure and relationship with other variables, such as statistics self-efficacy and attitudes.

Both the STARS and SAS tap into several domains with similar statistic anxiety factors. However, the construct of the SAS contains more descriptions of the specific statistics anxiety compared to the STARS, which measures self-concept and attitude. In this case, self-concept and attitude are not needed as both are categorized under the self-efficacy domain (Bandura, 1986). Therefore, the SAS was chosen to measure statistics anxiety for this research.

2.9.3 Statistics Anxiety and Cognitive Load

Zeidner and Safir (1989) theorized that anxiety develops from a history of success and failure in learning experiences and is mostly shaped by the effects of learners' cognitive factors. Later, Eysenck (1992) found that anxiety can lead to a decrease in performance because the working memory is occupied with fear and worry rather than completing the tasks.

For example, Horwitz (2001) and Chen and Chang (2009) conducted studies on cognitive load and anxiety in the context of foreign language learning. The results showed that students with higher levels of anxiety in foreign language also experienced higher levels of cognitive load while engaged in the listening and comprehension tasks. Their findings also showed that high anxiety and high cognitive load interfered with student learning and impeded their performance. Chen and Chang (2009) noticed that by using well-designed instructions, the level of cognitive load eventually decreased, students experienced less stress when learning, and so, scored higher in the test.

Although the effects of anxiety and cognitive load have been extensively studied (Osborne, 2006), the detrimental effects of these two factors have not been thoroughly studied in relation to statistics. Hence, one of the purposes of this study was to explore the relationship between statistics anxiety and memory load in the cognitive process so as to extend the literature.

2.9.4 Statistics Anxiety and Self-Efficacy

Both fear and anxiety regarding statistics are real to many students. Self-efficacy in statistics or a person's confidence in the performance of statistics may be related to prior experiences, successes, and/or failures (Legum et al., 2011). Students with low self-efficacy may believe statistics is tougher than it really is and this creates anxiety and a narrow vision of how to solve a problem in statistics (Vuong et al., 2010). Thus, there is a mutual relationship between self-efficacy and anxiety. Students who do not have high efficacy beliefs may readily experience feelings of anxiety in statistics. On the contrary, statistics anxiety may prompt low efficacy perceptions in students.

Bessant (1995) and Onwuegbuzie et al. (2010) stated that the reason why students experience statistics anxiety and low self-efficacy in solving statistics is that students do not learn to understand and link the statistical process with concepts, which could potentially create anxiety since students do not see the overall picture of statistics, and this may also lead to low self-esteem and confidence in solving statistical tasks. In some cases, students' anxiety in statistics does not necessarily arise from a lack of training or insufficient skills, but may be due to a lack of students' efficacy perceptions in statistics (Onwuegbuzie et al., 2010). A study by Perepiczka et al. (2011) found a statistically significant relationship between self-efficacy and statistical anxiety, indicating that students with a higher self-efficacy had lower statistics anxiety. Hence, the importance of students' beliefs in their competence of facing the challenges of learning statistics cannot be ignored.

Legum et al. (2011) emphasized the importance of studying the role of self-efficacy in relation to statistics anxiety. They predicted that students with higher self-efficacy beliefs apply more effective strategies and respond more appropriately to well-designed statistics instructions. Students with high efficacy beliefs may experience feelings of anxiety in a statistics course if the materials presented do not help in understanding (Meyer & Thille, 2006). Hence, proper presentation of information that creates a practical understanding of statistics concepts may help to increase their self-efficacy level and lower their statistics anxiety (Onwuegbuzie et al., 2010).

Although statistics anxiety has been extensively discussed in the literature, more research needs to be done that may link it with self-efficacy. The combination of statistics anxiety and self-efficacy may help guide the way on how statistics materials can be presented in an e -book to find solutions or interventions to improve performance.

2.10 Achievement in E-learning

An achievement is a way to measure students' performance and extent of learning in certain topics or subjects (Gay & Airasian, 2003). Most studies have used final grades as the outcome variable to assess academic achievement (Posner, 2011).

Several researchers have found that using technology in presenting information in e-learning leads to greater levels of learning and achievement among students compared to the traditional way of information delivery. For example, studies conducted to determine the benefits of using animation and multimedia in material delivery have indicated a positive relationship with achievement (Connor, Moss, & Grover, 2007; Hsieh & Dwyer, 2009).

Recent studies also yielded similar results. Kuhl et al. (2011), in the context of dynamic and static visualizations in understanding physical principles of fish locomotion, reported that a majority of the learners in the text and dynamic and text with static visualisations condition out-performed in the tests than those in text-only condition. Wang et al.’s (2011) study also supported the notion that animation and multimedia interactivity impacted students’ improvement on understanding introductory statistics. In the study focusing on multimedia and learning performance, Chen and Sun (2012) stated that video-based multimedia material generates better learning performance than static materials containing text and image.

However, other studies have concluded that the use of technology has little or no effect on student achievement (Martindale, Pearson, Curda, & Pilcher, 2005; Wilson, Berkowitz, Bullock, Cockrell, Rodriguez, & Onwuegbuzie, 2012). For instance, Wilson et al. (2012) focused their study on the use of animation and multimedia simulation in e-learning on a mathematics course and the results revealed there was no positive impact of animation and multimedia on the mathematics scores among the participants. Since the findings from literature showed inconsistent results in students’ achievement in terms of different presentations in e-learning, this study hoped to find out more especially in the context of using e-book.

2.10.1 Achievement and Cognitive Load

Many researchers have conducted various experiments on the effect of cognitive load towards students' learning achievement, but the findings have lead to different outcomes.

For example, Kablan and Erden (2008) reported that reduced cognitive load during learning improves learning performance. A similar outcome was reported by Wästlund, Norlander, and Archer (2008), who found a significant difference between cognitive load and students' learning achievement in e-learning settings.

A study by Lee and Rha (2009) used structured presentation (text only) and unstructured presentation (animation and video) in teaching a management course through e-learning. The result showed that achievement using unstructured presentation was significantly higher than in structured presentation. Meanwhile, similar studies have shown that multiple representations of animation and multimedia, when used properly in e-learning, can increase achievement (Kim & Gilman, 2009; Mayer, 2010).

In a study by Yeh et al. (2012), they discovered that when students perceived lower levels of cognitive load, they showed better learning outcome in the animation-based curriculum on earthquakes instruction in Taiwan. Furthermore, they also found that students' perceived cognitive load was negatively associated with their learning outcomes. A recent study by Meissner and Bogner (2013) on heuristic science lesson among students found that lower cognitive load enabled students to achieve better in tests.

However, some studies found the level of cognitive load did not have a strong relationship with students' learning achievement in general education at a community college (DeTure, 2004), or in a teacher education program at a university (Downing, 2005) when using web-based learning.

Hence, there are contradictory findings with regards to the relationship between level of cognitive load and achievement. This research hoped to contribute to the literature based on learner's cognitive load and students' achievement and other factors by using different sets of designed instructions in e-book.

2.10.2 Achievement and Self-Efficacy

Numerous studies have documented moderate to strong relationships between both academic achievement and self-efficacy (Pajares, 1996; Pajares & Kranzler, 1995; Putwain et al., 2012; Skaalvik & Skaalvik, 2005; Vuong et al., 2010; Zimmerman & Bandura, 1994).

Self-efficacy has been found to influence how much effort is put into performing a task, persevering on the task, and as a result, affecting the level of students' achievement (Choi, 2005).

Skaalvik and Skaalvik (2005) strongly indicate that self-efficacy is an important mediator of academic achievement. Their study strongly supports the view that students' self-efficacy and perceptions are important prerequisites for learning and achievement. Self-efficacy also positively correlated with various outcome measures such as grades, and scores on examinations and quizzes. The research findings from Vuong et al.'s (2010) study showed that self-efficacy affected the scores on GPA among students who are first in their families to attend college.

Although the relation between self-efficacy and achievement is well established in the research literature, there has been continuing debate about the fundamental relations between academic achievement and self-efficacy (Vuong et al., 2010). Self-efficacy literature has been less researched with the association of self-efficacy and achievement in e-learning and this study hoped to find more evidence in the e-book context.

2.10.3 Achievement and Statistics Anxiety

Several authors have noted the presence of statistics anxiety among their students and its effects on their achievement (Onwuegbuzie et al., 2010; Zanakis & Valenzi, 1997; Zeidner, 1991). Generally, the literature reported that statistics anxiety has negative effects towards the examination scores in statistics classes (Keeley et al., 2008; Macher et al., 2012; Onwuegbuzie & Wilson, 2003; Onwuegbuzie et al., 2010). For instance, Onwuegbuzie and Wilson (2003) found students often delay enrolling into statistics courses because of their anxieties and this behaviour can lead to lower academic performance. Keeley et al. (2008) found a negative correlation between statistics anxiety and students' final examination scores. Onwuegbuzie et al. (2010) reported findings indicating that low achievement of students was related to higher levels of statistics anxiety and assumed that statistics anxiety decreases achievement in statistics. They also mentioned that statistics anxiety has a negative effect on learning and is the best predictor of academic achievement. A study on psychology students further proves that statistics anxiety had a negative influence on achievement (Macher et al., 2012).

Given a large amount of data on the negative impact of statistics anxiety towards achievement, Macher et al. (2012) mentioned that statistics anxiety may also have a direct positive influence on achievement if other factors are considered, such as students' learning styles.

2.11 Learning Styles

Critics of the research on learning styles argue that learning styles theory faces three major problems: unclear definitions, ambiguous identification of learner characteristics, and weakness in reliability and validity of instruments (Curry, 1990). Nevertheless, supporters of learning styles claim it is important to understand learners' learning styles in order to assist instructors in providing better guidelines when implementing technology in e-learning (Kalyuga, Ayres, Chandler, & Sweller, 2003; Zacharis, 2010).

Firstly, on definition, although there is no generally accepted definition of learning styles; they can be referred as a particular capability or preference that probably enhances learning (Lu et al., 2007). Dewey (1972) hypothesized that what people experience is directly related to how people learn. Through experience, students adapt to new learning in an environment, and they gradually adjust and figure out how to be successful.

As mentioned by Curry (1990), learner characteristics are rather vague and difficult to be categorised together with the reliability and validity weakness of learning styles instruments. As a result, there are many different learning style models from the literature. Many of them were derived from a common ancestry and measure similar dimensions (Garland & Martin, 2005). The Kolb learning style model with its instrument, the Kolb Learning Style Inventory (KLSI), remains one of the most influential models and widely used instrument to measure individual learning preference (Kolb & Kolb, 2011; Lu et al., 2007).

The Kolb learning style model is based on Kolb's experiential learning theory. Kolb's model identifies perception and processing as separate learning styles. How a person perceives information is classified as a concrete experience or abstract conceptualization, and how person processes information is classified as active experimentation or reflective observation (Garland & Martin, 2005; Lu et al., 2007; Simpson & Du, 2004; Zacharis, 2010).

Accordingly, Kolb (1985) and Kolb and Kolb (2011) described the process of experiential learning as a four-stage cycle involving four adaptive learning modes: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). CE tends towards peer coordination and benefited most from discussion with fellow CE learners. AC learner tends to be oriented towards symbols and learns best in expert-directed, impersonal learning situations, which emphasizes theory and systematic analysis. AE learner tends to be an active by doing and relies heavily on experimenting and engaging in projects. RO learner relies heavily on careful observation in making judgments.

Kolb (1985) also identified four learning style groups based on the four learning modes:

1) Divergers favour CE and RO;
2) Assimilators favour AC and RO;
3) Convergers favour AC and AE; and
4) Accommodators favour CE and AE.

People with Diverging style have dominant learning abilities of CE and RO, where they are best at viewing concrete situations from many different points of view. They are also interested in people, tend to be imaginative and emotional, have a broad culture. They prefer to work in groups, listening with an open mind to different points of view and receiving personalized feedback (Garland & Martin, 2005; Kolb & Kolb, 2011; Lu et al., 2007).

People with an Assimilating style have AC and RO learning abilities. They are best at understanding a wide range of information and putting into construct and logical understanding. They are less focused on people and less interested in ideas and abstract concepts. They prefer readings, lectures, exploring analytical models, and having time to think things through (Cooze & Barbour, 2007; Garland & Martin, 2005; Kolb & Kolb, 2011; Lu et al., 2007).

Individual with a Converging style has AC and AE learning abilities, in which they are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. They prefer to experiment with new ideas, simulations, laboratory assignments and practical applications (Cooze & Barbour, 2007; Garland & Martin, 2005; Kolb & Kolb, 2011; Lu et al., 2007).

Lastly, people with an Accommodating style have CE and AE as the dominant learning abilities. In this context, they have the ability to learn from hands-on experience. They enjoy carrying out plans and involving themselves in new and challenging experiences. They rely more on people for information than on their own technical analysis when solving problems. They prefer to work with others to get tasks done, set goals, do field work and test out different approaches to complete a project (Cooze & Barbour, 2007; Garland & Martin, 2005; Kolb & Kolb, 2011; Lu et al., 2007).

Although the Kolb learning style model focuses on the cognitive processes of learning, knowledge learning, and related applications (Garland & Martin, 2005), the issue of whether understanding different learning styles can assist learners in an e-learning environment has continued to be debated throughout the literature.

2.11.1 Kolb Learning Styles in E-learning

Over the past few decades, researchers have made significant developments in understanding human learning styles, especially in an e-learning environment. However, the research regarding the relationship between learning styles and e-learning is rather controversial.

For instance, Terrell (2002) indicated that, in a web-based learning environment, students whose learning styles belonged to Convergers and Assimilators were more likely to succeed than those whose learning styles belonged to Divergers and Accommodators. In another study, Fahy (2005) concluded that students who were identified as assimilators required the most support in e-learning and discovered that Convergers were the most active when interacting with activities in e-learning such as online group discussion.

In another study, Garland and Martin (2005) used the KLSI to identify differences between the learning styles of students in traditional face-to-face courses and students in matched courses taught online with gender as the moderator. The results showed that there was a difference in the learning style of the online student and the student in the face-to-face course and that gender was a factor in the relationship between learning style and student engagement. Lu et al. (2007) examined the relationship between Kolb learning styles and online learning behaviour among students majoring in educational technology and found that Convergers and Assimilators were more successful in online learning than Divergers and Accommodators. On the other hand, Mupinga et al. (2006) reported that they did not find a particular style among the students in an e-learning course. Akdemir and Koszalka (2008) stated learning styles play critical roles that influence student retention and success in e-learning courses.

Zacharis (2010) examined learning styles in both an online course. Using the KLSI, Zacharis (2010) found that learning styles were non-significant predictors of learning in online course although a majority of students with assimilator and accommodator learning styles preferred learning from the online course. Furthermore, Ku and Chang (2011) reported that learning styles among Taiwanese college students influenced the way they preferred visual and verbal learning in a web-based learning environment. In addition, they support the view that learning style is an ongoing issue of great importance to educational research obviously. However, a survey study by Kucuk (2012) found that learning styles among English-majoring students had no significant effect towards preferences for online and face-to-face courses.

There is limited research on how to effectively adapt to learning styles in an e-learning environment, especially in the e-book context and a “one size fits all” mentality is still prevalent. Students studying from e-learning vary, not only in regard to their experiences and expectations, but they may also differ in their learning styles. Some learners prefer written information and facts; others have a preference for visual clues such as graphics and videos, while some learn best when provided with verbal presentations or an opportunity to interact with others (Santo, 2006). As recommended by Zacharis (2010), instructors need to be cognizant of the types of learners in their e-learning courses and to design learning activities that will address the different learning styles (Zacharis, 2010).

2.11.2 Learning Styles and Achievement

Research investigating the learning outcome in an e-learning environment and learning styles also reached contradictory conclusions. For example, Davidson-shivers, Nowlin, and Lanouette (2002) investigated the effect of Kolb learning styles on undergraduate writing performance in a multimedia lesson and found no significant difference in writing performance among the learning styles. Miller (2005) found no effect of Kolb learning styles on performance when using a computer-based instruction system to teach introductory probability and statistics. Lu et al. (2007) conducted a study on learning animation with Flash on students majoring in educational technology and noticed that there was no significant effect between Kolb learning styles and achievement but the students with Convergers and Assimilators scored higher in the examination than Divergers and Accommodators.

Zacharis's (2010) study revealed no significant difference in students' course grades and learning styles in online learning. Metin, Yilmaz, Birisci, and Coskun (2011) conducted their study on 347 pre-service teachers at the Department of Primary and Science Teacher Education in Faculty of Education at Artvin Coruh University. The results show that the dominant learning style among the students was accommodator and it was followed by convergent, divergent and assimilator learning styles but there was no significant difference between students' learning style and grade level.

Although literature found that learning styles do not significantly affect achievement, several possible factors were reported to rationalize the significant influence of learning styles on achievement. The concepts of self-efficacy and students' anxiety regarding statistics and statistics teaching have been considered to be significant factors underlying their learning styles and achievement (Mandic, 2010). According to Yushau (2006), students may experience anxiety and low confidence in studying statistics even though they understand the theories and formulae. As a result, students tend to score lower marks in their examinations.

2.11.3 Learning Styles, Cognitive Load, Self-Efficacy and Statistics Anxiety

Little research has dealt with the relationships between learning styles and cognitive load. However, educational researchers agree on the importance of identifying and recognizing learning styles among learners in order to improve learning by lowering the level of cognitive load in designing technology in e-learning (Kalyuga et al., 2003; Ramsden, 1992).

Boldaji (2008) suggested that to increase students' self-efficacy, it may be necessary for them to be aware of their own learning styles in relation to their own goals and ability to achieve their goals. In this way, students can use their acquired knowledge in a more practical manner and regard themselves as more efficient individuals, and increase self-efficacy and self-esteem.

In relation to statistics anxiety, Ramsden (1992) and Sloan, Daane, and Giesen (2002) suggested that students' anxiety affects their learning styles. In the study of a statistics course, Ramsden (1992) further suggested that materials presented should seek to support students' learning styles in order to allow students to be comfortable with their own learning styles during the learning process. With this, the existing anxiety will be reduced when students learn statistics.

The literature showed few studies on the relationships between learning styles, cognitive load, self-efficacy and statistics anxiety. Hence, the purpose of this study was to further investigate the differences in cognitive load, self-efficacy and statistics anxiety between Kolb learning style groups and to cover the gap in the literature in the context of the e-book.

2.12 Gender in E-book and E-learning

In relation to gender and frequency of e-book use, Ismail and Zainab (2005) detected men used e-books more frequently than women while examining patterns in e-book usage among computer science and information technology undergraduate students in Universiti Malaya (UM). The male participants perceived themselves as competent and confident in using computers to read e-books and were more inclined to search for information through e-books. They experienced less disorientation in using e-books compared to female participants. Overall, the male participants favoured using e-books to study more than female participants. In contrast, female participants reported having higher levels of discomfort and less confidence in using e-books. It is argued that this may be because the male participants possessed more experience in using computers than did the female participants (Mustafa, 2005). However, Kang et al. (2009) reported that female students performed better in reading e-books than male students. These concerns further showed the need for designers to consider different user interfaces and different navigation supports required by users of different genders in e-book usage (Ismail & Zainab, 2005), such as providing different presentation formats, for example, visual and multimedia, to help learners be more confident when using e-books (Li et al., 2013; Warren, 2009).

In the aspects of different presentation formats for information, there are a few articles on gender-based differences. For example, Alias, Black, and Gray (2002) found no statistically significant difference between gender and different information presentations or interaction effect in online learning among engineering students in Malaysian polytechnics. On the other hand, Chen (2005) and Demirbas and Demirkan (2007) revealed that male students obtained higher scores in e-learning courses than female students.

A study by Wang and Chen (2008), who examined the effects of gender and type of information presentations in an ICT course, revealed that female students performed better than male students in the animation presentations. However, this was not supported by Sanchez and Wiley (2010) and Sáinz and López-Sáez (2010) where female students benefited less than males from animations. O'Day (2010) revealed significant differences between male and female students in types of presentations formats, where male students preferred animation than graphic-only formats but female students displayed similar preferences in both formats.

Scholten's (2001) study on the multimedia formats found that male students experienced better performance than female students. Conversely, Malik (2010) revealed that there was no significant difference between gender and multimedia-based technology in learning algebra concepts.

As discussed previously, while there is an abundance of research relating gender to different types of presentation formats in e-learning environment, no study was found in the context of e-books. A further investigation should be considered as gender has a potential effect towards e-books preferences in the study.

2.12.1 Gender, Cognitive Load, Self-Efficacy and Statistics Anxiety

Gender differences in working memory structure have been reported in recent web-based technology, neurological and psychological studies (Chang & Yang, 2010; Geiger & Litwiller, 2005; Speck, Ernst, Braun, Koch, & Miller, 2000). However, this area of study has not been extensively investigated. For example, the study conducted by Arroyo, Woolf, and Beal (2006) indicated that males and females did not differ in terms of their mental load while learning mathematics from an online multimedia tutoring system. However, the study found male students spent more time and responded well to different forms of presentation formats than female students. In a web-based instruction, Chang and Yang (2010) posited that male and female participants displayed significant differences in the level of cognitive load. The mean of cognitive load of females was significantly higher than that of males in participation in the chat room and online information search whereas male students seemed to be overloaded when reading scientific articles. Similarly, Hwang et al. (2013) also reported that females had a higher cognitive load level as compared to males when playing online games to learn Chinese characters.

Gender could possibly predict differences in levels of self-efficacy (Bandura, 1997), although research has yielded different results. Relatively no study has been conducted on the gender differences of self-efficacy in the usage of the e-book. For example, early research from Busch (1995) found that women with higher levels of self-efficacy were more likely to score higher in statistics examinations than men. On the other hand, Kumar and Lai (2006) examined the role of self-efficacy and gender among adolescents and the analysis found no interaction between gender and self-efficacy. In the aspect of mathematics, Goodwin et al., (2009) conducted a survey among undergraduates at a western American university and revealed no significant gender differences in self-efficacy.

The role of gender and its relationship to statistics anxiety is of interest to a wide variety of researchers (Baloglu et al., 2011; DeCesare, 2011; Hall, Davis, Bolen, & Chia, 1999; Kessler et al., 1995; Hsiao & Chiang, 2011; Zeidner, 1991). In general, studies appear to support the notion that women report more statistics anxiety compared to men. DeCesare (2011), Kessler et al. (1995) and Zeidner (1991) found that women significantly have higher statistics anxiety than men.

However, Baloglu et al. (2011) and Hall et al. (1999) did not find such a difference in gender and statistics anxiety. This is in agreement with the study by Onwuegbuzie and Wilson (2003) and Hsiao and Chiang (2011) that reported gender was not a significant predictor of statistics anxiety.

Educational study has pointed out that gender differences exist in the e-book (Ismail & Zainab, 2005) but little is known about how males and females approach cognitive load, self-efficacy and statistics anxiety in the usage of e-book. Better understanding of the relationships would help instructors and course designers to be more effective in their teaching and develop different information presentation formats in the e-book.

2.13 Computer Use Experience

Amadieu et al. (2010) refers to computer use experience as the skills, knowledge or familiarity with computers. The activities such as navigation or orientation in computers, and understanding of concepts in linked electronic representation, for example, texts or graphics, in general are considered as relevant experiences. It was also perceived that such experience will gradually increase with the number of years of computer usage. Researchers have suggested that computer use experience is an important factor that affects learning, particularly in an e-learning environment (Thatcher, 2008).

The existing research related to e-learning suggests that learners with high levels of computer use experience generally set their own learning paths to reach their learning goals. In contrast, learners with low levels of computer use experience tend to follow the sequence of the learning content to achieve their learning goals rather than explore on their own (Khosrowjerdi & Iranshani, 2011). The findings from the studies reviewed have suggested that learners with high levels of computer experience have an advantage over those with low levels of computer experience when using the e-book (Li et al., 2013).

Foasberg (2011) examined the effects of using e-book readers. His results showed that learners with high levels of computer use experience or skills tended to use the hyperlinks and other online tools such as History, Search and Bookmark in the e-book which allowed them to reach the information easily. As proposed by Thatcher

(2008), the learners who possessed a greater understanding of computer applications were more comfortable with computers. Likewise, learners with low levels of computer use experience or skills were not aware of the additional online tools and tended to face difficulties in searching for information, thus resulting in frustration and low usage of the e-book. Hence, as suggested by Li et al. (2013), in order to support active reading in e-book, learners should possess a certain level of computer experience, particularly in understanding the hypertext structures and navigational activities developed in the e-book.

It seems little research has been conducted on the relationship between levels of computer use experience, cognitive load, self-efficacy and statistics anxiety in introductory graduate statistics courses. The perception was that students may struggle to use the e-book and find difficulty in understanding information presented in different formats, which leads to a high cognitive load, lower self-efficacy and higher statistics anxiety level because they do not have the necessary levels of computer use experience..

2.14 Summary

The literature review indicated the growing popularity of e-books which has paved the way to how educational contents are demonstrated. Previous literature found that the use of visual texts with other supporting media such as graphics, animation or videos as the components has a significant influence towards learning. The approach taken in this research study is to compare three different e-book formats, namely text with static image, text with animation and text with multimedia (video and audio) in the hope of obtaining meaningful results. Various aspects from several prominent theories were discussed namely, working memory model (Baddeley & Hitch, 1974), dual-coding theory (Paivio, 1986), Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2001) and Cognitive Load Theory (CLT) (Sweller, 2010). As such, these theories serve as theoretical constructs and offer guiding design principles for use in animation and multimedia applications in the e-book. Five of Mayer's seven multimedia principles have guided the design and implementation of the e-book. However, should the information be presented with complex images, videos and animation, it may have significant effect towards the different types of cognitive load among the students. As mentioned in the literature, the level of self-efficacy and statistics anxiety was found to be a potential influence towards the students in learning statistics; however, there are research gaps in using e-books that merit further consideration Furthermore, students' achievement was found to be a factor worthy of being checked for correlation. The students' learning styles, gender and computer experiences were found to be variables worthy to be researched into in relation to the usage of different e-book formats. The literature review confirmed a lack of literature on e-books in statistics education, and the preferred e-book formats among the university students, especially in Malaysia. The study took a first step in this direction in the Malaysian scenario.

The following chapter reports the research methodology of the study to gather data to the research questions stated in Chapter One.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

This chapter includes a description of the research design, selections of the participants of the study, data collection procedures and research instruments used for the study. Next, e-book formats design using the Waterfall model is discussed. Further, the pilot study details are reported. The last part of the chapter presents the statistical analysis approach, the steps that were taken to avoid threats to the validity of the study and ethical issues involved in the study.

3.1 Research Design

The purpose of this study is to examine the effects of different e-book formats on students' cognitive load, self-efficacy, statistics anxiety and achievement, moderated by learning styles and demographic variables. The study involves learning sessions in a first year statistics course for duration of 12 weeks. The study use questionnaires and posttests to gather the required data for the research. The design is based on the quantitative quasi-experimental format using non-equivalent group, posttest-only control group design. However, the data collection includes quantitative and qualitative techniques.

Research studies (Mitchell & Jolley, 2012; Salkind, 2011; Wise, Nordberg, & Reitz, 1967) define the posttest control group format's steps as comprising of (a) random assignment of participants for both the experimental and control group; (b) administration of the treatment to the experimental group with no, or altered, treatment for the control group; and (c) completion of a posttest. According to Wilkinson (2004), the quantitative posttest control group format: (a) combines the benefit of random assignment of participants within the control group composition; and (b) reflects a methodical process of investigation of media treatments and learning achievement. These points relating to the quantitative posttest control group format reflects the strengths of this methodology.

In this study, the students self-select their preference and tutorial groups' availability using the university "Allocate+ System". The Allocate+ System is a web-based class allocation system for the students to indicate their preferred time slots for the subjects that they enrol in the semester and to obtain their class schedule (Allocate Plus, n.d.). Hence, quasi-experimental research design is used because it was not possible to practice true randomization of the participants, which makes a true experiment impossible (Mitchell & Jolley, 2012; Salkind, 2011).

Posttest-only control group design involves comparisons between experimental group and a control group. For the experiment, the populations of the students enrolling for the statistics course are placed into three tutorial groups based on the participants' selection, using the "University Allocate+ System", ranging from 25-30 students per group. Each treatment group is assigned to different e-book formats where, the control group will be the tutorial group assigned with T&S of the e-book format (X_C). Treatment X_{T1} and Treatment X_{T2} are designed as T&A and T&M of the e-book formats respectively. Students begin to learn the statistics from the e-book formats assigned in their group at the first week of the semester. The statistics content in the control group and both treatment groups is the same; however the method of presentation for each of the e-book formats are different. As shown in Table 3.1, participants' self-select into different treatment groups based on their preferences or availability where O represents a process of measurement or observation and X represents treatments that participants received. A more detail sampling of the study is shown in Figure 3.1. Table 3.2 shows the summary of research design.

Pretest is not included in the design due to two reasons. First, students enrol in this statistics course have not been taught to use Ti-83 calculator in their previous study, therefore, it is assumed that neither group of students had any knowledge related to the usage of Ti-83 calculator and the posttest-only design found most appropriate for this study (Salkind, 2011). Second, the population of the students enrol in this statistics course consists of local and international students. Considering the high school, pre-university or A' level grades in Mathematics as the pretest variable may not be adequate as the grades are not significantly equivalent. Further, in this particular study, the control and treatment group sizes remain constant throughout the duration of the study.

The scores from the survey questionnaire, the Mid Semester Test and Final Examination will be considered for the findings of this study. The students are given one hour test for Mid Semester Test, which includes Chapter 1 and Chapter 2 items (See Appendix E). The final assessment is a three hour test in Final Examination, which includes the items from Chapter 3 to Chapter 8 (See Appendix F). The reason Chapter 3 to Chapter 8 are included in the last six weeks duration is because the materials in the initial chapters were fundamental theories related to the following chapters. For example, students will need to comprehend the statistics theories in Chapter 3 and Chapter 4 on probability and normal probability distribution in order to apply such knowledge to Chapter 5 on Sampling and Estimation and Chapter 6 on Hypotheses Testing. Both Mid Semester Test and Final Examination are taken as part of the posttest data in this study in addition to the use of a questionnaire to collect the require data.

Table 3.1 *Summary of Non-Equivalent Group, Posttest-Only Design*

Groups	Treatment Groups	Posttests
Group 1	Control (X_C)	$O_1 \rightarrow O_2 \rightarrow O_3$
Group 2	Treatment (X_{T1})	$O_1 \rightarrow O_2 \rightarrow O_3$
Group 3	Treatment (X_{T2})	$O_1 \rightarrow O_2 \rightarrow O_3$

Note: X_C = T&S, X_{T1} = T&A, X_{T2} = T&M, O_1 = Mid Sem Test, O_2 = Questionnaire, O_3 = Final Examination

Table 3.2 *Summary of Research Design*

Independent Variables	Treatment Groups	Dependent Variables	Posttests
Gender Computer Use Experience Learning Styles (Moderating Variables)	Control (X_C)-T&S Treatment (X_{T1}) - T&A Treatment (X_{T2}) – T&M	1. Cognitive Load 2. Statistics Anxiety 3. Self-Efficacy 4. Achievement	1. Mid Semester Test 2. Final Examination 3. Questionnaires

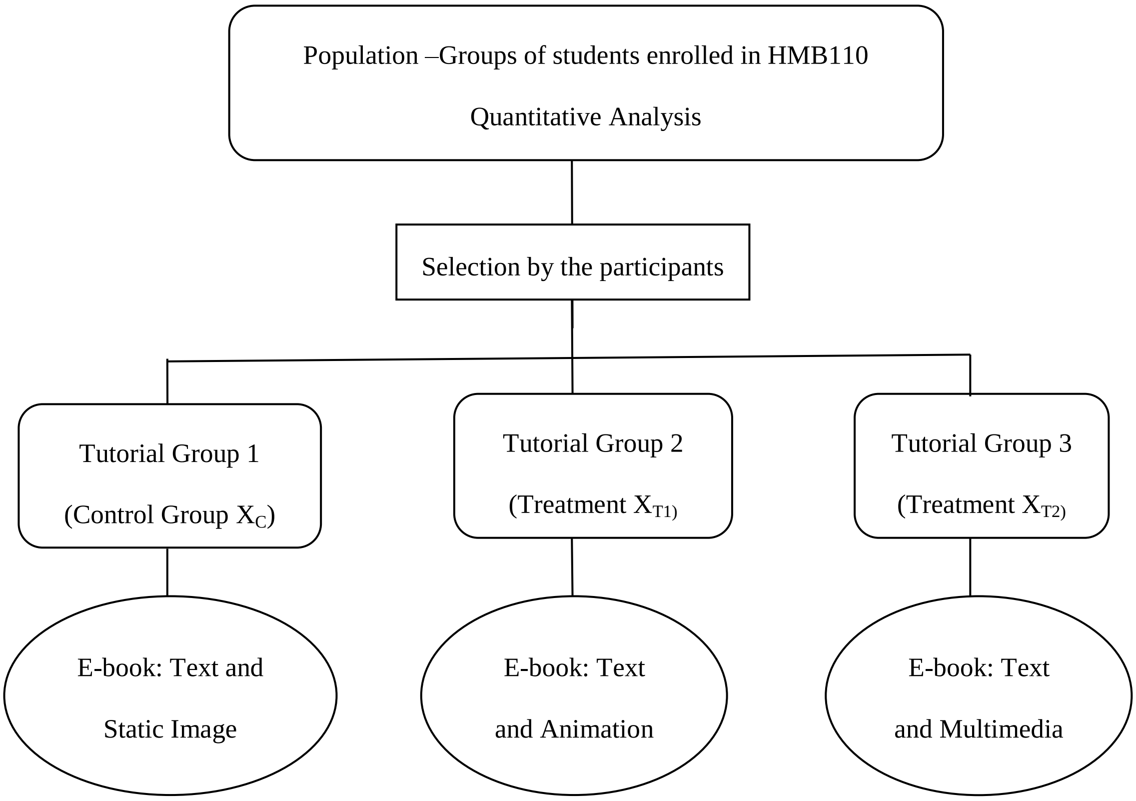


Figure 3.1: Sampling of the study

In the search for relevant and useful information, mixed strategies of quantitative and qualitative inquiries could create meaningful interpretation of data (Castellan, 2010). Thus, the data collection techniques used for this study are a mixture of quantitative and qualitative techniques, as shown in Figure 3.2.

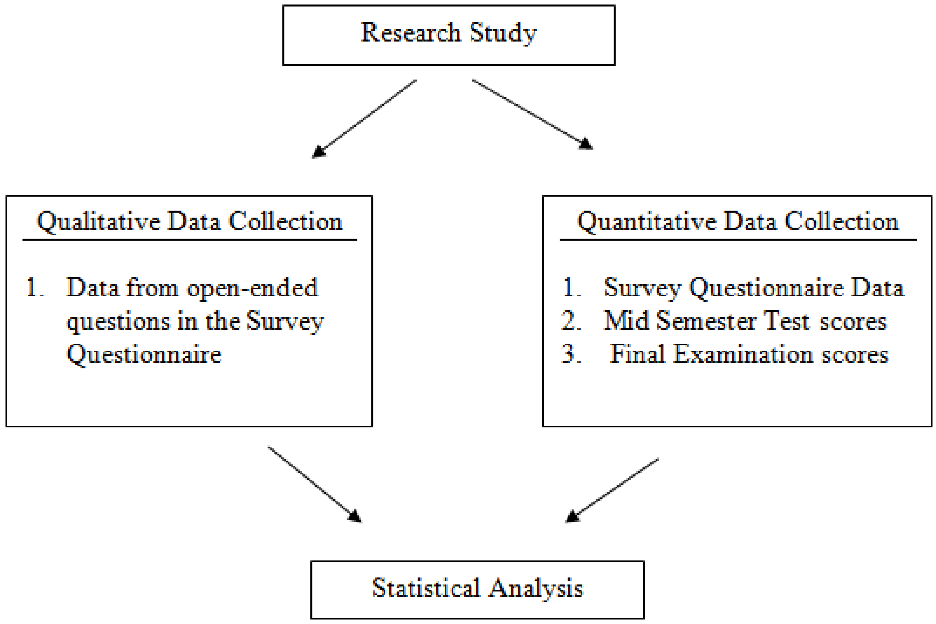


Figure 3.2: A mixed paradigm of data collection methods

Quantitative methods typically depend on larger sample size, selected randomly in order to generalize with confidence to the whole population (Jick, 1979). Thus, using quantitative methods helps in interpreting the findings in a holistic way. On the other hand, as mentioned by Patton (2002), qualitative inquiry focuses on small samples selected which will allow inquiry to understand a situation in depth. Hence, a much smaller sample of open-ended questions will add details and meaning at a certain level of experience. The qualitative data collection techniques adopted is the open-ended questions to collect feedback, for example, the perceptions and experience of the participants while using the assigned e-book format.

Hair, Money, Page, and Samouel (2007) concluded that the combination of quantitative and qualitative will result in richer data and deeper understanding of the data, rather than just one method. Thus, both qualitative and quantitative data can be collected in this study in order to obtain a more meaningful interpretation of data (Castellan, 2010), since the two methods constitute alternative but not mutually exclusive strategies for research.

3.2 Participants

Swinburne University of Technology (Sarawak campus) in Malaysia is identified as the institution investigated in this study. There are approximately 1,000 students enrolled in the commerce programs and about 50 to 90 students taking statistics unit in every semester. The course involved in this study is the first semester statistics unit, of the Bachelor of Commerce programme. The unit is called Quantitative Analysis with the unit code HMB110.

On the whole, the students constitute quite a homogeneous sample in terms of age. Being the first year university students coming from pre-university, upper secondary school (after Form 6) or A' level, the age of the participants are at their late teens or early 20s. The participants consist of a mixture of local (Malaysian) and international students. The international students are from Bangladesh, Indonesia, Sri Lanka and Pakistan, to name a few. Majority of the participants are local students compared to international students, with the ratio of 7:1. In terms of unit understanding, it is assumed that the participants have similar background knowledge in statistics and are new to the experience of using Ti-83 graphic calculator and e-book formats in the statistics learning.

3.3 Data Collection Procedures

Students enrolled in HMB110 Quantitative Analysis are invited to participate in this study. Participation in the study is voluntary and there is no extra credit or inducement. Once the students are allocated into tutorial groups at the beginning of the semester through self-selection in the Allocate+ system, each tutorial group is assigned to one of the three e-book formats. Each student is given notice of Consent Information Statement (See Appendix D) beforehand and indicates agreement by participating in the study before the start of the study. Refusal to participate in the study will not affect the student's grade as the researcher does not know who has opted out of the study until after all the grades were submitted.

The study begin with the researcher introducing the procedures of the study to the participants during the first week lecture class, since it is important making the data collection easier and more effective. During the second week of the study, where tutorial classes have commenced, the participants are shown how to access the link to show the e-book format online to which the tutorial groups are assigned to. All of the students are reminded to use the e-book to help them to understand the usage of

Ti-83 graphic calculator in solving the tutorial questions throughout the semester. Besides using the e-book format during tutorial sessions, students can learn using the e-book format at home but they can only interact with their classmates who are in the same treatment group. The researcher is also helping to direct students back to the e-book when they have questions related to the statistics topics through email correspondence during the experiment. Interaction with the students is kept limited to avoid any element of bias which may affect the study result. It is expected that there will be sufficient motivation for the students to use the e-book.

Here, the participants re informed to use the e-book (via website) for the first six weeks of the semester to learn how to use the Ti-83 graphic calculator for Chapter 1 and Chapter 2. At the end of the six weeks, participants are given the first posttest, Mid Semester Test (O_1), in which learners are examined on Chapter 1 and Chapter 2 using Ti-83 graphic calculator. After the Mid Semester Test, the participants continue to use the assigned e-book. At the end of the semester (after 12 weeks), the participants are given questionnaires (O_2) as the second posttest. The questionnaires are distributed to the participants during their allocated tutorial time and are asked to complete the questionnaire in front of the researcher. The whole process of answering questionnaires typically took 20 minutes. In this study, the questionnaires are designed to ask for the participants' perceptions of the issues concerned, and there are no right or wrong answers. The integrity of the findings depends on the openness and frankness of students to reveal information. The students are assumed to be honest in responding to the self-reporting questionnaires.

Moreover, students are assumed to have empathy for the research aims as well as truly understand the usage of e-book in different formats. Lastly, final posttest as part of the Final Examination (O_3), which consisted of Chapter 3 to Chapter 8, is administered to measure their learning achievement. The results of Mid Semester Test and Final Examination posttests are collected from student exam papers, score and enter into Excel and later transferred into SPSS. All data are to be kept anonymous and confidential.

3.4 Research Instruments

After a review of the literature, several possible research instruments are identified as potentially useful to measure the independent, dependent and moderating variables of the study. Some of the results are used as it is while others are adapted and modified to suit the needs of the study. The questionnaire can be found in Appendix A. Section 1 to Section 6 contributed to the quantitative analysis while Section 7 intended to provide qualitative data of the study.

The research instrument used in this study is a questionnaire which is divided into seven sections:

1) Section 1 has questions about the demographic characteristics of the students.
2) Section 2 is based on the Post-Study System Usability Questionnaires (PSSUQ) by Lewis (1995), which seek to measure the usability of the e-book formats.

3) Section 3 is based on the Cognitive Load (CL) questions by Paas (1992), which measured the level of cognitive load among the students, when using different e-book formats.
4) Section 4 asks questions on the students' level of self-efficacy, which is based on Neill (2008) learning self-efficacy (LSE) instrument.
5) Section 5 is based on the Statistics Anxiety Scale (SAS) by Vigil-Colet et al. (2008), measuring the level of statistics anxiety among the students.
6) Section 6 is based on Kolb and Kolb (2011)'s Learning Styles Inventory (LSI) to measure the learning styles of the students.
7) Section 7 asks open-ended questions on the students' experiences, comments and opinions when using the assigned e-book.

3.4.1 Section 1 of questionnaire: Demographics

The first section of the questionnaire asks for information on the demographic background of the respondents. The demographic variables measured in this study are gender, computer use experience, and type of commerce program.

The number of years of computer use will be taken as the measure for the computer use experience. Li et al. (2013) stated that if there is an increase in the number of years in computer usage, it is perceived that the experience and expertise will gradually increase among the users. In addition, because all of the students are undergraduate business students in their late teens to early 20s, it is assumed that age will not be a factor in this study. Hence, the age variable is omitted from the analysis.

3.4.2 Section 2 of the questionnaire: Post-Study System Usability Questionnaires (PSSUQ)

The Post-Study System Usability Questionnaire by Lewis (1995) is used to measure the usability of the e-book formats. Study conducted by Fruhling and Lee (2005) have shown that this questionnaire could successfully measure a system which include several factors such as design, functionality, ability to learn, satisfaction, reliability, ease of use and the outcome of the system. The list of the factors with the items can be found in Appendix H. The study conducted by Fruhling and Lee (2005) and Lewis (2002) found all the items' reliabilities values exceeded 0.80, indicating that PSSUQ have sufficient reliability to be a valuable instrument for measuring usability of a system. This is supported by the initial assessments of the PSSUQ scales by Lewis (1995), where the reliability values also exceeded 0.80. Lewis (2002)'s investigations into the scale validity in PSSUQ found that the overall score of the PSSUQ correlated highly with other measure, such as user satisfaction and computer usage experience.

The questions are written in both the positive and negative way to increase the reliability of the scale. The intention of including a mixed format is to prevent habitual responses from participants who tend to mark the same response for all survey items (Salkind, 2011). The results are explained on the criteria of scores between 1.00 - 1.91 = low, 2.00 – 2.99 = moderate, and 3.00 – 4.00 =‘high. The questionnaire has 19 questions, each with 4-point Likert choices, corresponding to from “Strongly Agree” (4), “Agree” (3), “Disagree” (2) and “Strongly Disagree” (1). Examples of questions are given in Table 3.3.

Table 3.3 *Sample of PSSUQ questions in the questionnaires*

Questions
The interface of the eBook was pleasant to follow.
It was simple to use this eBook.
I felt comfortable using this eBook.

3.4.3 Section 3 of the questionnaire: Cognitive Load (CL)

Cognitive load refers to the amount of mental capacity in working memory. As discussed in the literature review, subjective ratings and self-assessed level of mental effort have been used extensively by researchers and have proved to be reliable measures of cognitive load (Clarke et al., 2005; DeLeeuw & Mayer, 2008; Paas, 1992; Paas & van Merrienboer, 1994; Sweller, 2010). It is easier to be implemented and analysed for this study because it concentrates on the performance (Agostinho et al., 2011).

Although this questionnaire is based on self-assessed mental effort by students, studies have shown that students have consistently demonstrated that they are able to numerically rate their level of perceived mental effort on an ordinal scale (Paas, 1992; Paas & van Merrienboer, 1994). For example, the instrument has been used in numerous studies across various areas, such as multimedia learning, mathematics and statistics education, thereby lending itself to being a highly valid and reliable instrument measurement (Amadieu et al., 2010; Paas et al., 2008; Sweller, 2010).

The cognitive load questionnaire is based on the revised questionnaire of Paas's (1992) Mental Effort Scale and is modified in this study to analyse students' cognitive load scores on the Ti-83 calculator presented in different e-book formats. The questionnaire has been used in a number of other related studies (DeLeeuw & Mayer 2008; Homer, Plass, & Blake, 2008; Sweller, 2010), where the scale's reliability (alpha > 0.80) and validity have been demonstrated.

The initial cognitive load by Paas's (1992) was calculated using three questions. The modifications of the questionnaire included rephrasing the questions accordingly to the usage of e-book formats. Additional two questions are inserted to allow participants to measure the mental effort and degree of difficulty when experiencing Ti-83 graphic calculator demonstrated from the e-book formats. Hence, the questionnaire consists of five Likert-scale questions that asked the participant to indicate the mental effort and the degree of difficulty involved in their experience with the different formats of e-book.

Paas's (1992) instruments consist of two types of subjective measures, namely mental effort and perceived degree of difficulty. These two distinctive measures of cognitive load are considered to understand the overall types of cognitive loads (intrinsic, extraneous, and germane load) which are assessed by the mental effort scale and the extraneous cognitive load assessed by the perceived difficulty scales (Amadieu et al., 2010; Paas, 1992). The mental effort scale only measure overall cognitive load and does not attempt to give a measure that allows the cause of different types of cognitive load to be analysed (Paas, 1992). However, the perceived difficulty is expected to reflect extraneous cognitive load because difficulty will involve the learning processes related to the design and materials presented (Amadieu et al., 2010). Nevertheless, the scores of the five questions can be used as an indicator for overall cognitive load in the study as reported by Amadieu et al. (2010) because both mental effort and perceived difficulty reflects the overall cognitive load and should be considered in order to provide more understanding of CL.

Table 3.4 shows the questions for cognitive load along with two subjective measures. Determined by Paas (1992), Question 1 measures the mental effort perceived by the participants when using e-book while Question 2 and Question 5 measure the perceived level of difficulty when using the assigned e-book. Question 3 (measuring perceived degree of difficulty) and Question 4 (measuring mental effort) are included additionally which related to the materials demonstrated by the Ti-83 graphic calculator. The question type for Question 3 measure extraneous cognitive load since it involves the manner how information are provided by Ti-83 graphic calculator in the e-book whereas Question 4 dealt with the mental effort given to understand the concepts and contents provided by Ti-83 graphic calculator in the e-book.

In this study, Question 1 is measured by a 9-point Likert-scale corresponding from the choice of “Very, Very High Mental Effort” (9), “Neither Low nor High Mental Effort” (5), and “Very, Very Low Mental Effort” (1). As for Question 2 to Question 5, there are 9-point Likert-scale ranging from “Very Difficult” (9), “Averagely Difficult” (5), and “Not Difficult at all” (1). The questionnaires are distributed to the students after experiencing the e-book to understand the level of cognitive load. The results of CL in the One-Way ANOVA analysis are explained based on the total scores of 5.00 – 14.99 = low level, 15.00 – 29.99 = moderate level, and 30.0 0-45.00 = high level. On the other hand, the descriptive statistics for each question on CL are explained based on the mean scores of 1.00 – 1.99 = low level, 2.00 – 2.99 = moderate level, and 3.00 - 4.00 = high level.

Table 3.4 *CL questions in the questionnaires*

Questions	Measure
Question 1: Using the e-book in learning certain topic(s), I invested:	Mental effort
Question 2: How do you find the level of difficulty in using the e-book?	Perceived degree of difficulty
Question 3: How do you find the level of difficulty in understanding the information provided by the Ti-83 graphic calculator given in the e-book?	Perceived degree of difficulty
Question 4: In understanding the concept and content of statistics provided by the Ti-83 graphic calculator in the e-book, I find them:	Mental effort
Question 5: How easy or difficult was it for you to understand the information provided for using the e-book?	Perceived degree of difficulty

3.4.4 Section 4 of the questionnaire: Learning Self-Efficacy (LSE)

LSE in this study refer to the personal judgement that a person makes about their level of confident and ability in accomplishing a task (Looney, Valacich, & Akbulut, 2004). The fourth section of the questionnaire is based on the Neill (2008) learning self-efficacy instrument. The Cronbach alpha results for each sub-scale ranged 0.76 to 0.90, and reported to be similar to Peschar et al.'s (1999).

There are 14 questions, each with a 4-point Likert choices, corresponding to from "Strongly Agree" (4), "Agree" (3), "Disagree" (2) and "Strongly Disagree" (1). Examples of questions are given in Table 3.5.

Table 3.5 *Sample of LSE questions in the questionnaires*

Questions
I learn the things I need to learn pretty fast
When studying, I keep working even if the material is difficult
I can understand the most difficult material presented
When studying, I do my best to acquire the knowledge and skills taught
I can understand the most complex material presented by my lecturer

The results in the One-Way ANOVA analysis are explained based on the total scores of 14.00 – 28.99 = low level, 29.00 – 43.99 = moderate level, and 44.00 – 56.00 = high level. Next, the descriptive statistics for each LSE factor are explained based on the mean scores of 1.00 – 1.99 = low level, 2.00 – 2.99 = moderate level, and 3.00 - 4.00 = high level.

3.4.5 Section 5 of the questionnaire: Statistics Anxiety Scale (SAS)

Statistics anxiety is a measure of a person's feeling of worry when taking or doing statistics subject (Everson et al., 2008). The statistics anxiety questionnaires is based on Vigil-Colet et al. (2008)'s instrument and modified to suit this study. The list of factors with the items can be found in Appendix I. There are 24 questions where the level of statistics anxiety were questioned, with 5-point Likert choices, corresponding to "High Anxiety" (5), "Considerable Anxiety" (4), "Moderate Anxiety" (3) "Slight Anxiety" (2) and "No Anxiety" (2). Examples of questions are given in Table 3.6.

Vigil-Colet et al. (2008) reported a high reliability with alpha values of 0.91 for total scale and as for subscales, 0.87 for Examination Anxiety, 0.82 for Interpretation Anxiety and 0.92 for Fear for Asking for Help. As supported by Chiesi et al. (2011) and Hsiao (2010), this instrument has proven to be useful and valid to measure statistics anxiety level in educational context.

In the One-Way ANOVA analysis, the results are explained based on the total scores of 24.00 – 62.99 = low level, 63.00 – 101.99 = moderate level, and 102.00 – 120.00 = high level. The descriptive statistics for each SAS factor are explained based on the mean scores of 1.00 – 2.99 = low level, 3.00 – 3.99 = moderate level, and 4.00 - 5.00 = high level.

Table 3.6 *Sample of SAS questions in the questionnaires*

Questions
Studying for an examination in a statistics
Asking a private teacher to explain a topic that I have not understood at all
Waking up in the morning on the day of a statistics test
Going to the teacher's office to ask questions
Trying to understand the odds in a lottery

3.4.6 Section 6 of the questionnaire: Learning Styles Inventory (LSI)

Learning style refers to how a person perceived, processed, stored and recalls information of what they are learning (Lu et al., 2007). The LSI is based on Kolb and Kolb (2011)'s instrument, a newer version of Kolb's (1985) KLSI. This version includes a more comprehensive instruction to participants, although they retained the original statements. The four learning modes included in the LSI are: concrete experience (CE, feeling), reflective observation (RO, watching), abstract conceptualization (AC, thinking) and active experimentation (AC, doing) (Kolb & Kolb, 2011). There are 12 questions which consisted of 4-point Likert choices, ranging from (1) "Least like you" to (4) "Most like you". Examples of questions are given in Table 3.7. While the LSI has undergone scrutiny by researchers debating the validity and reliability, it is still however, viewed as a valuable framework for learning activities from previous researchers on Kolb's (1985) LSI (De Ciantis & Kirton, 1996; Garland & Martin, 2005; Zacharis, 2010) especially in higher education (Ku & Chang, 2011; Platsidou & Metallidou, 2009; Wang, Wang, Wang, & Huang, 2006).

Table 3.7 *Sample of LSI questions in the questionnaires*

Questions	Choices: Please rate (1 to 4) the following activities of how anxious they make you feel			
When I learn	I like to deal with my feelings	I like to think about ideas	I like to be doing things	I like to watch and listen
I learn best when	I listen and watch carefully	I rely on logical thinking	I trust my hunches and feelings	I work hard to get things done
When I am learning	I tend to reason things out	I am responsible about things	I am quiet and reserved	I have strong feelings and reactions

3.4.7 Section 7 of the questionnaire: Open-ended questions

As mentioned by Creswell (2013), open-ended questions help to search for relevant and useful information and considered the most appropriate to focus on what happened in a given context, how the events take place and why they occur. Open-ended question is considered in this study as a means to collect feedback because it obtained a more specific and meaningful information rather than just filling out questionnaires (Patton, 2002). The open-ended question is used to comprehensively measure the perceptions and experience of the participants while using the assigned e-book and is self-constructed. Additionally, the open-ended questions are reviewed to corroborate the usability of the e-books. The questions are given in Table 3.8.

Table 3.8 *Open-ended questions in the questionnaires*

Questions
1. Looking back on your experience of using the e-book, please share the problems that you have encountered.
2. In your opinion, is the e-book useful for your learning?
3. Any other comments that you would like to provide regarding the use of this e-book?

3.5 Design of the E-book using Waterfall Model

This section describes the learning materials and the considerations that were taken into account for the design of the user interface and the navigation for the e-book. The Waterfall model is used for the development of the e-book.

Specifically, the design of the e-book formats follows the Waterfall model. As discussed in Chapter 2, the Waterfall model is a five-phase process that is widely used for website development (Frantiska, 2003). The five phases: Analysis, Design, Implementation, Testing and Maintenance, provide an ideal framework to develop the e-book, as the e-book is deployed using a website. The activities took place over a period of twelve months (48 weeks), beginning from the planning and continued until the entire e-book formats had been created.

3.5.1 Phase 1: Analysis

The analysis phase is often overlooked even though it is considered as one of the most essential phases in the Waterfall model (Bassil, 2012). Like any significant project, this phase started with the analysis of the goals of e-book formats, analysis of the learners and analysis of the course.

Analysis of the goals of e-book formats

Once committed to the general idea of converting paper-based textbook to e-book, the researcher form a mental prototype of the course e-books, representing two goals for the learning. The first goal is to effectively facilitate student learning specific to the prescribed learning objectives of HMB110 Quantitative Analysis, an introductory statistics unit in the Bachelor of Commerce programme. The final goal is to design and develop e-books that would engage the students in an e-learning environment, where the students would have access to concepts and learning activities with dynamic media representation in e-book formats.

Analysis of the learners

Olgren (1998) reported that the knowledge on how people learn is essential for course design. In this part of analysis phase, the researcher performed an observation to provide focus on the students' learning needs. As far as demographics, students exhibited similar traits in learning needs as well as background knowledge in statistics. In this case, it is assumed that none of the students had used Ti-83 calculator, hence there is a need to facilitate the usage of Ti-83 calculator in statistics using e-book in different formats.

Analysis of the course

In order to construct the learning environment of the e-book, the course Quantitative Analysis with the course code HMB110, is selected. This course is a first year unit for first semester students enrolled in the Bachelor of Commerce programme in Swinburne University of Technology, Sarawak Campus in Malaysia.

HMB110 Quantitative Analysis unit is chosen for several reasons. Firstly, the expert-refined and validated learning materials in paper-based text books are available, which are kindly provided by the lecturer, who teaches the unit for several semesters. Secondly, statistics was considered a timely and difficult subject to learn for most of the students in colleges and universities (Dinov, Sanchez, & Christou, 2008). In addition, the lecturer who had taught this unit for four semesters observed similar situation, where the students faced difficulties in understanding how to use the Ti-83 calculator. With this, it opens an opportunity to develop different representations for the same statistics concept by employing different formats of media experiences using e-book.

The objective of the unit is to provide students with knowledge of basic financial mathematics and statistical techniques and the skills to analyse and interpret the results of statistical analysis. It is a 12.5 credit point unit and offers a formal contact time of four hours per week (two hours lecture and two hours tutorial). This unit is predominantly conducted face-to-face and is conducted over 12 weeks duration. The unit outline is available in Appendix B.

The learning materials cover the following learning objectives:

1) Solve financial problems concerning compound interest, mortgages, annuities, loans and investment.
2) Summarise quantitative and qualitative data in graphical and numerical forms.
3) Interpret cross-tabulations of two and three variables.
4) Calculate and interpret simple probabilities using tree diagrams and contingency tables using the ideas of mutually exclusive events, independent events and conditional probability.
5) Explain the concept of a random variable and the probability distribution of a random variable and calculate and interpret the expected value and standard deviation of a discrete random variable.
6) Apply the basic properties of the normal probability distribution and solve problems that utilise the normal probability distribution.
7) Find point estimates of population parameters using sample statistics.
8) Calculate and interpret confidence intervals for a mean and for a proportion.
9) Calculate sample sizes needed to estimate population means and proportions.
10) Carry out and interpret tests of hypotheses concerning population means and proportions from one population or from two populations, using a z-test or t-test, as appropriate.

11) Test for a relationship between two categorical variables using a Chi-square test.

12) Calculate the line of best fit for a set of bivariate data, test for the significance of the gradient and, if significant, use the line for prediction.

13) Calculate and interpret coefficients of correlation and of determination.

14) Analyse time series using the multiplicative model, including fitting linear and exponential trend lines, deseasonalising using seasonal indices and forecasting.

15) Calculate the different types of index numbers.

In this study, three e-book formats are developed based on all the chapters in the unit. The chapters covered and the subchapters were listed in Table 3.9 as follows:

Table 3.9 *Lists of statistics chapters and subchapters*

Chapters	Subchapters
Chapter One: Financial mathematics	• Interest, Investments and Loans • Compound Interest • Annuities • Amortisation • Discounted Cash Flow Analysis
Chapter Two: Descriptive Statistics	• Introduction to Statistics • Visual Displays for Qualitative Data • Summarising Quantitative Data • Measures of Location • Measures of Dispersion • Describing Data Sets • Comparing Data Sets: A Worked Example • Cross Tabulation
Chapter Three: Introduction to	• Prelude

Probability	• Tree Diagrams • Probabilities from Data • Relationships between Events • Two General Examples • Discrete Probability Distributions
Chapter Four: The Normal Probability Distribution	• Introduction to the Normal Distribution • The Probability Density Curve • The Normal Density Curve • Properties of the Normal Distribution • Standartisation • Standard Normal Curve
Chapter Five: Sampling and Estimation	• Introduction to Statistical Inference • Sample Statistics and Point Estimates • Choosing Samples • Selecting a simple random sample • Sampling Distributions • Interval Estimation • Estimating Proportions • Deciding on the sample size
Chapter Six: Testing Hypotheses	• Hypothesis Testing for a Single Population Mean • Hypothesis Testing for a Single Proportion • Hypothesis Testing for Comparing Two Populations • Interpreting Computer Output • Testing for a Relationship Between Two Variables: The Chi-Square Test
Chapter 7: Correlation and Regression	• Linear Functions • Correlation and Regression • The Least Squares Regression Line
Chapter 8: Time Series	• Components of a Time Series • Fitting the Trend • Seasonal Variation • Forecasting Using the Multiplicative Model • Index Numbers

As shown in the unit outline (Appendix B), at the end of six weeks, the students are given the Mid Semester Test, which carried the weightage of 25% overall total mark. The final assessment, namely Final Examination are conducted at the end of the semester and this carried the weightage of 60% overall total mark. The remaining marks are allocated in Individual Assignment (15%), which is not considered in this study as Ti-83 graphic calculator is not used to complete this assessment.

3.5.2 Phase 2: Design

Brewer, DeJonge, and Stout (2001) found that course planning and preparation directly influences course effectiveness. In this study, the e-book formats are not developed as a new unit to the institutional curriculum but based on the existing unit HMB110 Quantitative Analysis delivered in paper-based textbook. Therefore, the learning objectives and course syllabus already existed and do not need modifications, except for the multimedia and animation representation of the content.

Table 3.10 lists the comparison of all statistics chapters between existing materials with the modified materials in three different e-book formats and their properties. It is important to take the interaction between learner and medium into account when assessing different media experiences (Kozma, 1991). As such, learning materials in one media experience can be subjectively perceived as “better” than learning materials in another media experience. In addition, it will be difficult to objectively assess the equivalence of learning materials in different media, except checking for consistency of content provided in each e-book format. Learners’ learning and experience may differ when they are exposed to learning materials presented in different media.

Table 3.10 *Specific e-book formats and components for the statistics course*

Statistics topics	Existing Materials	Modified Materials
All chapters included	Textbook and PowerPoint lecture slides. Printed copy of PowerPoint slides are given to students.	Format 1: T&S • Replaced paper-based textbook in PDF version (e-book) on local Web site. • Similar to the existing materials, T&S e-book format include all text pages and static images of figures, diagrams and tables showing the usage of Ti-83 calculator were included in this e-book format.
All chapters included	Textbook and PowerPoint lecture slides. Printed copy of PowerPoint slides are given to students.	Format 2: T&A • Replaced paper-based textbook in PDF version (e-book) on local Web site. • Interactive flash animations of the Ti-83 calculator were shown at the Content Page where Ti-83 calculator is used to solve exemplar of statistics problems.
All chapters included	Textbook and PowerPoint lecture slides. Printed copy of PowerPoint slides are given to students.	Format 3: T&M • Replaced paper-based textbook in PDF version (e-book) on local Web site. • Interactive multimedia or video presentation and animations of the Ti-83 calculator were shown at the Content Page where Ti-83 calculator is used to solve exemplar of statistics problems.

The next section will review the models and principles used to guide the development of the e-books.

Theoretical Justification on E-book Formats

Research by Baddeley and Hitch (1974) and Paivio (1986) on information processing and working memory models shows a relationship between visual and verbal information processing, which are hallmarks of animation and multimedia development of the e-books for this study. Based on these models, the e-book formats include verbal and visual representations as researchers proved that comprehension is improved in a dual channel presentation (verbal and visual) than in a single channel (Mayer, 2001; Mayer & Moreno, 2003; Tindall-Ford et al., 1997).

Further, Mayer (2001)'s multimedia principles have guided the choice and combination of different representation in the e-book formats. For example, the multiple representation principle is applied in the e-book by combining text, animation and multimedia. The learning materials of the statistics unit are designed to follow the coherence principle by excluding nice-to-have information. Additionally, contiguity principle and split-attention principle are considered as a priority in the design of the animation and video learning materials.

Consideration towards cognitive load is a critical concern for designers when designing animation and multimedia teaching materials, because unnecessary animation and multimedia messages may worsen learning performance by increasing working memory load and interrupting information processing (Agostinho, Tindall-Ford, & Roodenrys, 2011; Bethel & Borokhovski, 2010; Chien & Chang, 2010; DeTure, 2004; Hwang, Hong, Cheng, Peng, & Wu, 2013).

Elements in E-books to Reduce Cognitive Load

Learning is promoted when design minimizes extraneous load in order to free up resources for intrinsic and germane processing, each of which play an essential role in learning (Agostinho et al., 2011; DeLeeuw & Mayer, 2008; Mayer, 2010; Meissner & Bogner, 2013). Using CLT by Sweller (2010), among the three types of cognitive loads, reducing extraneous cognitive load is the primary focuses of this study. Because e-books are developed using the existing statistics textbook, inherently all the learning materials and work-out examples remain similar in the e-book versions, especially in the T&S e-book format (scanned in PDF format). Hence, in this study, intrinsic cognitive load cannot directly be reduced in the e-books as the content and presentation of the information reflect the original textbook.

As discussed earlier, germane cognitive load may positively influence learning, depending on how the materials are presented (Meissner & Bogner, 2013; Sweller et al., 2011). Paas et al., (2008) and Clark et al. (2006) asserted that the goal of designing instruction material is to present information in a manner that elicits the highest level of germane cognitive load and this can be seen in the performance in which measured as posttest scores. Thus, whether the presentation of information in the e-books lead to a more effective learning outcome, or not, depends on how the results ascribe to germane load, which can be determined in the posttest scores in this study. Nevertheless, as mentioned by Aryes and van Gog (2009), animation and multimedia (video and audio) helps to retain information as they create interest that motivate student to exert more effort, thus may increase germane cognitive load.

Even though e-books are developed based on the printed textbook, this study offered different formats of presentation, such as animation and multimedia, to find the most preferred format by the students in learning statistics, particularly in learning how to use Ti-83 graphic calculator. Since CLT suggests that efficient learning requires reduction of extraneous cognitive load (Agostinho et al., 2011; Meissner & Bogner, 2013), the instructional materials in T&A and T&M e-book formats are optimally designed to reduce the disorientation and split attention effect.

While using e-book, it is plausible that student may experience a sense of disorientation, feelings of being lost, and difficultly returning to pages previously visited because reading hundreds of continuous pages on the screen consume high working memory (Conklin, 1987; Grimshaw et al., 2007). Disorientation may occur when e-books are chunked into one whole chapter. In relation to reducing disorientation, the materials in the e-books are divided into smaller chapters with individual headlines and a tree-like content hierarchy is created. The tree-like content hierarchy will allow student to obtain a whole picture of the e-book.

While reading an e-book on the screen, split attention and dual-tasking burdens occur when a student's concentration is diverted to scroll down each page by either mouse clicking or hitting the page down button on a keyboard, thereby resulting in extraneous cognitive load (Lambert, Kalyuga, & Capan, 2009). In order to avoid the split attention effect and dual-tasking burdens, both animation and multimedia e-books are designed with separate pop-up window and visual of the exact replica of the Ti-83 graphic calculator and narration that are understandable. The separation of the pop-up window distinguishes the animation or multimedia illustrations from the text only e-book, enabling students to focus and control their learning pace.

Moreover, subtitles are added to the animation and multimedia to reduce the working memory capacity and help to retain information. There were past studies shown that animation and multimedia with the help of subtitles assist students to require less effort to create mental representation during learning (Mayer, 2009; Meissner & Bogner, 2013). With animation or multimedia, Cook, Zheng, and Blaz (2009) suggested that not only students are able to build a mental representation easily, but both can also facilitates learning by reducing the split attention effect. This has been supported by Spanjers, van Gog, and van Merrienboer (2011) in their studies on video and voice narration for probability instruction, Yeh et al. (2012) on animation-based instruction on earthquake studies in Taiwan, Aldalalah (2012), in the context of learning music theory using audio and images, and Meissner and Bogner (2013) on heuristic science lesson with text, images and interactive images. Hence, if the information represented in both animation and multimedia are understandable, it will actually enhance understanding, learning and performance of learning activities.

Application of Multimedia Principles

The e-book is designed into three formats, namely T&S, T&A, and T&M. Multimedia principles by Mayer (2001) and Paivio (1986)'s dual coding theory are used as a guide for the design of the e-book formats. For example, the combination of text with static image, animation and multimedia reflected Mayer's first multimedia representation principle, where it is better to present the explanations in text and pictures rather than solely in text.

In T&A and T&M e-book formats, the "pop-up" window with the on-screen content placement reflects Clark and Mayer's (2011) contiguity principle, which suggested that corresponding text was positioned best near the animated graphic or video it described. This may help to reduce extraneous cognitive load.

In addition, the auditory narration in the T&M e-book format emphasizes the split attention principle by Mayer (2001) where text should be presented using audio rather than visually.

Lastly, in order to help the students to learn statistics better by using Ti-83 graphic calculator, Clark and Mayer's (2011) coherent principle is applied. For example, the steps of using Ti-83 graphic calculator are summarized and highlighted in the animation and multimedia e-book formats instead of a longer description (as in the original textbook). Also, the students can monitor their own learning pace, by clicking on the ‘Next’ button in the animation. A shorter yet detailed presentation primes the students to organize the information productively (Chen & Sun, 2012).

Types of E-book Formats in this Study

Based on the prevalent findings on the effect of different representations, the e-books are designed with three different formats, namely, T&S, T&A and T&M. The T&S e-book format constitutes an exact replica of the hardcopy textbook, albeit in an e-book version while, the T&A e-book format includes animated interpretation of the Ti-83 graphic calculator. The T&M e-book format contains video and audio explanation on statistics and how to use the Ti-83 graphic calculator. All three e-books have identical content and formatting (e.g., text, headings, subheadings, pictures, tables, charts, graphic images, page numbers, etc.) except with additional links for T&A and T&M e-books.

T&S Treatment

The statistics paper-based textbook was scanned and developed into the first e-book format of T&S. This e-book contained static text, pictures, graphs and other static illustrations. For example, the screens of Ti-83 graphic calculator were shown as the static images for this format as pictured in Figure 3.3 to Figure 3.5.

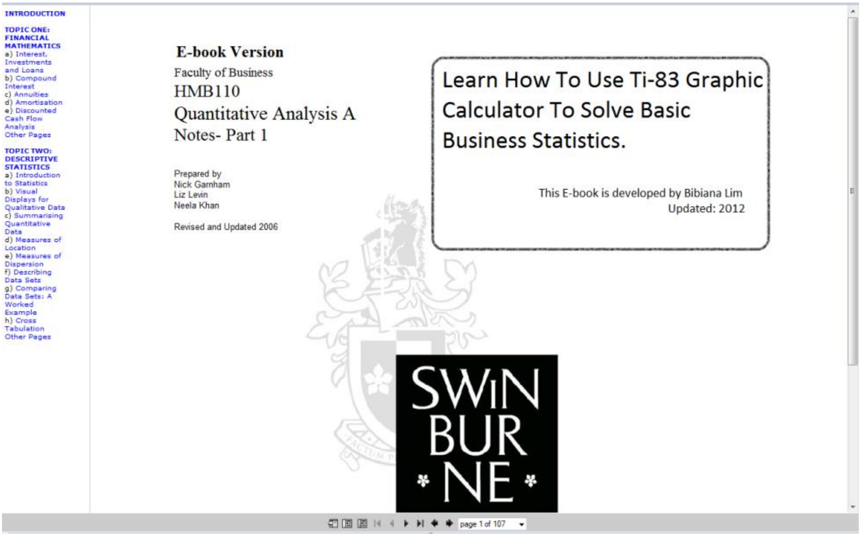
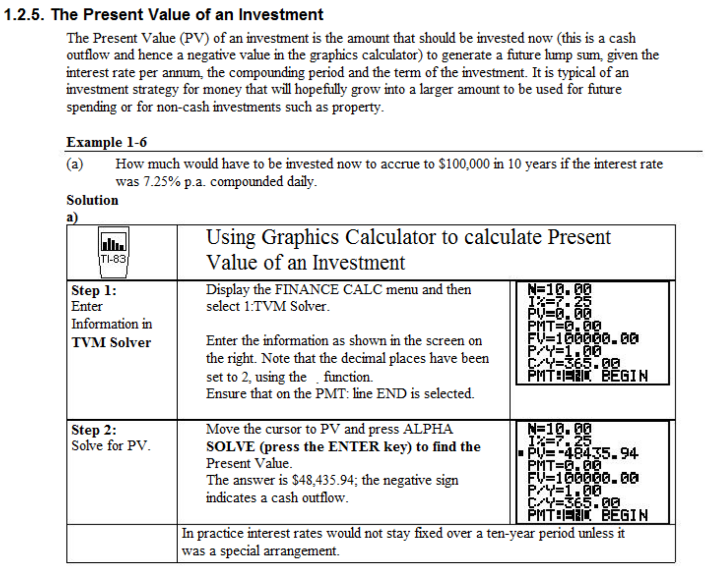


Figure 3.3: Screen shot of the front page of the e-book (T&S) with the navigation panel on the left.



1.2.5. The Present Value of an Investment

The Present Value (PV) of an investment is the amount that should be invested now (this is a cash outflow and hence a negative value in the graphics calculator) to generate a future lump sum, given the interest rate per annum, the compounding period and the term of the investment. It is typical of an investment strategy for money that will hopefully grow into a larger amount to be used for future spending or for non-cash investments such as property.

Example 1-6

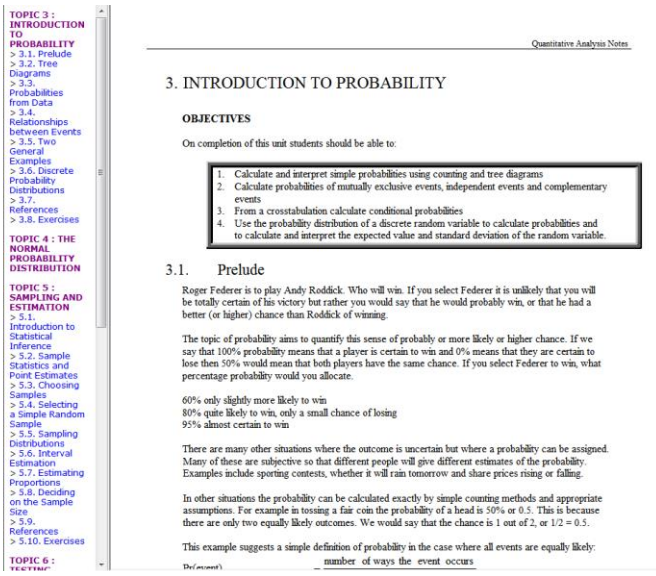
(a) How much would have to be invested now to accrue to $100,000 in 10 years if the interest rate was 7.25% p.a. compounded daily.

Solution

a)

TI-83	Using Graphics Calculator to calculate Present Value of an Investment	
Step 1: Enter Information in **TVM Solver**	Display the FINANCE CALC menu and then select 1:TVM Solver. Enter the information as shown in the screen on the right. Note that the decimal places have been set to 2, using the _ function. Ensure that on the PMT: line END is selected.	N=10.00 I%=7.25 PV=0.00 PMT=0.00 FV=100000.00 P/Y=1.00 C/Y=365.00 PMT:END BEGIN
Step 2: Solve for PV.	Move the cursor to PV and press ALPHA **SOLVE (press the ENTER key) to find the** Present Value. The answer is $48,435.94; the negative sign indicates a cash outflow.	N=10.00 I%=7.25 ▪PV=-48435.94 PMT=0.00 FV=100000.00 P/Y=1.00 C/Y=365.00 PMT:END BEGIN
	In practice interest rates would not stay fixed over a ten-year period unless it was a special arrangement.	

Figure 3.4: Screen shot of a text and static image of the e-book.


TOPIC 3 : INTRODUCTION TO PROBABILITY
> 3.1. Prelude
> 3.2. Tree Diagrams
> 3.3. Probabilities from Data
> 3.4. Relationships between Events
> 3.5. Two General Examples
> 3.6. Discrete Probability Distributions
> 3.7. References
> 3.8. Exercises

TOPIC 4 : THE NORMAL PROBABILITY DISTRIBUTION

TOPIC 5 : SAMPLING AND ESTIMATION
> 5.1. Introduction to Statistical Inference
> 5.2. Sample Statistics and Point Estimates
> 5.3. Choosing Samples
> 5.4. Selecting a Simple Random Sample
> 5.5. Sampling Distributions
> 5.6. Interval Estimation
> 5.7. Estimating Proportions
> 5.8. Deciding on the Sample Size
> 5.9. References
> 5.10. Exercises

TOPIC 6 :

Quantitative Analysis Notes

3. INTRODUCTION TO PROBABILITY

OBJECTIVES

On completion of this unit students should be able to:

1. Calculate and interpret simple probabilities using counting and tree diagrams
2. Calculate probabilities of mutually exclusive events, independent events and complementary events
3. From a crosstabulation calculate conditional probabilities
4. Use the probability distribution of a discrete random variable to calculate probabilities and to calculate and interpret the expected value and standard deviation of the random variable.

3.1. Prelude

Roger Federer is to play Andy Roddick. Who will win. If you select Federer it is unlikely that you will be totally certain of his victory but rather you would say that he would probably win, or that he had a better (or higher) chance than Roddick of winning.

The topic of probability aims to quantify this sense of probably or more likely or higher chance. If we say that 100% probability means that a player is certain to win and 0% means that they are certain to lose then 50% would mean that both players have the same chance. If you select Federer to win, what percentage probability would you allocate.

60% only slightly more likely to win
80% quite likely to win, only a small chance of losing
95% almost certain to win

There are many other situations where the outcome is uncertain but where a probability can be assigned. Many of these are subjective so that different people will give different estimates of the probability. Examples include sporting contests, whether it will rain tomorrow and share prices rising or falling.

In other situations the probability can be calculated exactly by simple counting methods and appropriate assumptions. For example in tossing a fair coin the probability of a head is 50% or 0.5. This is because there are only two equally likely outcomes. We would say that the chance is 1 out of 2, or 1/2 = 0.5.

This example suggests a simple definition of probability in the case where all events are equally likely:

Figure 3.5: Screen shot of the page of the e-book (T&S)

The design of the research treatment required that two versions of the e-book be created using the same content verbiage, but with different presentation formats, namely animation and video.

<u>T&A treatment</u>

The second e-book format includes text and animated interpretation of the Ti-83 graphic calculator. A hyperlink [Animation] is shown next to the explanation of the exemplar of a statistic problem and when clicked, a new Window will show a step by step animated version of Ti-83 graphic calculator, based on the statistics functions. This is shown in Figure 3.6 and Figure 3.9.

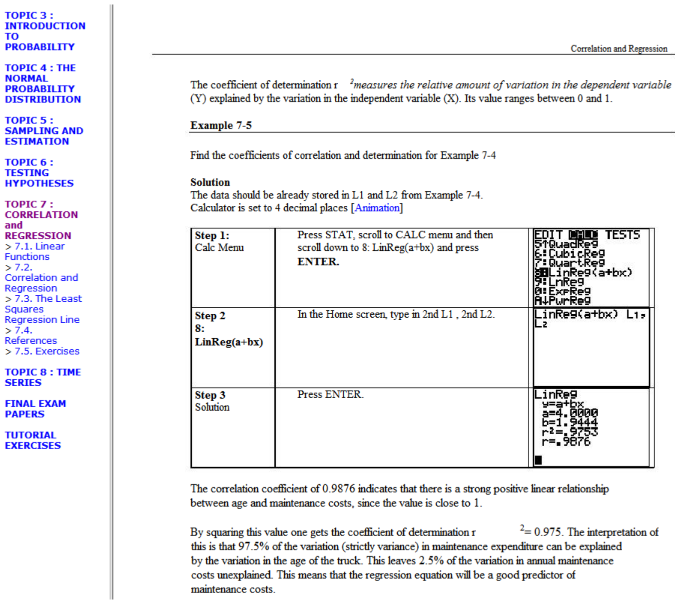


Figure 3.6: Screen shot of one of the e-book pages (T&A) with the [Animation] options shown.

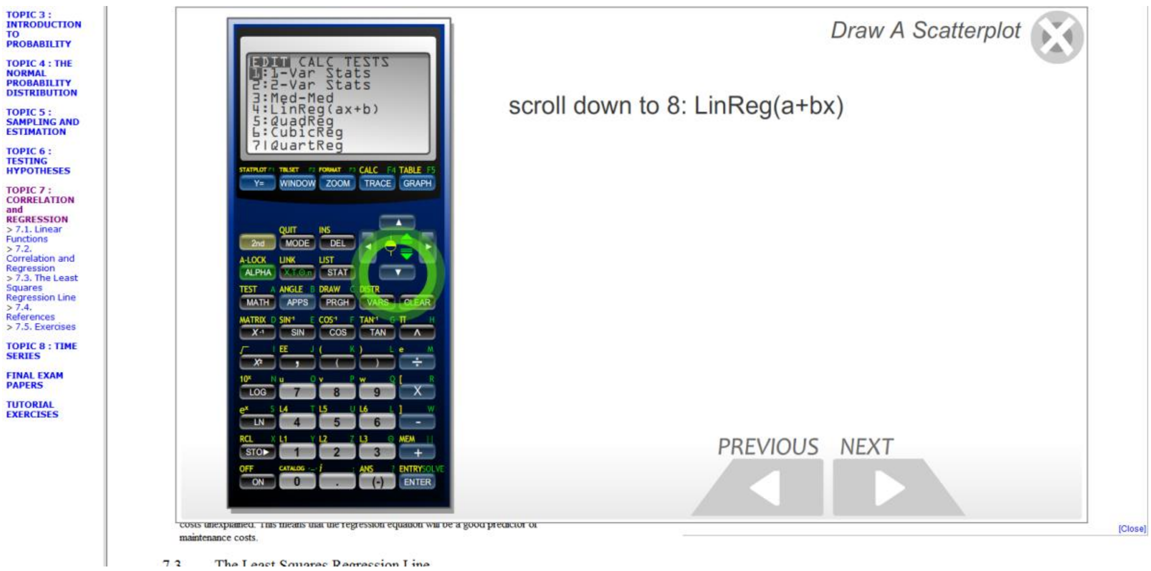


Figure 3.7: Screen shot of the "pop-out" screen showing the e-book page (animation with text) on how to use the graphics calculator.

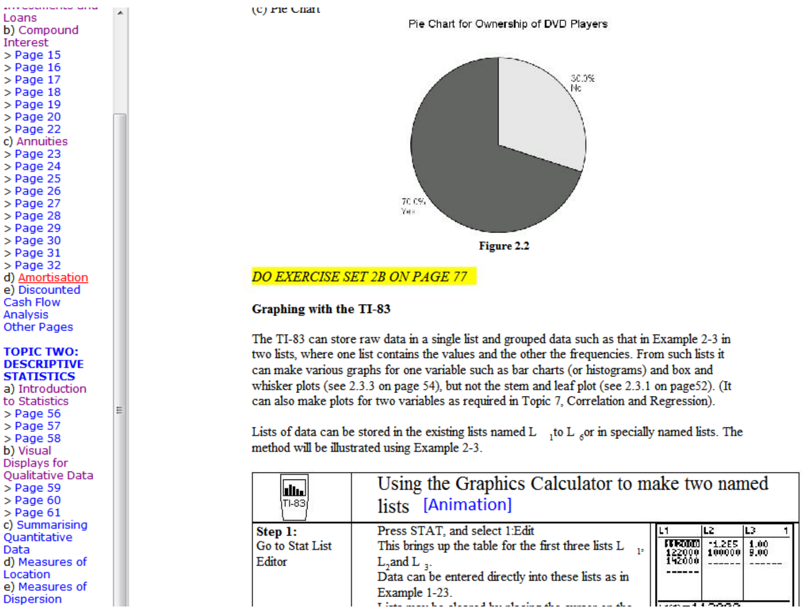


Figure 3.8: Screen shot of text and animation e-book format with [Animation] link.

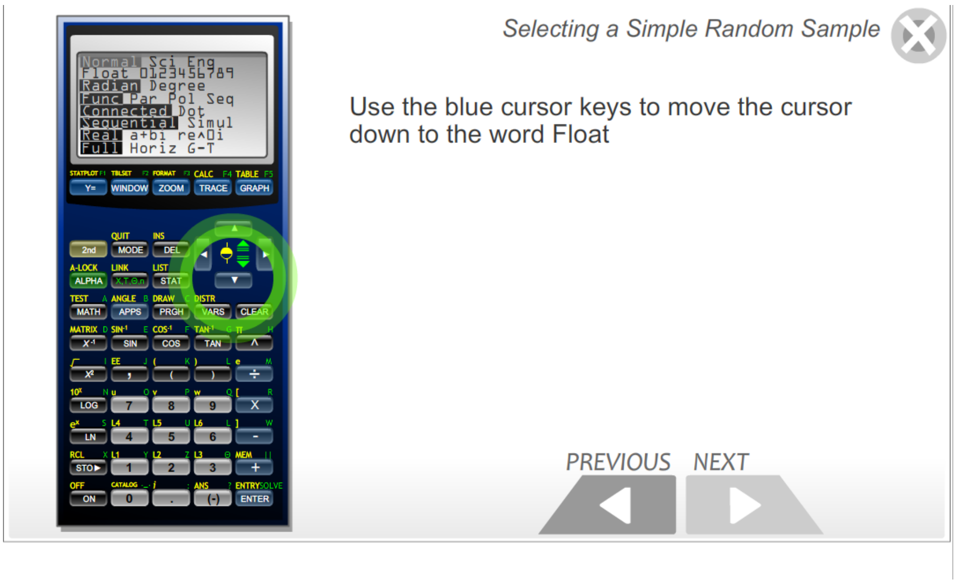


Figure 3.9: Screen shot of the “pop-out” screen showing the animation with text.

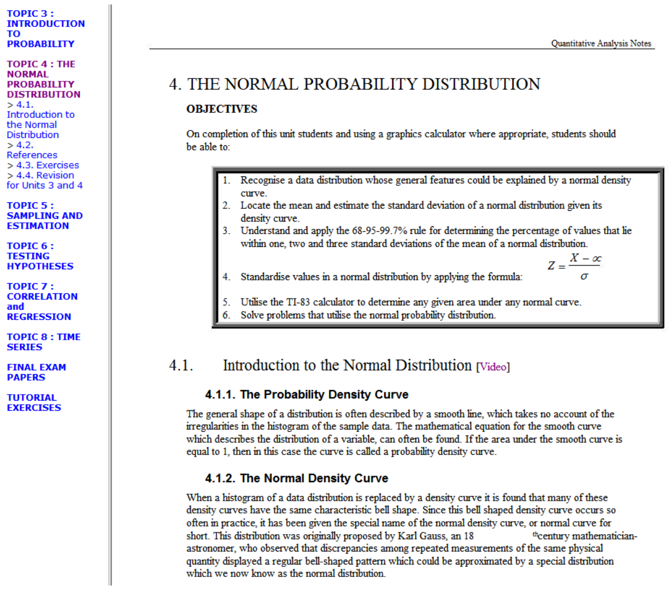
Rogers (2008) suggests a strategy that can be used when designing animations for learners. He argues that a good approach is to design simple animation that deliver information in stages rather than designing a complete set of animation that visualize all information at the same time. This approach is likely to result in less cognitive load on students' working memory when they try to relate multiple changes on the computer screen to what they are learning. Therefore, the T&A e-book was developed to allow learners to follow the steps by clicking "Next" button while learning how to use Ti-83 graphic calculator. The animation contains a more realistic graphic interpretation via higher levels of visual elaboration of a Ti-83 graphic calculator. For example, graphics are illustrated with the exact replica of the graphic calculator that include colour and this is consistent with the recommendations by Tversky (2011), where the essential graphic information is deemed necessary for integration of visualization and comprehension of instruction. Hence, the unique differences in colour, form and texture and the added motion, define the T&A e-book group's treatment experience.

T&M treatment (video and audio)

The final format includes T&M or video presentation. Similar to the T&A e-book format, a hyperlink [Video] is inserted next to the subtopic explanation on how to use the Ti-83 graphic calculator and when clicked, a "pop-up" Window will show a video with audio presentation, assisted by animated version of Ti-83 graphic calculator as shown in Figure 3.10 to Figure 3.14.

Tversky (2011) emphasises the necessity of supporting video and audio representations with explanatory cues in the form of short notes (or subtitles), as they can increase the amount of information that the user receives through different working memory channels.

In order to produce the auditory media experience from the textual materials, there are two options: speech synthesis or a manual recording of a speaker. Speech synthesis is the process of converting a written text to speech with a computer program (a so called "engine") (Mayer, 2009). However, manual recording is chosen for this project, because speech synthesis is considered too impersonal and too difficult to understand. The speech synthesis output still sounded more like a computer than a human voice. Moreover, Mayer (2009) provided evidence for a personalisation effect: students learn more deeply if materials are presented in a conversational style that creates a personal connection with the student, compared to formal, impersonal style. The recording of the audio is completed by the researcher herself.



TOPIC 3 : INTRODUCTION TO PROBABILITY

TOPIC 4 : THE NORMAL PROBABILITY DISTRIBUTION
> 4.1. Introduction to the Normal Distribution
> 4.2. References
> 4.3. Exercises
> 4.4. Revision for Units 3 and 4

TOPIC 5 : SAMPLING AND ESTIMATION

TOPIC 6 : TESTING HYPOTHESES

TOPIC 7 : CORRELATION and REGRESSION

TOPIC 8 : TIME SERIES

FINAL EXAM PAPERS

TUTORIAL EXERCISES

Quantitative Analysis Notes

4. THE NORMAL PROBABILITY DISTRIBUTION

OBJECTIVES

On completion of this unit students and using a graphics calculator where appropriate, students should be able to:

1. Recognise a data distribution whose general features could be explained by a normal density curve.
2. Locate the mean and estimate the standard deviation of a normal distribution given its density curve.
3. Understand and apply the 68-95-99.7% rule for determining the percentage of values that lie within one, two and three standard deviations of the mean of a normal distribution.
4. Standardise values in a normal distribution by applying the formula: $Z = \frac{X-\alpha}{\sigma}$
5. Utilise the TI-83 calculator to determine any given area under any normal curve.
6. Solve problems that utilise the normal probability distribution.

4.1. Introduction to the Normal Distribution [Video]

4.1.1. The Probability Density Curve

The general shape of a distribution is often described by a smooth line, which takes no account of the irregularities in the histogram of the sample data. The mathematical equation for the smooth curve which describes the distribution of a variable, can often be found. If the area under the smooth curve is equal to 1, then in this case the curve is called a probability density curve.

4.1.2. The Normal Density Curve

When a histogram of a data distribution is replaced by a density curve it is found that many of these density curves have the same characteristic bell shape. Since this bell shaped density curve occurs so often in practice, it has been given the special name of the normal density curve, or normal curve for short. This distribution was originally proposed by Karl Gauss, an 18 th century mathematician-astronomer, who observed that discrepancies among repeated measurements of the same physical quantity displayed a regular bell-shaped pattern which could be approximated by a special distribution which we now know as the normal distribution.

Figure 3.10: Screen shot of T&M e-book format with [Video] link.

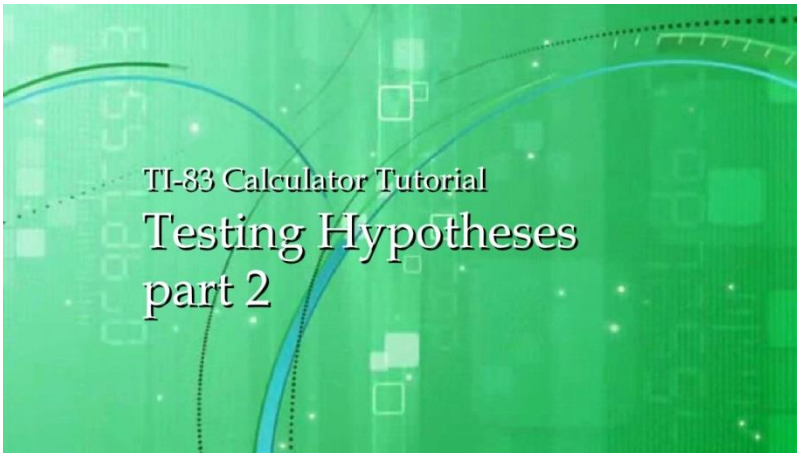


Figure 3.11: Screen shot of the “pop-out” screen showing the introduction page of the video and audio.

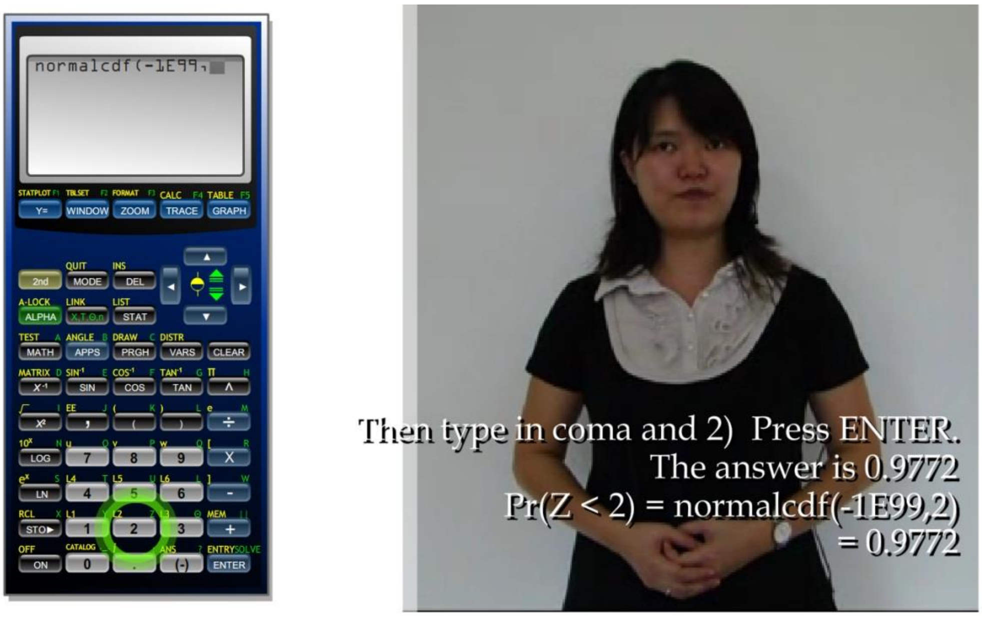
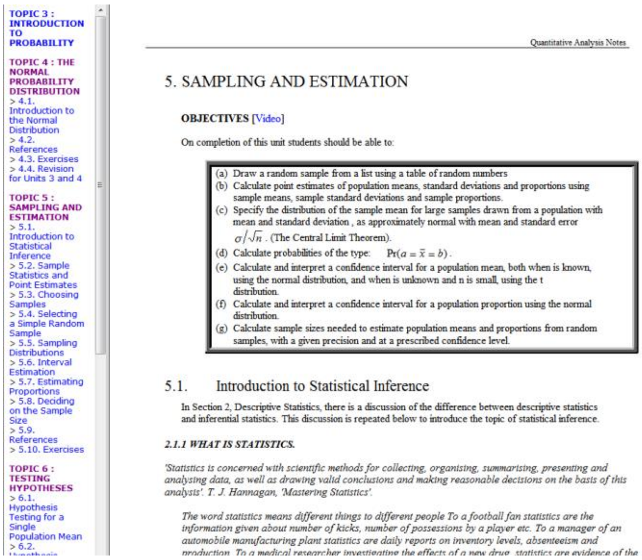


Figure 3.12: Screen shot showing the e-book page
(text, video and audio presentation embedded with animation).



TOPIC 3 : INTRODUCTION TO PROBABILITY

TOPIC 4 : THE NORMAL PROBABILITY DISTRIBUTION
> 4.1. Introduction to the Normal Distribution
> 4.2. References
> 4.3. Exercises
> 4.4. Revision for Units 3 and 4

TOPIC 5 : SAMPLING AND ESTIMATION
> 5.1. Introduction to Statistical Inference
> 5.2. Sample Statistics and Point Estimates
> 5.3. Choosing Samples
> 5.4. Selecting a Simple Random Sample
> 5.5. Sampling Distributions
> 5.6. Interval Estimation
> 5.7. Estimating Proportions
> 5.8. Deciding on the Sample Size
> 5.9. References
> 5.10. Exercises

TOPIC 6 : TESTING HYPOTHESES
> 6.1. Hypothesis Testing for a Single Population Mean
> 6.2.

Quantitative Analysis Notes

5. SAMPLING AND ESTIMATION

OBJECTIVES [Video]

On completion of this unit students should be able to:

(a) Draw a random sample from a list using a table of random numbers
(b) Calculate point estimates of population means, standard deviations and proportions using sample means, sample standard deviations and sample proportions.
(c) Specify the distribution of the sample mean for large samples drawn from a population with mean and standard deviation , as approximately normal with mean and standard error $\sigma/\sqrt{n}$. (The Central Limit Theorem).
(d) Calculate probabilities of the type: $\Pr(a = \bar{x} = b)$.
(e) Calculate and interpret a confidence interval for a population mean, both when is known, using the normal distribution, and when is unknown and n is small, using the t distribution.
(f) Calculate and interpret a confidence interval for a population proportion using the normal distribution.
(g) Calculate sample sizes needed to estimate population means and proportions from random samples, with a given precision and at a prescribed confidence level.

5.1. Introduction to Statistical Inference

In Section 2, Descriptive Statistics, there is a discussion of the difference between descriptive statistics and inferential statistics. This discussion is repeated below to introduce the topic of statistical inference.

2.1.1 WHAT IS STATISTICS.

'Statistics is concerned with scientific methods for collecting, organising, summarising, presenting and analysing data, as well as drawing valid conclusions and making reasonable decisions on the basis of this analysis'. T. J. Hannagan, 'Mastering Statistics'.

The word statistics means different things to different people To a football fan statistics are the information given about number of kicks, number of possessions by a player etc. To a manager of an automobile manufacturing plant statistics are daily reports on inventory levels, absenteeism and

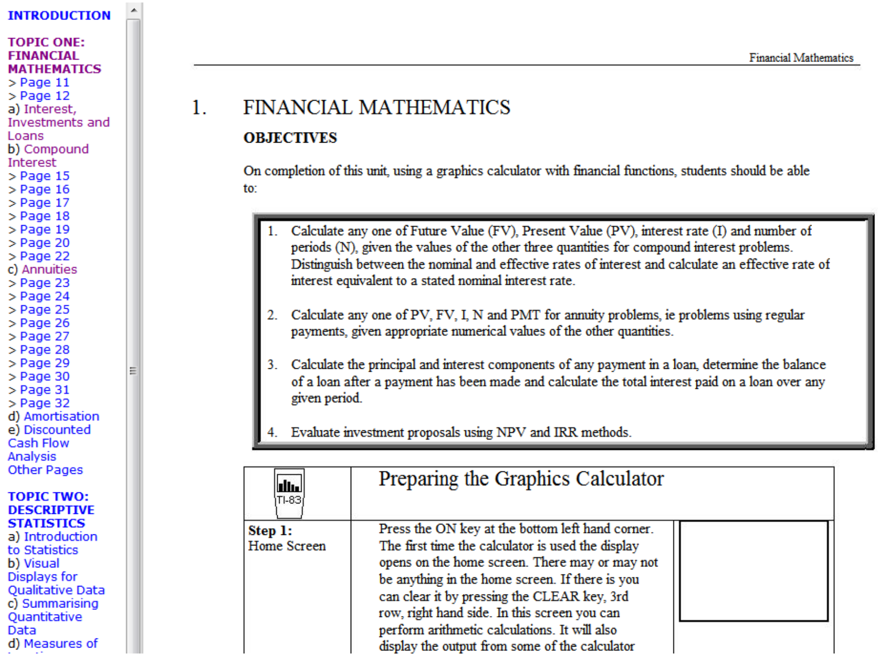
Figure 3.13: Screen shot of one of the e-book pages (T&M) with the [Video] options.

Figure 3.14: Screen shot of the "pop-out" screen showing the e-book page (text, video and audio presentation embedded with animation).

<u>Example of how the three e-book formats were developed in this study</u>

To further illustrate the difference among the three e-book formats in relation to the learning materials, an example on "How to prepare the graphic calculator for calculating Financial Mathematics" is presented.

As mentioned, T&S e-book format is a replica of the existing printed textbook as shown in Figure 3.15. The instruction was delivered in a table form, showing how to use the graphic calculator step-by-step.


INTRODUCTION

TOPIC ONE: FINANCIAL MATHEMATICS
> Page 11
> Page 12
a) Interest, Investments and Loans
b) Compound Interest
> Page 15
> Page 16
> Page 17
> Page 18
> Page 19
> Page 20
> Page 22
c) Annuities
> Page 23
> Page 24
> Page 25
> Page 26
> Page 27
> Page 28
> Page 29
> Page 30
> Page 31
> Page 32
d) Amortisation
e) Discounted Cash Flow Analysis
Other Pages

TOPIC TWO: DESCRIPTIVE STATISTICS
a) Introduction to Statistics
b) Visual Displays for Qualitative Data
c) Summarising Quantitative Data
d) Measures of

Financial Mathematics

1. FINANCIAL MATHEMATICS

OBJECTIVES

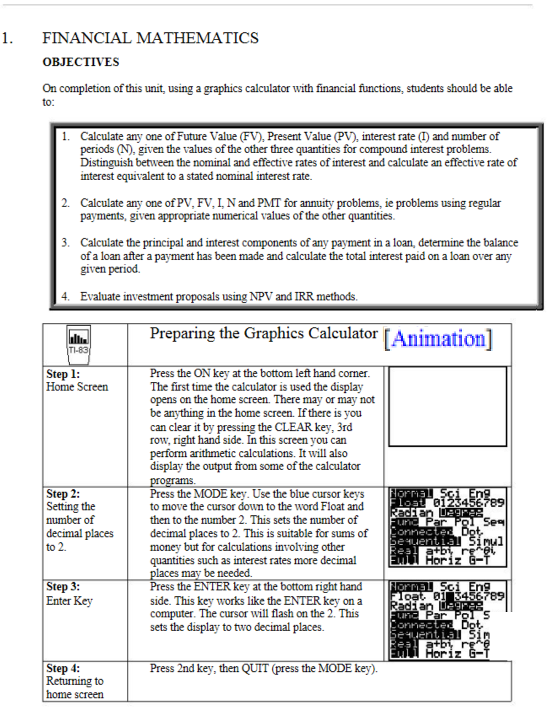
On completion of this unit, using a graphics calculator with financial functions, students should be able to:

1. Calculate any one of Future Value (FV), Present Value (PV), interest rate (I) and number of periods (N), given the values of the other three quantities for compound interest problems. Distinguish between the nominal and effective rates of interest and calculate an effective rate of interest equivalent to a stated nominal interest rate.
2. Calculate any one of PV, FV, I, N and PMT for annuity problems, ie problems using regular payments, given appropriate numerical values of the other quantities.
3. Calculate the principal and interest components of any payment in a loan, determine the balance of a loan after a payment has been made and calculate the total interest paid on a loan over any given period.
4. Evaluate investment proposals using NPV and IRR methods.

TI-83	Preparing the Graphics Calculator	
Step 1: Home Screen	Press the ON key at the bottom left hand corner. The first time the calculator is used the display opens on the home screen. There may or may not be anything in the home screen. If there is you can clear it by pressing the CLEAR key, 3rd row, right hand side. In this screen you can perform arithmetic calculations. It will also display the output from some of the calculator	

Figure 3.15: Screen shot of the page of the e-book (T&S) on "Preparing the Graphics Calculator" for calculating Financial Mathematics.

Using the same example, the T&A e-book include an animation link which is located in the same table description, as shown in Figure 3.16. Once the animation link is clicked, a "pop-up" window will appear, showing graphic calculator in animated version, giving similar instruction as from the table in T&S (refer to Figure 3.17).


1. FINANCIAL MATHEMATICS

OBJECTIVES

On completion of this unit, using a graphics calculator with financial functions, students should be able to:

1. Calculate any one of Future Value (FV), Present Value (PV), interest rate (I) and number of periods (N), given the values of the other three quantities for compound interest problems. Distinguish between the nominal and effective rates of interest and calculate an effective rate of interest equivalent to a stated nominal interest rate.
2. Calculate any one of PV, FV, I, N and PMT for annuity problems, ie problems using regular payments, given appropriate numerical values of the other quantities.
3. Calculate the principal and interest components of any payment in a loan, determine the balance of a loan after a payment has been made and calculate the total interest paid on a loan over any given period.
4. Evaluate investment proposals using NPV and IRR methods.

TI-83	Preparing the Graphics Calculator	[Animation]
Step 1: Home Screen	Press the ON key at the bottom left hand corner. The first time the calculator is used the display opens on the home screen. There may or may not be anything in the home screen. If there is you can clear it by pressing the CLEAR key, 3rd row, right hand side. In this screen you can perform arithmetic calculations. It will also display the output from some of the calculator programs.	
Step 2: Setting the number of decimal places to 2.	Press the MODE key. Use the blue cursor keys to move the cursor down to the word Float and then to the number 2. This sets the number of decimal places to 2. This is suitable for sums of money but for calculations involving other quantities such as interest rates more decimal places may be needed.	Normal Sci Eng Float 0123456789 Radian Degree Func Par Pol Seq Connected Dot Sequential Simul Real a+bi re^θi Full Horiz G-T
Step 3: Enter Key	Press the ENTER key at the bottom right hand side. This key works like the ENTER key on a computer. The cursor will flash on the 2. This sets the display to two decimal places.	Normal Sci Eng Float 0123456789 Radian Degree Func Par Pol S Connected Dot Sequential Sim Real a+bi re^θ Full Horiz G-T
Step 4: Returning to home screen	Press 2nd key, then QUIT (press the MODE key).	

Figure 3.16: Screen shot of an [Animation] hyperlink on the topic “Preparing the Graphics Calculator” for calculating Financial Mathematics.

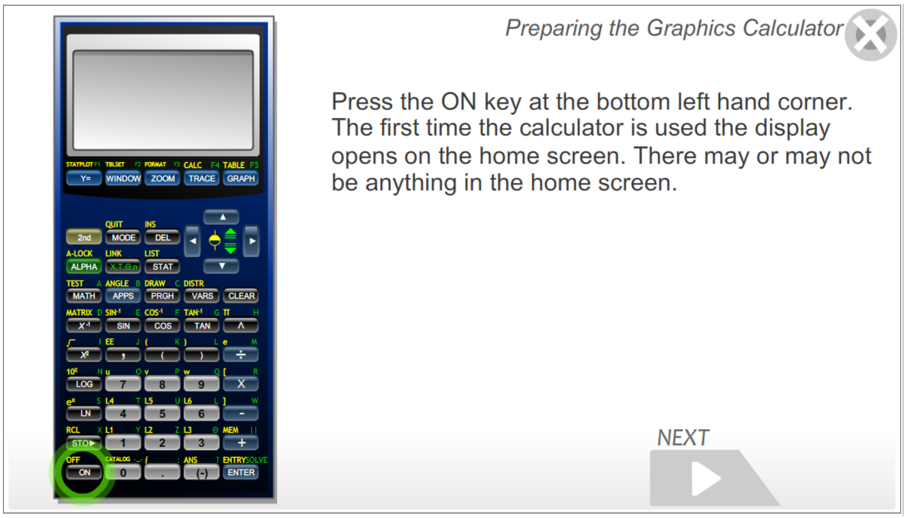
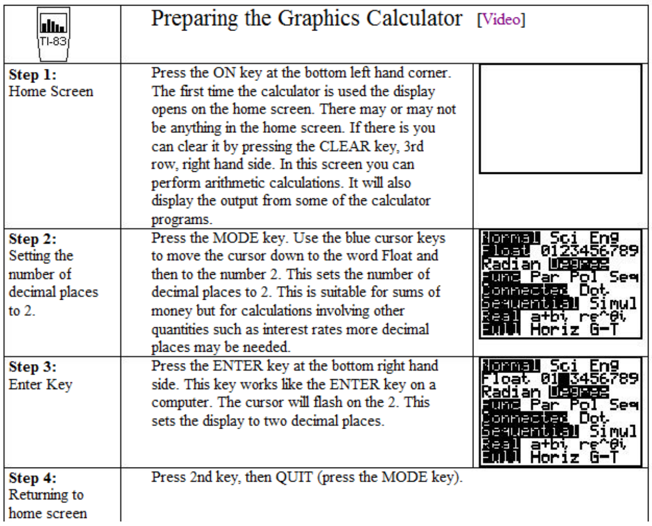


Figure 3.17: Screen shot of a “pop-up” window on the topic “Preparing the Graphics Calculator” for calculating Financial Mathematics.

Likewise, T&M e-book includes a video link and once click, a “pop-up” window will appear, showing a video and audio presentation on how to prepare the graphic calculator for calculating Financial Mathematics, embedded with animated graphic calculator. Figure 3.18 and Figure 3.19 show the screen shots of T&M e-book format.



TI-83	Preparing the Graphics Calculator [Video]	
Step 1: Home Screen	Press the ON key at the bottom left hand corner. The first time the calculator is used the display opens on the home screen. There may or may not be anything in the home screen. If there is you can clear it by pressing the CLEAR key, 3rd row, right hand side. In this screen you can perform arithmetic calculations. It will also display the output from some of the calculator programs.	
Step 2: Setting the number of decimal places to 2.	Press the MODE key. Use the blue cursor keys to move the cursor down to the word Float and then to the number 2. This sets the number of decimal places to 2. This is suitable for sums of money but for calculations involving other quantities such as interest rates more decimal places may be needed.	
Step 3: Enter Key	Press the ENTER key at the bottom right hand side. This key works like the ENTER key on a computer. The cursor will flash on the 2. This sets the display to two decimal places.	
Step 4: Returning to home screen	Press 2nd key, then QUIT (press the MODE key).	

Figure 3.18: Screen shot of a [Video] hyperlink on the e-book.

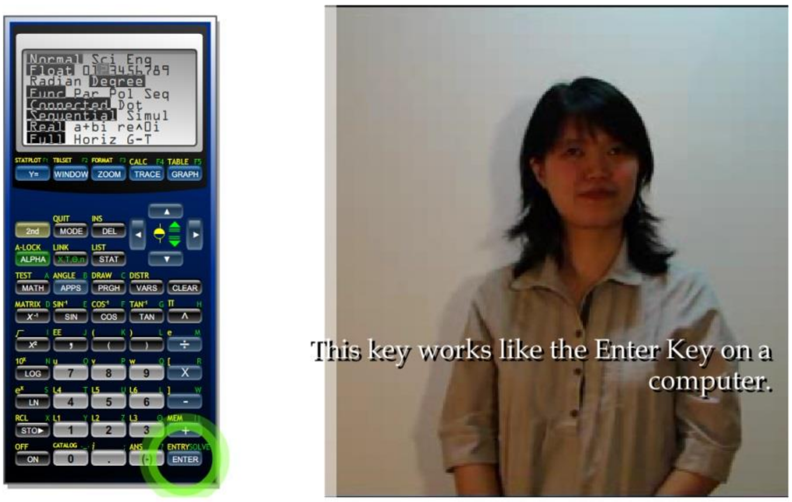


Figure 3.19: Screen shot of a T&M image of the e-book in a “pop-up” window

3.5.3 Phase 3: Implementation

The implementation phase includes the construction of the content graphical and multimedia elements. Since this is a development of existing paper-based textbook into e-books, most of the design elements such as colours, page layout, font styles and placement of the information in the e-books remain to maintain the originality of the textbook, except for developing animation and multimedia e-book formats. The phase included three main developments of e-books, namely Course Content and Learner Progression through e-book, Navigation and User Interface and Production of e-book and Media Experience.

Course Content and Learner Progression through E-book

As a first step, the learning materials from the paper-based text book need to be converted into PDF format. PDF format is probably the most common portable document format which can embed Flash, video, audio and possibly other media (Foasberg, 2011). The PDF format of the learning materials would be uploaded to local Web site in order to convert into an e-book.

In addition to the PDF format and easy access to the participants, the topics and subtopics are created to maintain a sense of orientation because it was assumed that if the participants lost track, it is more likely they may lose their motivation (Kalyuga et al., 2003). The participants may face the challenge of maintaining a balance between connectivity, for example, the distance between pages with too many links, where the participants may face difficulty of deciding where to go next

(Bollen, 1999). The more links participants can choose, the more likely they can experience the "lost in space" effect and distracted (Conklin, 1987, pg. 38). Li et al. (2013) also mentioned in their study that e-books should present with toolbar that reflect the physical structure of the book and the relative relationship between content structures and pages to ease the navigation.

Hence, the materials are instructionally enhanced by subdividing the materials into smaller chunks with individual headlines; a tree-like content hierarchy is created. Several studies indicated that a tree-like structure is helpful for novice learners and ill-structured materials. For example, experiments conducted by Pollock et al. (2002) showed that cognitive load was reduced for beginners, if ill-structured content, for example high element interactivity, was taught in a serial manner. Similarly, Shin, Schallert, and Savenye (1994) investigated the effect of content structures in a hypermedia learning environment and found that hierarchical (as opposed to networked) structures led to higher test grades. In accord with these findings, a hierarchical, tree-like content structure is built that reveal content pages progressively in the e-book, hoping to reduce the level of cognitive load among the users.

As a guide to the learner progression through the e-book, simple steps are displayed in Figure 3.20, detailing the steps and description of a learning sequence. Every lesson followed the same sequence in all three e-book formats and each of the tutorial groups is randomly assigned to an e-book format. The control group will be the tutorial group assigned to e-book with T&S format. The participants are shown an introductory page of their assigned e-book. The screenshots of the introductory page for the three e-book formats were displayed in Figure 3.21 to Figure 3.23 respectively. In the next step, participants are allowed to use the assigned e-book for the first six weeks of the semester followed by Mid Semester Test. The participants continue to use the assigned e-book for the rest of the semester. As part of the limitation of the study, the research has no control over participants from different groups, who may tend to interact and exchange what they experience from different e-book formats. Therefore, the participants are reminded to use the assigned e-book format from time to time during the experiment. To avoid the element of bias, the participants are not informed about preferences towards e-book format. After the end of semester, participants answer the questions in the questionnaire and finally the final posttest (Final Examination) will be administered.

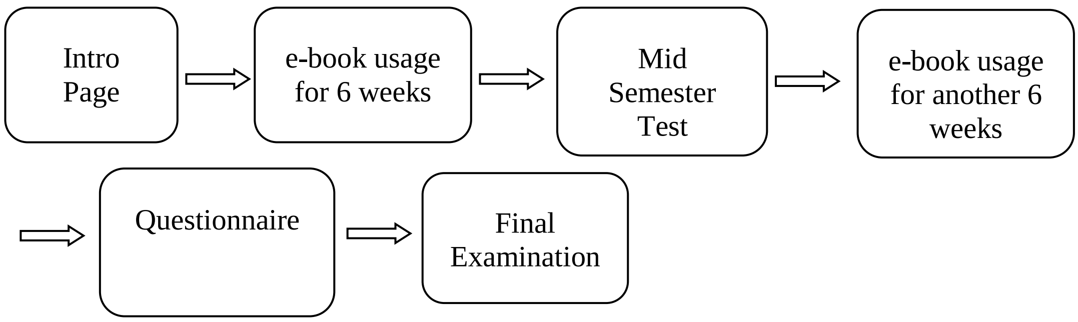


Figure 3.20: Learning sequence from intro page to post-test

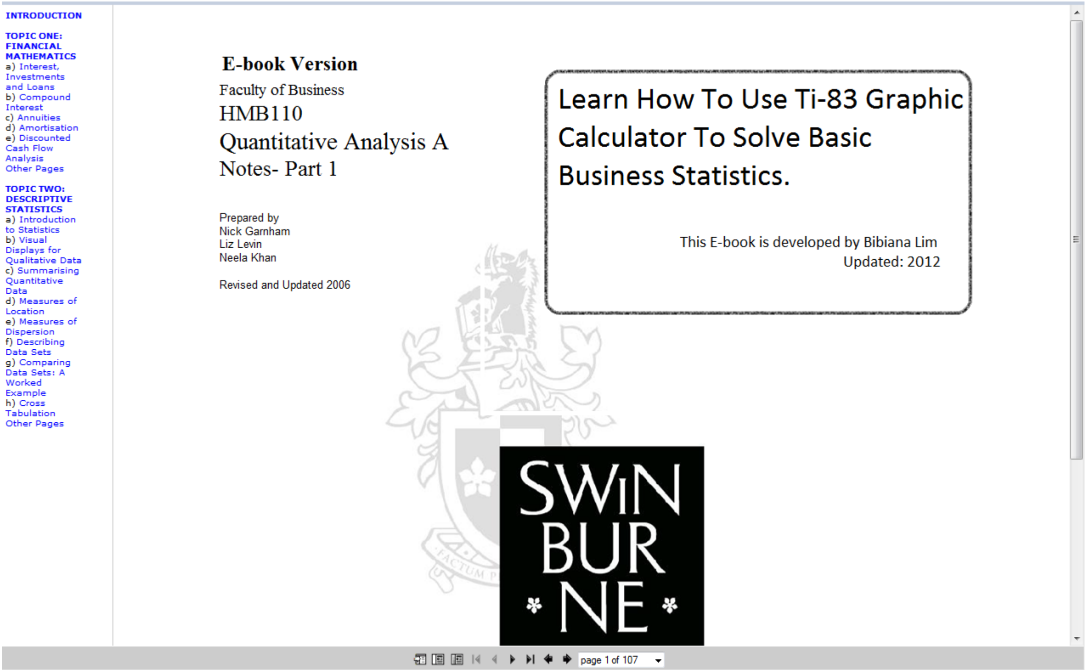


Figure 3.21: Screenshot of the T&S introductory page

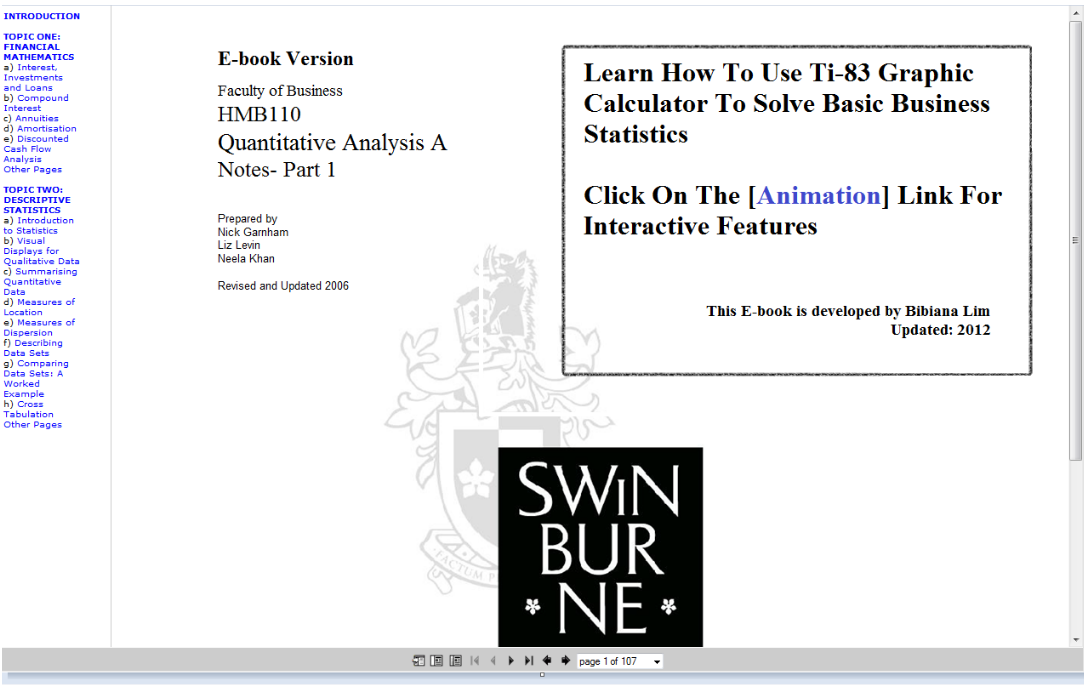


Figure 3.22: Screenshot of the T&A introductory page.

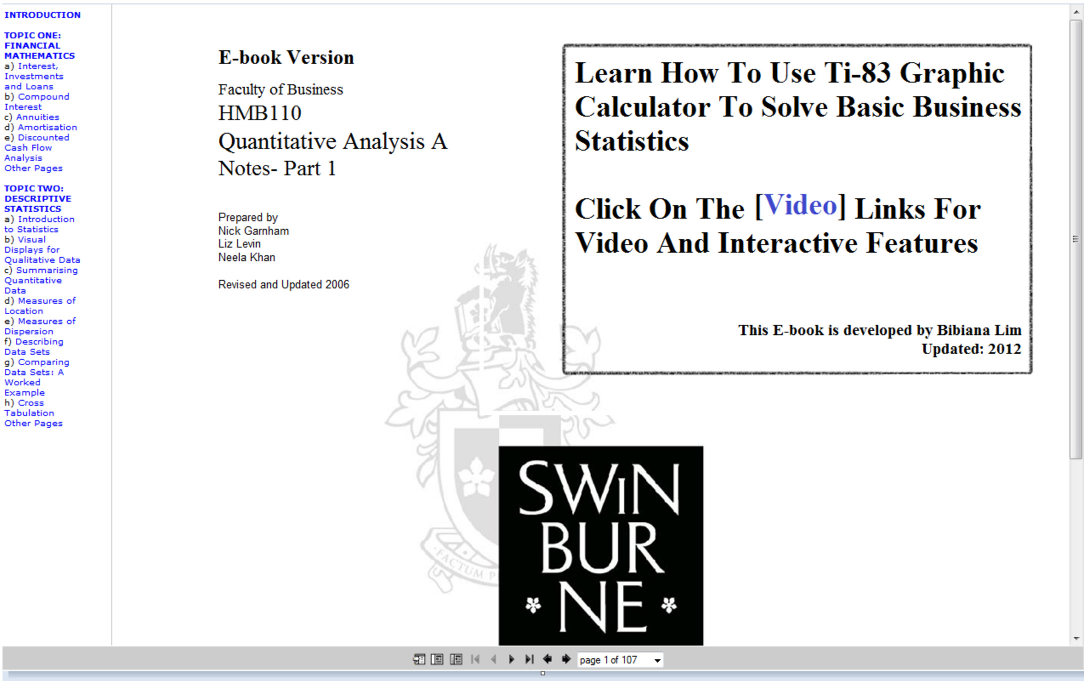


Figure 3.23: Screenshot of the T&M introductory page.

Navigation, User Interface and Production

It is essential that usability issues are considered and eliminated wherever possible to avoid a negative impact on the teaching and learning process (Bourges-Waldegg, Moreno, & Rojano, 2000). This section describes the user interface and the guidelines that were taken into account for this design.

Figure 3.24 depicts the main user interface of e-book, with individual components described below. Note that whenever participants click on the pages, only the content area in the centre of the screen change. The animation and multimedia presentation are presented in a separate window as shown in Figure 3.25 and Figure 3.26 respectively.

Learning tree: The learning content are accessible in a hierarchical, tree like fashion with the aid of a collapsible JavaScript tree menu. The tree grew with the learning progression of the learner.

Navigation tools: As shown in Figure 3.27, the learner has access to all the functions of the content pages, such as next page or last page options, different learning content panel or frame and access to different page number of the e-book [Go To Page].

Learning Content: The central screen area is reserved for the learning content, presented in text and static image, links to animation and multimedia.

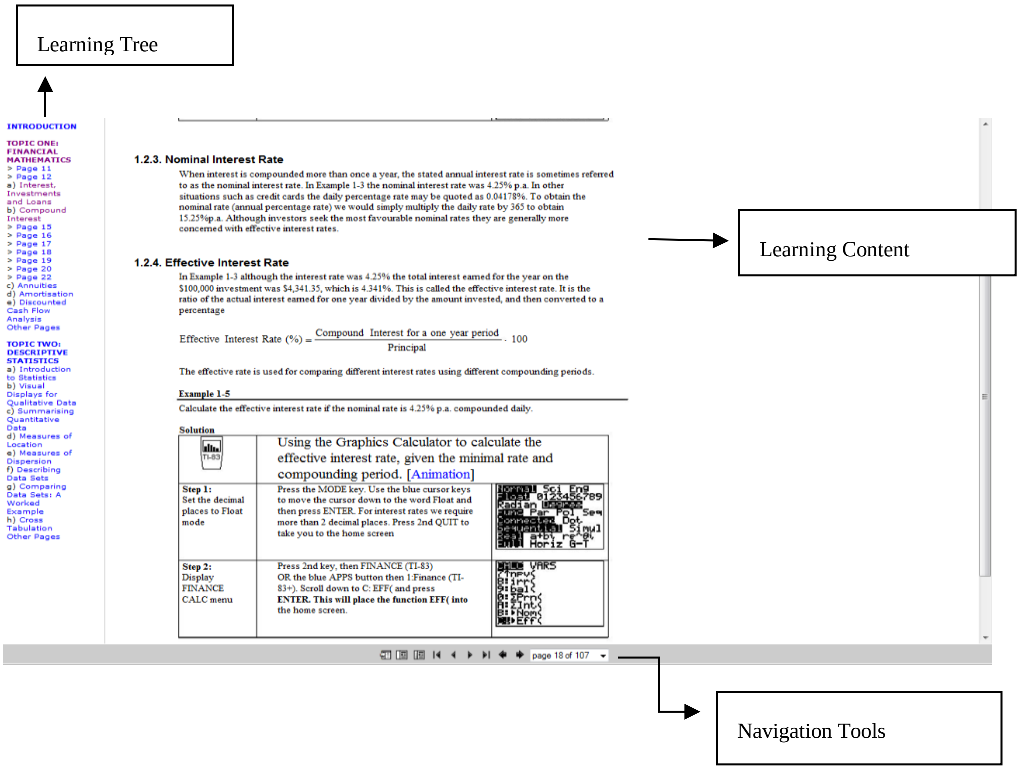


Figure 3.24: Screenshot of the main user interface of the e-book. The individual components are identified.

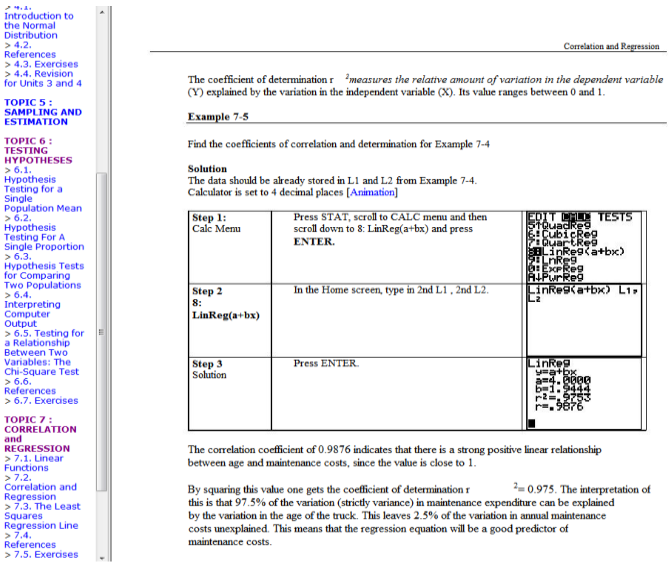


Figure 3.25: Screenshot of an example of an e-book with animation. Note that the hyperlinks in the learning content show the [Animation] link.

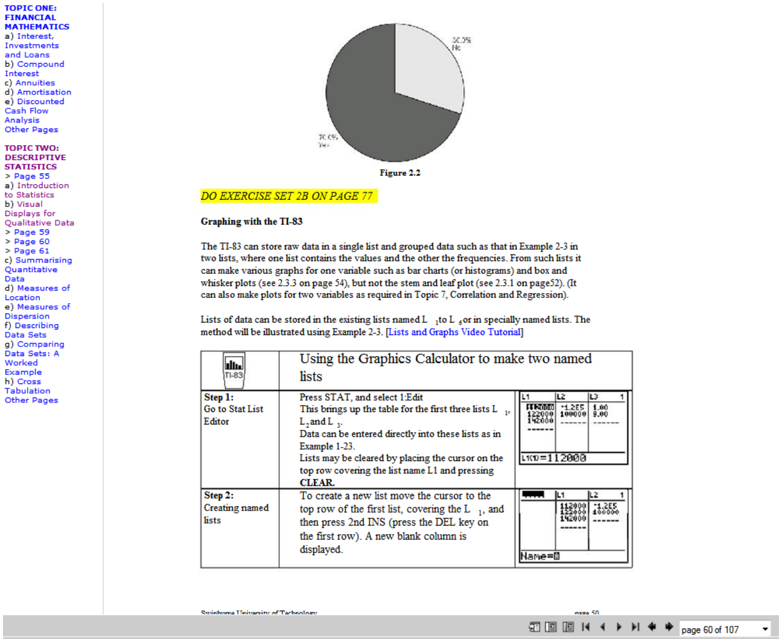


Figure 3.26: Screenshot of an example of an e-book with multimedia. Note that the [Lists and Graphs Video Tutorial] hyperlink.

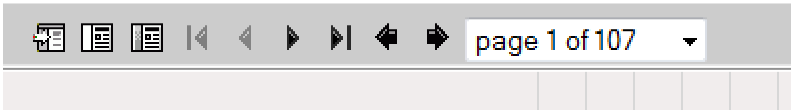


Figure 3.27: Screenshot of the navigation tools of the e-book.

The navigation is implemented using a JavaScript tree menu (Suehring, 2010), as depicted in Figure 3.28. The tree menu is similar to the Windows Explorer tree structure with expandable and collapsible submenus or branches and content leaves. It is the central navigation device for participants and therefore it is important as a guide for participants.

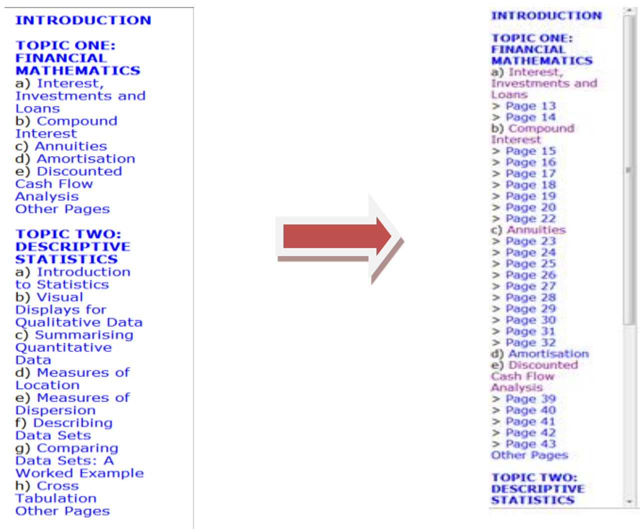


Figure 3.28: Screenshots of the tree menu navigation.

<u>Production of E-books and Media Experiences</u>

In the implementation and production of the e-book formats, the media experiences (animation and multimedia) consist of a variety of media, including HTML, interactive and non-interactive Flash animations and RealMedia files (synchronized with HTML pages via SMIL). Animations are created with Macromedia Flash. The Flash format is chosen over alternatives including Shockwave and Dreamweaver because of its widespread support in Internet browsers, the compact size of the output files and its building ActionScript capability. ActionScript allows the development of sophisticated animations (Suehring, 2010).

To produce auditory and video media experience from the textual materials, the manual recording is chosen because an animated character and speech synthesis with a computer program were considered too impersonal and too difficult to follow. The audio and video are recorded over three months with recording equipment in the School of Business and Design laboratory at Swinburne University of Technology, Sarawak Campus. Afterwards, the materials are cut, filtered, normalized and finally compressed with the RealMedia codec. The RealMedia codec was selected, because a subjective codec comparison gave the impression that this codec produced more superior results for voice-only audio and video (Dingler et al., 2008; Stokas, 2002).

The linking of PDF within HTML content pages with corresponding animation and video stream is achieved through the Synchronised Multimedia Integration Language (SMIL). SMIL is an XML-based language that stored in simple text files. SMIL can combine separate media elements in a flexible way. This facilitates content maintenance and guarantees the future scalability of the learning environment.

All three formats of the e-books are tested on both Windows 7 operating systems and on Internet Explorer 6. A minimum screen resolution of 1024 x 768 pixels is required. The client computers need a local installation of Active-X Control, which will be prompted by Internet Explorer 6.

3.5.4 Phase 4: Testing

The next phase, testing, concerns the launching of the e-book, where students are about to use the e-book for the first time, and thus begin a process that started with the pilot study.

Moore, Winograd, and Lange (2001) emphasized the importance of opening and initiating instruction before introducing a new learning tool to students. The researcher begins the first instructional class with a short 10 to 15 minute introductory speech and tour of the e-books for each group of the participants. Directions on the e-books are also uploaded in the Blackboard Learning System and emails are sent to encourage participation in the study. Participants are briefed on the contents and are directed to explore their assigned e-book on their own. More information on the pilot study is discussed in Section 3.6.

3.5.5 Phase 5: Maintenance

The final phase is maintenance. The maintenance phase helps the researcher to determine whether the learning tool is successful and how it can be improved. In this phase, students' interaction in e-books, feedback, questions, emails and responses to the questionnaire are used as the sources of evaluation. To describe the difference experiences and observations during this phase, the following observations have been divided into two general categories: general observations of student use and design observations.

Based on the results of the pilot study, several issues were identified. The issues and solutions were as follows:

General Observation

Beginning with general observation, there were several key elements of participants' use of the e-book. The first was their use of the e-book was immediate and apparently effortless. The participants began to explore the content and the links immediately after the introductory tour. During this time, there were no questions and participants were able to navigate without any further instruction. Second, the participants began to explore the content and the researcher became aware of the amount of reading that students were doing on the e-books. Many of them were only skim-reading, if reading at all. The research was proposing to the students that they need to read the content in the e-book as much as they would read a paper-based text-book. Therefore, in the actual data collection, the researcher emphasized the importance of reading the content of the e-book to the participants.

During the pilot study period, it was found that the participants faced difficulty in seeking assistance. For example, one of the participants emailed to the researcher on the how to solve a tutorial question using the Ti-83 graphic calculator. The researcher did not give any explanation on the tutorial question, as the role of the researcher was more to technical support and only intervened in the event of technical problems such as faulty links or about the user interface. The researcher did not assume the role of lecturer in this study and the interactions between the participants and the researcher were kept to a minimum during the experiments to reduce any element of bias. Nevertheless, the researcher encouraged the participant to focus on the materials presented in the e-book that was assigned. Instead, the participant reached for the lecturer in the class because they were used to receiving an immediate response from the lecturer in the tutorial class. In order to solve this, the researcher highlighted that the participants should try the e-books first before directly going to their lecturer for help. In the actual study, the researcher emphasized this issue again to ensure smooth process of data collection.

In the beginning of the pilot study, some of the participants expressed discomfort with the e-books. For example, one of the participants expressed that reading from computer or laptop was tiring to the eyes and they were concerned about the confidentiality. The participants were briefed on the purpose of this study again and reassured that the confidentiality of the data would be protected. To minimize the eyes fatigue among the participants, the researcher informed the lecturer to allow some breaks during the tutorial class.

Overall, from the pilot study feedback, the audio and visual data recorded had fair quality. There were no reports or complaints from the participants on any faulty links in the e-book. Finally, the data collection during the pilot study was running smoothly at the end of the six weeks.

Design Observations

During the pilot tests, several irregularities and errors shown in different Internet browsers were detected by some of the participants. As a consequence, the allowed browser was restricted to Microsoft Internet Explorer (with Active-X Control installed) only, as the other browsers do not support the Flash scripts written for the e-books.

A number of participants reported that they felt frustrated with the initial Navigation Bar. The participants found it difficult to go to certain page by clicking on the left panel Navigation Bar. To overcome the problem, a tree-like menu (as shown in Figure 3.29) was created and enhanced with the main topic and sub-topics.

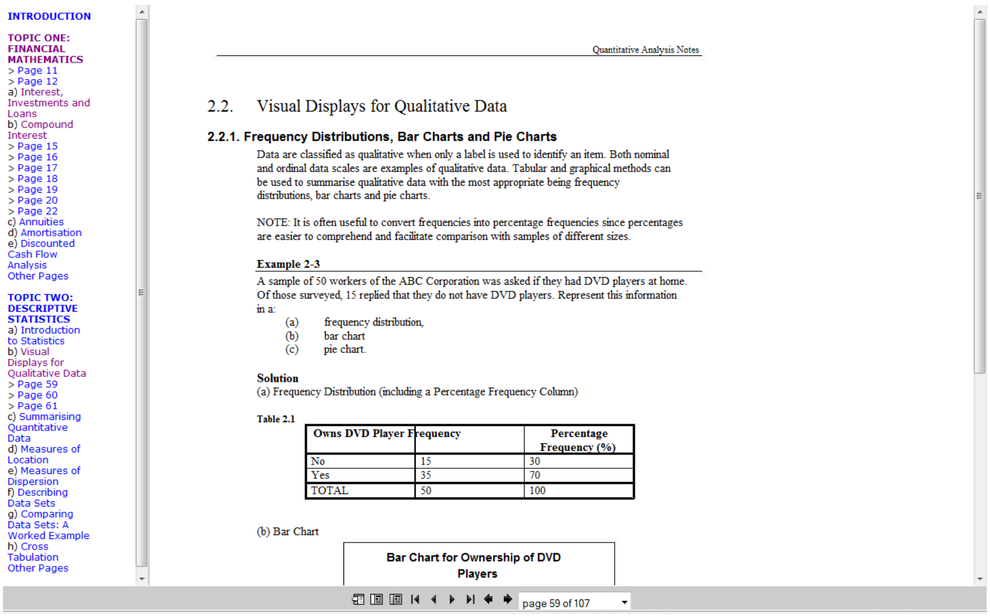


Figure 3.29: Screenshot of tree-like menu on the left panel.

The T&A e-book format had some settings which create difficulty for the participants. For example, some participants noticed that there was no [CLOSE] button for the initial animated version of the e-book. Hence, to solve this problem, a [CLOSE] with "X" button was created at the upper right corner of the animation (See Figure 3.30).

With these two design errors detected during the pilot study, the researcher redesigned the e-book accordingly to the needs of the participants.

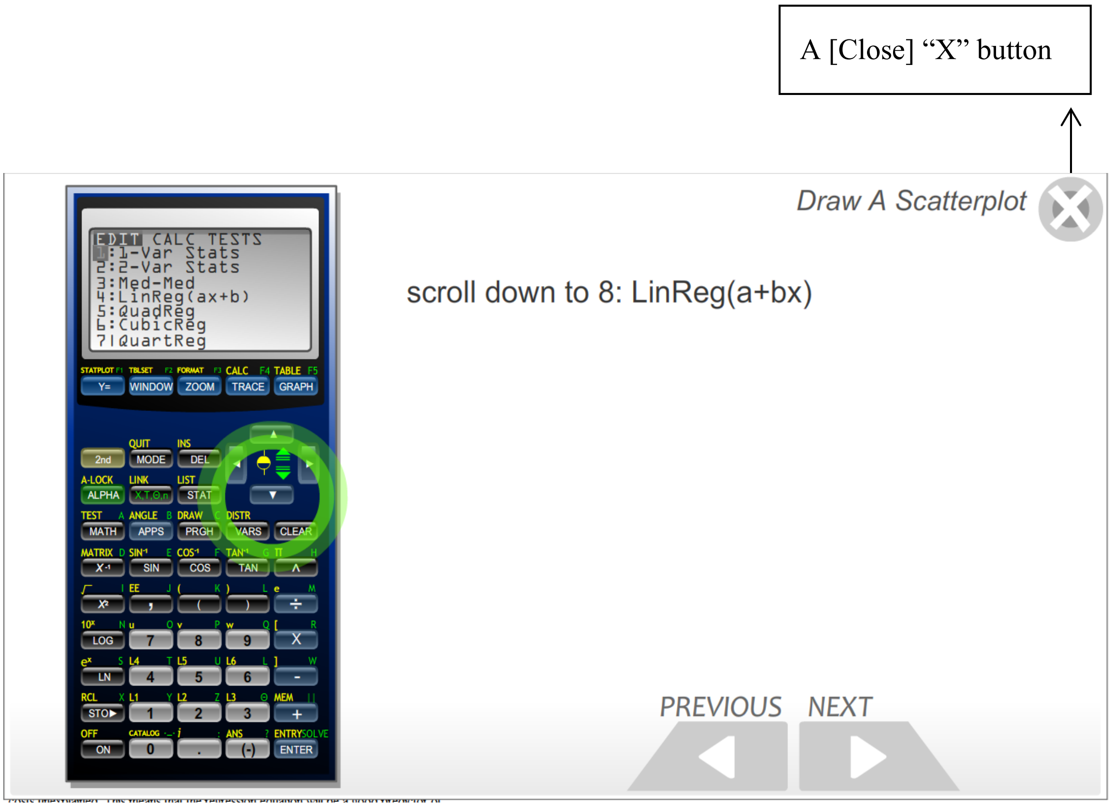


Figure 3.30: Screen shot of e-book with animation with [CLOSE] "X" button at the upper right corner.

3.6 Pilot Study

To ensure reliability of the research instrument, a pilot study was carried out to test part of the e-book and questionnaires were also distributed. The details of the participants for the pilot study are discussed in Section 3.6.1.

The e-book was designed in three formats namely, T&S, T&A and T&M and was never used before in any related studies. Apart from improving the user interface, the pilot study allowed the e-book usability and reliability to be established before it can be used in the main study. The pilot study also helped to analyse the data preliminarily and examined any similarities or differences in results with relevant studies conducted in the past. Lastly, there is a need to conduct a pilot run of the whole procedure to check the validity and reliability of the research instruments.

3.6.1 Pilot Study Results

The pilot sample were students enrolling in HMB1110 Quantitative Analysis in second semester (starting September), in the year 2011. The pilot study only run for the first six weeks of the semester and data were collected at the end of six weeks, with only Mid Semester Test been administered. The participants were a different cohort from the actual study, although there might be repeaters in the actual study (next semester), if they failed in this unit. Overall, there were 87 students who completed the instruments in the pilot study. As shown in Table 3.11, there were 30 students in the T&S group, followed by 28 students in the T&A group. Lastly, 29 students participated and used the T&M e-book in the pilot study.

Table 3.11 Participant distribution of each group for the pilot study

Demographics Variables		T&S		T&A		T&M		Overall	
		N (30)	%	N (28)	%	N (29)	%	N (87)	%
Gender	Male	16	53.3	13	46.4	14	48.3	43	49.4
	Female	14	46.7	15	53.6	15	51.7	44	50.6
Commerce Major	Accounting	10	33.3	13	46.4	11	37.9	34	39.1
	Marketing	1	3.3	6	21.4	5	17.3	12	13.8
	Human Resource	0	0.0	2	7.1	4	13.8	6	6.9
	International Business	2	6.8	2	7.1	1	3.4	5	5.7
	Management	7	23.3	4	14.4	6	20.7	17	19.5
	Finance	0	0.0	1	3.6	0	0.0	1	1.2
	Others	10	33.3	0	0.0	2	6.9	12	13.8
Computer Usage	Less than 5 years	3	10.0	0	0.0	4	13.8	7	8.0
	More than 5 years	27	90.0	28	100.0	25	86.2	80	92.0

Data gathered from the pilot study was evaluated to determine if any changes were necessary. The reliability of the research instruments namely the Post-Study System Usability Questionnaire (PSSUQ), Cognitive Load (CL), Learning Self-Efficacy (LSE), Statistics Anxiety Scale (SAS) and Learning Style Inventory (LSI) were measured based on Cronbach's alpha for the participants in the pilot study. The respective values were shown in Table 3.12.

Table 3.12 *Internal Reliability of the Instruments for Pilot Study*

Instrument Categories	Alpha
Post-Study System Usability Questionnaires (PSSUQ)	0.886
Cognitive Load (CL)	0.832
Learning Self-Efficacy (LSE)	0.832
Statistics Anxiety Scale (SAS)	0.928
Learning Styles Inventory (LSI)	0.576

Note: n = 87

According to Salkind (2011), Cronbach's alpha coefficients values above 0.70 were considered acceptable for analyses. Therefore, the values of the reliability results were acceptable except for LSI instrument. Kolb (1985) reported a standard alpha from 0.71 to 0.85 in terms of reliability for LSI. However, in this pilot study, the value for LSI was 0.576 and was considered to be lower than those reported by Kolb (1985), Wang et al. (2006), Kolb and Kolb (2011) and Ku and Chang (2011). Nevertheless, the low value was similar to result found by other independent studies (French & Poulsen, 2002; Sternberg & Zhang, 2000). As raised by Craighhead and Nemeroff (2001), the possibility of low reliable value for LSI was due to small number of responses in each subscale. Furthermore, the participants could not fully interpret their own learning styles as Oughton and Reed (2002) posited that early tertiary university students may find it difficult to identify their own learning styles.

Table 3.13 Means and standard deviations for the PSSUQ factors

Item No.	PSSUQ Factors	Overall		T&S		T&A		T&M	
		M	SD	*M*	SD	*M*	SD	*M*	SD
1.	Design & Layout	2.98	0.724	3.02	0.655	3.13	0.529	2.80	0.875
2.	Functionality	2.92	0.729	2.88	0.800	2.99	0.599	2.86	0.747
3.	Ease of Use	2.99	0.724	2.77	0.788	3.19	0.544	3.03	0.741
4.	Ability to Learn	3.08	0.658	2.95	0.634	3.07	0.602	3.21	0.709
5.	Satisfaction	3.00	0.698	2.91	0.655	3.05	0.538	3.05	0.828
6.	Future Use	2.97	0.698	2.84	0.679	3.07	0.576	3.02	0.800
7.	Errors	3.00	0.707	2.93	0.765	3.02	0.526	3.05	0.792
	Average	2.99	0.662	2.86	0.710	3.07	0.559	3.03	0.784

Noted: 1) T&S = Text and Static Image, T&A = Text and Animation, T&M = Text and Multimedia, and SD = Standard Deviation. 2) The items in the PSSUQ questions had responses in the Likert format with: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Agree (A) and 4 = Strongly Agree (SA). 3) For the overall scores, scores of 1.0-1.99 = low level, 2.0-2.99 = moderate level and 3.0-4.0 = high level.

According to the pilot PSSUQ results as shown in Table 3.13, overall, most of the students perceived that the e-books were easy to learn and the information provided for the e-books was easy to understand (refer item 4 in Table 3.13, M = 3.08). This was followed by the high level of satisfaction among the participants while using the e-books (refer item 5 in Table 3.13, M = 3.00). In addition, when the participants made a mistake while using the e-books, they could recover easily and quickly with the help of clear error messages prompted by the e-books (refer item 7 in Table 3.13, M = 3.00). However, the participants scored lower for the functionality factors, as they faced difficulty in completing the tasks and became less productive while using the e-books (refer item 2 in Table 3.13, M = 2.92).

The participants who used the T&A and T&M e-book formats reported higher average scores than T&S group of participants in most of the PSSUQ items. Unlike participants using T&A e-book format, participants using T&S e-book format found that the e-book was rather difficult to use and the information was difficult to find and the instructions was not clear (refer item 3 in Table 3.13, M = 2.77).

The results of the pilot study suggest that all three e-book formats are suitable to use in the research study, based on PSSUQ outcomes. Based on this, the research continued into the actual study but in a period of 12 weeks.

3.7 Data Analyses

The data analyses are carried out based on the research questions for the study. SPSS is used to run the required analyses of the data collected. The analyses are conducted to measure categories representing demographic data, usability test, cognitive load, self-efficacy level, statistics anxiety level and learning styles.

There are five steps in the data analysis for quantitative analysis:

(1) For each section of the questionnaire, the reliability, Cronbach's alpha is calculated to estimate the internal consistency.

(2) Descriptive statistics such as frequency distributions, mean and standard deviations of all the instruments and items are measured.

(3) For the inferential statistics, the assumptions of the test are first tested.

(4) Inferential statistics of One-Way ANOVA and One-Way MANOVA are then implemented to examine the differences between the three e-book formats among the dependent variables. If the test was significant, post-hoc multiple comparison tests are carried out. Additionally effect sizes are calculated, which indicate the magnitude of the difference between the conditions (McKay, 2000). Effect size is a measure of the strength of the relationship between two variables and indicates practical significance (Cohen, 1992; Rosenthal & Rosnow, 1991). This study used Cohen's *d* effect size value.

(5) Hierarchical multiple regression are conducted to identify significant predictors of dependent variables about the three e-book formats and to test moderating effect in the hierarchical regression. According to Baron and Kenny (1986), a moderator is defined as a variable that affects the direction and/or strength of the relationship between a predictor (or independent variable) and a criterion (or a dependent variable).

The open-ended questions survey is not used to answer the research questions; rather they are utilized to corroborate for the usability results of the e-book. The 'unit of analysis' refers to 'a short phrase' or 'a sentence' from each participant's response to the open-ended question and are studied carefully to determine categories and codes. The researcher uses 'unit of analysis' for coding and also looks for description (Babbie, 2013). This means that the data is not coded sentence by sentence, but coded for meaning by reading through the data and comparing with literature review (Babbie, 2013, Maykut & Morehouse, 1994). Then, the unit of analysis re grouped into categories and constant comparative method is used. Maykut and Morehouse (1994) defined constant comparative method as a process of coding the data by category, comparing meanings across categories, refining categories, exploring relationships and patterns across categories and integrating the data. This is followed by the rules of inclusion where statements from the data would serve as the basis for including or excluding a unit of analysis in the category (Babbie, 2013; Maykut & Morehouse, 1994). Hence, pieces of data would often intersect to make meaningful connections and build categories of relevant information. Table 3.14 shows the categories related to participant's perception towards e-book formats.

Table 3.14 *Categories, rules of inclusions, and examples for coding the participants' perceptions towards e-book formats*

Categories	Rules of inclusion	Examples
Physical constraint	Participants felt that they were mostly tired, having fatigue, having eye-strain, and having difficulty remembering information especially when using T&S e-book format. This was indicated by comments such as "tiredness", and "dizzy".	"I need to have a computer to open the e-book while having a textbook is easier. My eyes become tired looking at the computer screen for a long time." (Participant A from T&S e-book group) "I have difficulty in recalling what I have read in the e-book and following the video on screen. Sometime I felt like I'm just watching a short

		movie and my mind wondered elsewhere.” (Participant K from T&M e-book group)
Time constraint	Participants felt that it was time-wasting to use e-book to learn statistics which indicated by comments such as “waste time”, and “slow”.	“I still think printing textbook is better as it saves time. Searching for some information in the e-book is a waste of time and slower. I need to hit the forward button to look for a certain method to use the graphic calculator.” (Participant B from T&S e-book group) “I think it is a waste of time to sit in front of the computer and listening to the video. I am somehow discouraged to follow the video all throughout the semester.” (Participant J from T&M e-book group)
Onscreen design problem	Participants commented that the navigation of the e-book was difficult to follow and the font sizes were too small for reading especially T&S e-book format. Other indications were phrases such as “difficulty in navigation”, “font size too small”,	“I am kind of lazy to access the e-book and to go through the pages. I don’t like to click on the page by page to read the e-book. I think textbook is still better for easy access.” (Participant F from T&S e-book group) “The font size is too small to read and it is difficult to read

	"difficult to read", and "design problem".	from the screen." (Participant C from T&S e-book group)
Positive responses	Participants found the e-book to be a new experience and generally motivated (phrases such as "like", "good", "nice", and 'interested') the participants toward using the e-book.	"I like the idea of having video and sound, seem like a lecture within the e-book. It interests me in learning statistics." (Participant O from T&M e-book group) "I think the animation is easy to follow to learn [how to use] the calculator. I find it interesting." (Participant N from T&A e-book group)
Negative responses	Participants expressed their general negative experiences when using the e-books. This were indicated by comments such as "troublesome", "not helping", "difficult to follow", and "boring".	"It's troublesome and the e-book did not help me much in learning." (Participant A from T&S e-book group) "I don't think learning statistics with graphic calculator is going to help in our future (working life) because we may not use it anymore." (Participant G from T&A e-book group)

Investigate the effects of the three e-book formats on the level of Cognitive Load among the students in the statistics subject;

(RQ1) Are there differences in the level of Cognitive Load as perceived by the students in the statistics subject for the three e-book formats?

Descriptive statistics such as Means and Standard Deviations are calculated for the three groups of participants using three e-book formats. The independent variables are the e-book formats (T&S, T&A and T&M) and dependent variable is the level of cognitive load. To answer the question, a One-Way ANOVA is performed. If the test is significant, post-hoc multiple comparison tests are carried out. The effect size is also calculated.

Investigate the effects of the three e-book formats on the level of Self-Efficacy among the students in the statistics subject;

(RQ2) Are there differences in the level of Self-Efficacy as perceived by the students in the statistics subject for the three e-book formats?

Descriptive statistics such as Means and Standard Deviations are calculated for the three groups of participants using three e-book formats. The independent variables are the e-book formats (T&S, T&A and T&M) and dependent variable is the level of self-efficacy. To answer the question, a One-Way ANOVA is performed. If the test is significant, post-hoc multiple comparison tests are carried out. The effect size is also included in the analyses.

Investigate the effects of the three e-book formats on the level of Statistics Anxiety among the students in the statistics subject;

(RQ3) Are there differences in the level of Statistics Anxiety as perceived by the students in the statistics subject for the three e-book formats?

Descriptive statistics such as Means and Standard Deviations are calculated for the three groups of participants using three e-book formats together with the effect size. The independent variables are the e-book formats (T&S, T&A and T&M) and dependent variable is the level of statistics anxiety. To answer the question, a One-Way ANOVA is performed. If the test is significant, post-hoc multiple comparison tests are carried out.

Investigate the effects of the three e-book formats on the students' achievement;

(RQ4) Are there differences in the students' achievement in the statistics subject for the three e-book formats?

The students' achievement is determined by the two posttests, Mid Semester Test and Final Examination. The mean scores for both of the post-tests are checked using paired t-test for significant differences in both post-tests. The independent variables are the e-book formats (T&S, T&A and T&M) and dependent variable is the two posttests. A One-Way MANOVA is performed. If the test is significant, post-hoc multiple comparison tests are carried out. The effect size is also calculated.

Investigate the effects of the three e-book formats on Cognitive Load; the level of Self-Efficacy; the level of Statistics Anxiety; and Achievement with Gender, Computer Use Experience and Learning Styles as the moderators;

(RQ5) Are the effects of the three formats of e-book on Cognitive Load, the level of Self-Efficacy, the level of Statistics Anxiety and Achievement moderated by Gender, Computer Use Experience and Learning Styles?

Before analysing the data using hierarchical multiple regression, participants' learning styles are calculated from LSI and groups of learning styles are identified.

Determine the types of learning styles among the participant's based on Kolb learning model.

Frequency and descriptive statistics are carried out with the examination on the participants' learning styles using Kolb and Kolb's (2011) LSI. The learning type was classified into 'Diverger', 'Assimilator', 'Converger' and 'Accommodator'. Twelve short statements concerning learning situations are presented and the participants re required to rank order four preferences for learning organized in four columns (e.g., When I learn: "I like to deal with my feelings," "I like to watch and listen," "I like to think about ideas," and "I like to be doing things"). After summing up each of the four columns, a total score for each of the four learning modes (concrete experience-CE, reflective observation-RO, abstract conceptualization-AC and active experimentation-AE) is obtained for each participant. Combined scores between the learning modes are also obtained to address the participants' preferences for each of the four learning styles: convergent (AC/AE), divergent (CE/RO), assimilative (RO/AC), and accommodative (AE/CE).

Specifically, to answer research question 5, a series of hierarchical multiple regression (also referred as sequential regression) are used, in which the independent variables can enter the regression model in an order specified by the researcher (Tabachnick & Fidell, 2007). The advantage of hierarchical regression is that it can identify the R square of each block of independent variables, whereas standard multiple regression can only give the total R Square of all independent variables (Hair et al., 2007).

First, the order of variables entering into the regression model, are determined according to the previous literature. With this, the hierarchical multiple regression placed participant's gender and computer use experience variables (moderator variables) in the first block, participants' learning styles (moderator variable) in the second block, and the three e-book formats (independent variables) in the last block. If any unique contribution is found to be significant, it would be sensible to conclude that the independent variables could significantly predict the dependent variables (Hair et al., 2007). Table 3.15 summarizes the data analysis performed to answer the research questions.

Table 3.15 *Research Questions and Analysis*

Research Questions	Data and variables	Data Analysis
1. Are there differences in the level of Cognitive Load (CL) as perceived by the students in the statistics subject for the three e-book formats?	Section 3 (CL) of the questionnaire • IV = e-book formats • DV = CL	Means and Standard Deviations, Frequency Distributions and One-Way ANOVA
2. Are there differences in the level of Self-Efficacy (SE) as perceived by the students in the statistics subject for the three e-book formats?	Section 4 (LSE) of the questionnaire • IV = e-book formats • DV = SE	Means and Standard Deviations, Frequency Distributions and One-Way ANOVA
3. Are there differences in the level of Statistics Anxiety (SA) as perceived by the students in the statistics subject for the three e-book formats?	Section 5 (SAS) of the questionnaire • IV = e-book formats • DV = SA	Means and Standard Deviations, Frequency Distributions and One-Way ANOVA
4. Are there differences in the students' achievement in the statistics subject for the three e-book formats?	Results from 2 posttests (Mid Semester Test and Final Examination) • IV = e-book formats • DV = 2 posttests results	Means and Standard Deviations, Frequency Distributions and One-Way MANOVA

5. Are the effects of the three formats of e-book on Cognitive Load, the level of Self-Efficacy, the level of Statistics Anxiety and Achievement moderated by Gender, Computer Use Experience and Learning Styles?	Section 1 (Demographics), 3, 4, 5, and 6 (Learning Style) of the questionnaire and 2 posttests • IV = e-book formats • DV = CL, SE, SA, 2 posttests results • Moderators = Gender, Computer Use Experience, Learning Style	Descriptive Statistics to find out Learning Styles Hierarchical Multiple Regression Block 1: Gender and Computer Use Experience (Moderator variables) Block 2: Learning Styles (Moderator variable) Block 3: E-book Formats (Independent variables)

Note: IV = Independent Variable, DV = Dependent Variable, CL = Cognitive Load, SE = Self-Efficacy and SA = Statistics Anxiety

3.8 Threats to Internal and External Validity

Quasi-experimental research design has an intermediate level of internal validity (Bleses, Vach, Jorgensen, & Worm, 2010). A possible threat to internal validity is "selection threat". A selection threat occurs when the control group and treatment groups have apparent effect on the intervention due to differences in the participants' characteristics. For this reason, control and treatment groups should be similar, especially with respect to any variables that can affect the measured outcomes (Bleses et al., 2010; Mitchell & Jolley, 2012). In this study, it is assumed that the participants enrolled in HMB110 Quantitative Analysis possessed similar characteristics in terms of age, level of prior education and statistics knowledge and level of learning experience. As stated earlier in Section 3.2, the participants are mostly first year university students coming from pre-university, upper secondary school (after Form 6) or A' level. Therefore, it is assumed that the age range of the participants was at their late teens or early 20s and had at least pass the Mathematics unit during their studies in pre-university, Form 6 and A' level equivalent.

Potential personal conflict to internal validity is possible since the researcher is the lecturer of the university and may have the opportunities to becoming other subject(s) lecturer to some of the participants in the future semesters, although the researcher did not teach any of the participants in the three groups during the study. To avoid this conflict, the Mid Semester Test papers and Final Examination of the participants are identified using their university student ID numbers. The Mid Semester Test and Final Examination papers are marked by the lecturer of the subject itself and the grades of the participants are compiled by the lecturer without identifying any participants to the researcher.

The possibility threat to external validity might be that the participants are told beforehand about their participation in this research study. This could lead them to seek external help from others to learn how to use Ti-83 graphic calculator rather than using the e-books. Further, participants may start to compare the e-book formats with different tutorial groups. In order to minimize this threat, the participants are encouraged to participate in the study in a genuine situation under the assigned e-book formats respectively.

3.9 Ethical Issues

It is essential to identify the issue of ethics at the beginning of the study. The research proposal was approved by the Swinburne University Human Research Ethics Committee (SUHREC) in Melbourne, Australia and the research committee at the Faculty of Cognitive Science and Human Development (FCSHD) in Universiti Malaysia Sarawak (UNIMAS), Malaysia. Appendix C showed the letter from SUHREC, confirming the study approval. The participants of the study are enlisted based on standard procedures implemented by the University. Participants are given consent forms, approved by SUHREC and the copy of the document is available in Appendix D. Further, participants re informed about the objective of the study and are assured to have the freedom to withdraw from the study any time without any obligation. The participation is voluntary and no inducements are expected from the study. In addition, the research proposal and related research instruments were also approved by the Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak (UNIMAS) postgraduate committee. Furthermore, confidentiality of participants is ensured all throughout the process of data collection, data analysis and reporting of the results.

3.10 Summary

This study primarily is conducted using quasi-experimental research design, using both quantitative and qualitative data collection methods to investigate the effects of three e-book formats, namely T&S, T&A and T&M on the level of cognitive load, self-efficacy, statistics anxiety, learning styles and demographics in the study. This chapter also described the Waterfall model used for development of the e-books, and data collection instruments. Moreover, further detail of the pilot study, data collection and data analysis procedures were provided with reference to the research questions. Lastly, threats to internal and external validity and ethical issues were discussed.

CHAPTER 4

RESULTS

4.0 Introduction

This chapter presents the results of the data analyses based on the research questions outlined in Chapter One. The data was analysed using quantitative and qualitative analysis techniques to answer the research questions.

4.1 Screening of Data

Prior to data analysis, data on measures of cognitive load, self-efficacy, statistics anxiety, learning styles, achievement, gender and computer use experience were examined through various descriptive procedures in SPSS to check for data accuracy, missing values, normality and assumptions of analyses. No missing values were found and no out-of-range values were detected. As a result, all cases were retained for subsequent analyses in the study.

4.2 Reliability of the Research Instruments

The reliability of the research instruments were measured based on Cronbach's alpha values. The values of the reliability in Table 4.1 fell within the range reported by Salkind (2011) where values of 0.70 and above indicated acceptable reliability value for analyses. However, the reliability value for LSI was deemed to be low, similar to what had been reported in the pilot study previously. The subscales or the factors of PSSUQ, LSE, SAS and LS instruments are shown in Table 4.2 to Table

4.5. In addition, the Cronbach's alpha coefficient for the Mid Semester Test and Final Examination was considered reliable (Cronbach's α = 0.844).

Table 4.1 *Reliability Coefficients of the Research Instruments*

Instrument Categories	Cronbach's Alpha
Post-Study System Usability Questionnaires (PSSUQ)	0.922
Cognitive Load (CL)	0.830
Learning Self-Efficacy (LSE)	0.741
Statistics Anxiety Scale (SAS)	0.873
Learning Styles Inventory (LSI)	0.422
Posttest (Mid Sem Test and Final Examination)	0.844

Note: n = 89

From Table 4.2, the Cronbach Alpha coefficienst for the Post-Study System Usability Questionnaire (PSSUQ) factors (Section 2 of the questionnaires) ranged from 0.402 to 0.863. Five of the seven factors had satisfactory reliability levels of 0.70 and above (Salkind, 2011). Only two had slightly lower reliability values of 0.438 (Ability to Learn) and 0.402 (Future use). The results reported were similar to the findings of Fruhling and Lee (2005). Possible reasons for the low reliability values for the two factors were the lack of items in the factors (two items in both Ability to Learn and Future Use factors). However, as suggested by Fruhling and Lee (2005) and Lewis (2002), these items were retained as they were important factors of PSSUQ.

Table 4.2 *Reliability of the PSSUQ factors*

Factors of PSSUQ	Cronbach Alpha coefficients
Design and Layout	0.763
Functionality	0.712
Ease of Use	0.720
Ability to Learn	0.438
Satisfaction	0.760
Future Use	0.402
Errors	0.863

Note: 1) n = 89
2) PSSUQ = Post-Study System Usability Questionnaire

The Cronbach Alpha coefficients for the LSE factors (Section 4 of the questionnaires) ranged from 0.404 to 0.721 (refer to Table 4.3). The reliability of LSE was satisfactory except for the Control Expectation factor, which however was comparable to the study by Neill (2008). A possible reason for the low reliability of the Control Expectation factor would be the lack of items (three items) in this factor. Nonetheless, as the Control Expectation factor is an important factor in LSE as reported by Neill (2008), the factor was retained.

Table 4.3 *Reliability of the LSE factors*

Factors of LSE	Cronbach Alpha coefficients
Self-Efficacy	0.611
Effort and Persistence in Learning	0.721
Control Expectation	0.404

Note: 1) n = 89
2) LSE = Learning Self-Efficacy

The reliability of the SAS factors (Section 5 of the questionnaires) was determined by computing the Cronbach Alpha coefficient for each SAS factor as shown in Table 4.4. The reliability of SAS was satisfactory and comparable to those reported by Chiesi et al. (2011).

Table 4.4 *Reliability of the SAS factors*

Factors of SAS	Cronbach Alpha coefficients
Examination Anxiety	0.610
Asking for Help	0.870
Interpretation	0.709

Note: 1) n = 89
2) SAS = Statistics Anxiety Scale

The Cronbach's Alpha coefficients were computed for the four styles of the LSI factors. The values for the AC, CE, AE and RO ranged from 0.39 to 0.46. They were lower than that reported by Kolb (1985), Wang et al. (2006), Kolb and Kolb (2011) and Ku and Chang (2011). Similar to what had been reported in the pilot study, the low reliability values could be due to the low number of participants in each subscale (Craighead & Nemeroff, 2001). Additionally, Oughton and Reed (2000) asserted that early tertiary students may not fully understand and identify their own learning styles, thus leading to unfamiliarity of Kolb's statements and lower reliability. Nonetheless, the results were similar to what had been reported by Sternberg and Zhang (2000) and French and Poulsen (2002) in their studies.

Table 4.5 *Reliability of the LSI subscales*

LSI Learning Modes	Cronbach Alpha coefficients
AC	0.462
CE	0.421
AE	0.411
RO	0.396

Note: 1) AC – Abstract Conceptualization, CE – Concrete Experience, AE – Active Experimentation and RO – Reflective Observation
2) n = 89
3) LSI = Learning Style Inventory

4.3 Demographics and Description of the Sample

The participants were students enrolling in HMB1110 Quantitative Analysis in Semester 2 (starting March and ended in June), in the year 2012. The overall study took 12 weeks to collect data. A total of 89 participants responded to the study and completed all the treatment and the questionnaires. The participants using text and static image e-book format was the control group and the others received different respective treatments, namely T&A e-book format and T&M e-book format. As shown in Table 4.6, there were thirty participants in both T&S image e-book format group, and in T&A e-book format group. Twenty-nine participants participated and used T&M e-book format group in the study. Table 4.7 summarizes the demographic characteristics of the participants.

Table 4.6 *Participant distribution of each e-book format group*

Groups using e-book formats	N
T&S	30
T&A	30
T&M	29
Total	89

Table 4.7 *Participant distribution of each e-book format group of the study*

Demographics Variables		T&S		T&A		T&M		Overall	
		N(30)	%	N(29)	%	N(29)	%	N(89)	%
Gender	Male	11	36.7	18	60.0	13	44.8	42	47.2
	Female	19	63.3	12	40.0	16	55.2	47	52.8
Commerce Major	Accounting	14	46.7	11	36.7	11	37.9	36	40.4
	Marketing	5	16.7	8	26.7	6	20.7	19	21.3
	Human Resource	1	3.3	0	0.0	0	0.0	1	1.1
	International Business	4	13.3	7	23.3	3	10.3	14	15.7
	Others	6	20.0	4	13.3	9	31.0	19	21.3
Computer Usage	Less than 5 years	6	20.0	3	10.0	4	13.8	13	14.6
	More than 5 years	24	80.0	27	90.0	25	86.2	76	85.4

Gender

Overall, there was almost equal distribution of gender among the sample, 47 (52.8%) were female and 42 (47.2%) were male. For the T&S e-book format group, 19 (63.3%) were female and 11 (36.7%) were male. In the T&M e-book format group, there were 16 (55.2%) female and 13 (44.8%) male. On the other hand, male made up 18 (60%) with 12 (40%) female in T&A e-book format group.

Commerce Major Program

Approximately a third of the participants were enrolled in the Accounting major program (36, 40.4%). Both Marketing and Other commerce major had 19 (21.3%) participants enrolled in the programs. The other commerce majors were identified as double major, for example, Accounting and Finance or Accounting and Management program. 14 (15.7%) were studying International Business major and only one (1.1%) who was enrolled in Human Resource Management major.

A similar pattern existed for T&S e-book format group where 14 (46.7%) of the participants enrolled in Accounting major, five (16.7%) enrolled in Marketing major while six (20%) enrolled in Others or double major program. Four (13.3%) studied International Business major and only one (3.3%) from Human Resource Management major.

Among the students in the T&A e-book format group, there were 11 (36.7%) students enrolled in Accounting major, followed by eight (26.7%) students in

Marketing major, seven (23.3%) from International Business major and four (13.3%) enrolled in double major program. Lastly, in T&M e-book format group, 11 (37.9%) of the participants studied Accounting major while six (20.7%) studied Marketing as their major. There were three (10.3%) and nine (31%) studying in International Business major and double major respectively. None of the students in T&A and T&M e-book group studied Human Resource Management major.

Computer Use Experience

The majority (76 or 85.4%) of the participants had more than five years of experience using computer. Only 13 (14.6%) had less than five years of using computer. For the T&S e-book format group, 24 (80%) of the participants had more than five years of experience using computer and only six (20%) of the rest possessed less than five of experience in using computer. Among the participants in T&A e-book format group, the majority of them had more than five years of computer use experience (27 or 90%), followed by only three (10%) who had less than five years of computer use experience. Lastly, 25 (86.2%) of the participants in T&M e-book format group had more than five years of experience using computer and only four (13.8%) had less than five years of computer use experience.

4.4 Usability of E-books (PSSUQ Factors)

The results on the Post-Study System Usability Questionnaire (PSSUQ) factors showed a moderate level of usability as compared to what has been reported in the pilot study in Section 3.6.1 based on the criteria of scores between 1.00 - 1.91 = low, 2.00 – 2.99 = moderate and 3.00 – 4.00 = high.

Table 4.8 Means and standard deviations for the PSSUQ factors

Item No.	PSSUQ Factors	Overall		T&S		T&A		T&M	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1.	Design & Layout	2.68	0.832	2.65	0.778	2.72	0.785	2.61	0.936
2.	Functionality	2.72	0.757	2.68	0.72	2.76	0.736	2.80	0.840
3.	Ease of Use	2.83	0.767	2.81	0.721	2.91	0.747	2.87	0.870
4.	Learned Ability	2.87	0.824	2.70	0.880	2.95	0.787	2.83	0.747
5.	Satisfaction	2.84	0.730	2.80	0.641	2.81	0.772	2.90	0.896
6.	Future Use	2.64	0.714	2.60	0.674	2.74	0.800	2.73	0.875
7.	Errors	2.75	0.770	2.82	0.921	2.88	0.719	2.71	0.695
	Average	2.76	0.770	2.75	0.717	2.79	0.767	2.77	0.877

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, and SD = Standard Deviation.
2) The items in the PSSUQ questions had responses in the Likert format with: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Agree (A) and 4 = Strongly Agree (SA).
3) For the overall mean scores, scores of 1.0-1.99 = low level, 2.0-2.99 = moderate level and 3.0-4.0 = high level.
4) PSSUQ = Post-Study System Usability Questionnaire

Overall, most of the participants found that the information for the e-books was slightly easy to understand and easy to learn (refer item 4 in Table 4.8, M = 2.87). The participants were moderately satisfied with the e-books and found it comfortable using the e-books (refer item 5 in Table 4.8, M = 2.84). They were somewhat capable of finding the information that they needed from the e-books and the information such as on-screen messages was clear (refer item 3 in Table 4.8, M = 2.83). The participants also could manage to recover easily and quickly with the help of clear error messages prompted by the e-books when they made a mistake while using the e-books (refer to item 7 in Table 4.8, M = 2.75). On the functionality factors, the participants faced little difficulty and could complete the tasks in a quick pace and were quite productive while using the e-books (refer item 2 in Table 4.8, M = 2.72). This is followed by a moderate level of acceptance towards the design, layout and interface of the e-books (refer item 1 in Table 4.8, M = 2.68). Finally, the participants perceived that the e-books have a moderate level of functions and capabilities that they expected (refer to item 6 in Table 4.8, M = 2.64).

On the overall comparison of the three e-book groups, the participants who used T&A (refer to overall average score in Table 4.8, M = 2.79) and T&M e-book (refer to overall average score in Table 4.8, M = 2.77) reported to have higher average scores in the usability test than T&S group of participants (refer to overall average score in Table 4.8, M = 2.75). In terms of Learned Ability factor, participants in the T&A format (refer to item 4 in Table 4.8, M = 2.95) and T&M e-book format (refer to item 4 in Table 4.8, M = 2.83) had higher average usability score than participants who used the T&S e-book (refer to item 4 in Table 4.8, M = 2.70). Similarly, the participants who used the T&A e-book format found the assigned e-book easy to use (refer to item 3 in Table 4.8, M = 2.91), recovered from errors easily (refer to item 7 in Table 4.8, M = 2.88) and discovered the e-book has all the functions and capabilities for future use (refer to item 6 in Table 4.8, M = 2.74).

Table 4.8 also showed that participants assigned to T&M e-book perceived themselves as having higher level of satisfaction (refer to item 4 in Table 4.8, M = 2.90) as compared to participants using T&A (refer to item 4 in Table 4.8, M = 2.81) and T&S (refer to item 4 in Table 4.8, M = 2.80). The T&M e-book group (refer to item 2 in Table 4.8, M = 2.80) also reported higher average score of e-book functionality than the other two groups. It was perceived that the participants were able to complete the questions given in the tutorial while using T&M e-book. On the other hand, participants using T&M e-book format found that the errors shown in the e-book was rather difficult to find and challenging (refer item 7 in Table 4.8, M = 2.71) compared to the other two group of participants. They also felt that the design, layout and interface of the T&M e-book (refer item 1 in Table 4.8, M = 2.61) were not as pleasant and clear as compared to T&A (refer item 1 in Table 4.8, M = 2.72 and T&S e-book formats (refer item 1 in Table 4.8, M = 2.65).

Unlike participants in T&A and T&M e-book group, participants in T&S acquired lower scores in most of the factors in the usability questionnaire. They found that the information was ineffective in helping them to solve statistics problems (refer item 2 in Table 4.8, M = 2.68) and that the functions and capabilities of the T&S were rather limited (refer item 6 in Table 4.8, M = 2.60). The participants also agreed that it was not easy to learn using the T&S e-book (refer item 4 in Table 4.8, M = 2.70). Overall, the participants using T&S e-book format were found to have the lowest level of satisfaction while using the e-book.

4.4.1 Qualitative Comments on the e-books

To corroborate the findings on the usability of the e-books, qualitative comments were collected and reviewed to obtain general perceptions from the participants. Three open-ended questions were posed to the participants after the treatments.

Sample comments from participants in each of the three groups with different e-book format are provided below.

Open-ended Question 1: Looking back on your experience of using the e-book, please share the problems that you have encountered.

Based on the "unit of analysis" method by Babbie (2013) and using rules of inclusion technique, the responses of the participants to the above question were classified into three different categories, namely, "physical constraint", "time constraint", and "onscreen design problem".

<u>Physical constraint</u>

This category was identified from 46 out of 53 responses from all three groups. Thirty-six responses were discarded due to incomplete answers. The participants felt tired, fatigue and having eye-strain, especially those using T&S e-book format. Twenty-four out of 30 participants from T&S e-book format complained on the physical constraint while twelve out of 30 participants from T&A e-book format and ten out of 29 participants from T&M e-book format felt the similar way. Example of responses from the participants reflected this theme, as shown below.

> "I need to have a computer to open the e-book while having a textbook is easier. My eyes become tired looking at the computer screen for a long time." (Participant A from T&S e-book group)

> "For me, I prefer textbooks because it is easier to read from books than computer screen. The e-book looks like the scanned copy of the normal textbook and it makes my head dizzy reading from the screen all the time." (Participant B from T&S e-book group)

> "I have difficulty in recalling what I have read in the e-book and following the video on screen. Sometime I felt like I'm just watching a short movie and my mind wondered elsewhere." (Participant K from T&M e-book group)

<u>Time constraint</u>

From the responses, 34 out of the 53 responses in all three e-book formats have commented on time constraint issue with 16 responses from T&S e-book group, seven responses from T&A e-book group and 11 responses from T&M e-book group. The usage of e-book formats were considered as time-wasting and some of the participants thought it would affect the time they need to learn statistics, as illustrated by the responses below.

> "I still think printing textbook is better as it saves time. Searching for some information in the e-book is a waste of time and slower. I need to hit the forward button to look for a certain method to use the graphic calculator." (Participant B from T&S e-book group)

> "I think it is a waste of time to sit in front of the computer and listening to the video. I am somehow discouraged to follow the video all throughout the semester." (Participant J from T&M e-book group)

Onscreen Design problem

Ten out of the 53 responses commented that the design of the e-books was rather limited. Some participants commented that the navigation of the e-book was difficult to follow. Some of the sample responses are shown below.

> "I am kind of lazy to access the e-book and to go through the pages. I don't like to click on the page by page to read the e-book. I think textbook is still better for easy access." (Participant F from T&S e-book group)

> "The font size is too small to read and it is difficult to read from the screen." (Participant C from T&S e-book group)

It could be inferred from the responses that the participants found some problems while using the e-books. It would appear that some of the participants felt uneasy reading from the e-books on the computer screen. Also, some of the participants thought that it was a waste of time to use e-books and they preferred printed textbooks. This may due to the onscreen design problem where the font size and navigation problem which were identified from the e-books.

Open-ended Question 2: In your opinion, is the e-book useful for your learning?

The responses to this question were identified from the positive and negative aspects. Sample comments are shown along with participants from different e-book groups. Only thirty two out of 89 participants gave response and majority of them were from T&M e-book group. Twenty participants expressed their general positive experience while 12 responded with negative experience.

Positive responses from participants include the following.

> "I like the idea of having video and sound, seem like a lecture within the e-book. It interests me in learning statistics." (Participant O from T&M e-book group)
>
> "I think the animation is easy to follow to learn [how to use] the calculator. I find it interesting." (Participant N from T&A e-book group)
>
> "It makes statistics more interesting." (Participant Q from T&M e-book group)
>
> "I'm not good in statistics, but ever since I use this e-book, I can see the whole picture of using the graphic calculator for statistics. It's not that hard after all." (Participant L from T&M e-book group)
>
> "It is interesting to see different kind of e-book (with video) because I thought e-book is just an online version of textbook. It helps me to enhance my understanding and knowledge about statistics." (Participant M from T&M e-book group)

Negative responses from participants.

> "It's troublesome and the e-book did not help me much in learning." (Participant A from T&S e-book group)
>
> "No, because it is so difficult to follow. I prefer learning from lecturer than e-books." (Participant E from T&S e-book group)
>
> "I don't think learning statistics with graphic calculator is going to help in our future (working life) because we may not use it anymore." (Participant G from T&A e-book group)

The positive responses from the participants in the T&M e-book group indicated that they found the e-book helped them in learning the usage of graphic calculator and statistics. On the whole, about two third of the participant responses appeared to be positive in the T&M e-book group. Conversely, majority of the negative responses were from T&S e-book group. The negative responses mainly indicated that the e-book was rather difficult to follow and did not significantly help them in learning.

Open-ended Question 3: Any other comments that you would like to provide regarding the use of this e-book?

This question invited the participants to give their overall comments while using the assigned e-book. Similar to Question 2, the sample comments were identified as positive and negative responses. Forty three out of the overall participants gave their responses to this question. About twenty-eight of the participants had positive experience and 15 participants had negative experience with the e-book. Some of the responses to the third open ended question were about similar to those provided for the second open-ended question. For instance, Participant Q, who commented on the third open ended question that the e-book helped to make statistics interesting, gave similar response to the second open ended question.

The following are examples of positive responses from the participants.

> "It's good. At least there is something new and not just a boring textbook and subject." (Participant Q from T&M e-book group)

> "I like it because I do not need to buy a textbook and just use e-book to study. It's good to have it online because it is hassle free." (Participant R from T&A e-book group)

> "I prefer e-book because I can access it anytime using my laptop. Also, I like the video so I didn't have to read a lot." (Participant P from T&M e-book group)

> "E-book is nice to use but have so many limitations. However, I'm glad to be given a chance to use e-book to study." (Participant H from T&A e-book group)

The following are some of the negative responses given by the participants.

> "I think e-book is good but I still prefer textbook." (Participant D from T&S e-book group)

> "It was hard to read from screen and I prefer to print out the content to read." (Participant F from T&S e-book group)

"I didn't find it (animation) visually interesting. It needs to be more interactive" (Participant I from T&A e-book group)

"The video and the sound were quite boring." (Participant K from T&M e-book group)

Majority of the participants expressed positive feedback with regards to their learning experience while using T&M e-book. The participants felt that it was interesting to have something new in the statistics unit that they have not encountered before. However, some of the participants still preferred printed textbooks than e-books, especially those who were in the T&S e-book group. Some of the participants from T&A e-book group voiced their disagreement to the use of animation only and suggested that it could be more interactive. Some participants proposed that the T&M e-book to be improved with better video and audio quality.

In a nutshell, the findings from the open-ended questions were consistent with the results obtained from the PSSUQ. Positive comments in all the three open ended questions are encouraging and point towards an acceptance and a certain enthusiasm among the participants, especially in the T&A and T&M e-books usage. The negative comments suggested that the design of the T&S and T&A e-books can be improved upon. Generally, the participants welcome the e-books as a medium of instruction.

4.5 E-book formats and level of Cognitive Load (CL)

CL was calculated using five questions about mental effort and level of difficulty. Each question used the scale developed by Paas (1992) to measure perceptions of cognitive load while using the assigned e-book format. Participants rated Question 1 whether "Using the e-book in learning certain topic(s), I invested," on a 9-point scale (1 =Very, very low mental effort to 9 = Very, very high mental effort.). They were also asked "How do you find the level of difficulty in using the e-book?" in Question 2 and "How do you find the level of difficulty in understanding information provided by the Ti-83 graphic calculator given in the e-book?" in Question 3. Lastly, Question 4 on "In understanding the concept and content of statistics provided by the Ti-83 graphic calculator in the e-book, I find them:" and Question 5 about "How easy or difficult was it for you to understand the information provided for using the e-book?" were also directed to the participants. The last four questions also had a 9-point scale (1 = Not difficult at all to 9 = Very difficult).

As mentioned by Paas (1992) and Amadieu et al. (2010), Question 1 and Question 4 measure the mental effort scale whereas Question 2, Question 3 and Question 5 were used to construct the composite measure of extraneous cognitive load. Overall, as indicated by Amadieu et al. (2010), the mean of all five questions can be used as an indicator of overall CL in the data analyses. Hence, the higher the averaged rating, the higher CL a participant experienced when learning the assigned e-book.

Since the cognitive load scale for each question ranged from 1 to 9, it is considered that the scores higher than the mid-point of 4.5 implied cognitive overload.

One-Way ANOVA was employed to determine the difference between the three e-book groups on the level of CL. The research question was “Are there differences in the level of CL as perceived by the students in the statistics subject for the three e-book formats?” Analysis began with evaluation of assumptions. One-Way ANOVA assumptions include normality and homogeneity of variance (Pallant, 2007). Normality was determined by inspecting the Shapiro-Wilks test value and Levene’s test value was used to test the assumption of homogeneity of variance.

A One-Way between-groups analysis of variance was conducted to explore the impact of three e-book formats usage groups (T&S, T&A and T&M) as independent variables on the average score of the CL questions as dependent variable.

The examination of Shapiro-Wilk test value revealed normality of the data distribution ($p = 0.381$). Hence, the population normality was assumed. The result shown for Levene’s test for homogeneity of variances was not significant ($p = 0.216$), thus indicating that the population variances for each group were approximately equal. Hence, the assumptions for One-Way ANOVA were satisfied.

Table 4.9 shows the result of the One-Way ANOVA among the three e-book formats and the level of CL. There was significant difference in the level of cognitive load across the different e-book formats, (F (2,86) = 3.80, $p < 0.005$).

Table 4.9 *Results on One-Way ANOVA between three e-book formats and CL*

	Sum of Squares	df	Mean Square	F	p
Between Groups	861.14	2	430.57	48.28*	< 0.005
Within Groups	766.87	86	8.91		
Total	1628.01	88			

Note: CL = Cognitive Load

The formula used to calculate the effect size using eta squared is as follows:

$$\text{Eta squared} = \frac{\text{Sum of squares between-groups}}{\text{Total sum of squares}}$$

$$= \frac{861.14}{1628.01}$$

$$= 0.5$$

The value for eta squared is 0.5, which is equivalent to an effect size of $d = 2.00$. This corresponds to what Cohen (1992) describes as a "large" effect size where "small" effect size is 0.20, a "medium" effect size is 0.50, and a "large" effect size is 0.80 and above. Thus, the statistically significant difference detected was also of practical importance.

The result of One-Way ANOVA is presented graphically in Figure 4.1.

Next, a post-hoc analysis (Tukey) was conducted for CL imposed by the three e-book formats. The results are shown in Table 4.10. The results were explained based on the total scores of 5.00 – 14.99 = low level, 15.00 – 29.99 = moderate level, and 30.0 0- 45.00 = high level. Post-hoc comparisons using the Tukey HSD test indicated that the mean differences were significant ($p < 0.005$) between participants using T&S e-book format and participants using T&A e-book format as well as T&M e-book format. However, there were no significant statistical differences in the means of CL level among the participants using T&A e-book format and T&M e-book format.

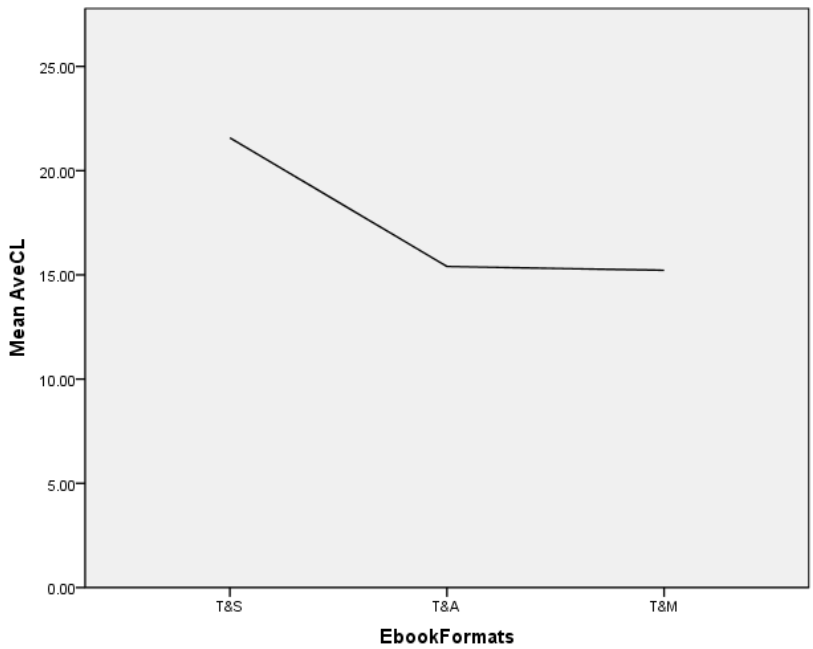


Figure 4.1: *Means plot from a One-Way ANOVA of CL and e-book formats.*

The participants in the group using e-book with T&S (M = 21.81, SD= 2.69) reported significantly higher level of CL than those participants using e-book with T&A (M = 15.02, SD = 2.81) and e-book with T&M (M = 15.47, SD = 3.41). In other words, participants using e-book with T&S format (moderate level of CL) invested higher level of CL as compared to participants using e-book with T&A and T&M format (low level of cognitive load).

Table 4.10 *Post-hoc differences in means of CL by e-book formats.*

E-book formats	M	SD	Comparison	M Difference	Std.Error	Sig.
T&S	21.81	2.69	T&S and T&A	6.78*	0.77	< 0.005
T&A	15.02	2.81	T&S and T&M	6.34*	0.77	< 0.005
T&M	15.47	3.41	T&A and T&M	-0.44	0.77	0.83

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, SD = Standard Deviation, and CL = Cognitive Load.
2) The mean difference is significant at the .05 level.
3) For the overall total scores, scores of 5.0-14.99 = low level, 15.0-29.99 = moderate level and 30.0-45.0 = high level.

The descriptive statistics were performed for each question on the types of CL and were explained based on the mean scores of 1.00 – 1.99 = low level, 2.00 – 2.99 = moderate level, and 3.00 - 4.00 = high level. The results in Table 4.11 show that the participants from T&S e-book format invested higher mental effort (refer to Question 1, M = 5.47, SD = 1.008 than those participants using T&M e-book format (refer to Question 1, M = 5.07, SD = 1.193) and T&A (refer to Question 1, M = 4.43, SD = 1.305) e-book format.

The participants from T&S e-book format group scored the highest level of difficulty in terms of using the assigned e-book (refer to Question 2, M = 5.17, SD = 1.147), compared to participants in T&A e-book format group (refer to question 2, M = 3.83, SD = 1.085) and T&M e-book format group (refer to Question 2, M = 3.52, SD = 1.271). Similarly, the information provided by Ti-83 calculator given in the e-book induced high CL to the participants from T&S e-book format group and they found it difficult to follow (refer to Question 3, M = 5.00, SD = 0.947), followed by participants from T&M e-book format group (refer to Question 3, M = 3.03, SD = 0.981). On the other hand, participants from T&A e-book format group could follow the information from the Ti-83 calculator easily (refer to Question 3, M = 2.93, SD = 0.828).

The result for question 4 in Table 4.11 revealed that participants from T&S e-book format group had difficulty in understanding the concept and content of statistics provided by Ti-83 graphic calculator given in the e-book (refer to Question 4, M = 5.13, SD = 0.937). However, participants from T&A e-book format group (refer to Question 4, M = 3.23, SD = 0.898) and participants from T&M e-book format group (refer to Question 4, M = 3.21, SD = 1.320), did not show much difference in the level of understanding the statistics contents delivered by Ti-83 graphic calculator in both of the groups.

Lastly, the participants from T&S e-book format group found that the information provided for using the e-book was rather difficult to understand (refer to Question 5, M = 5.23, SD = 1.331). In contrast, the information presented in T&A e-book format was slightly easier to comprehend (refer to Question 5, M = 2.97, SD = 0 .964) than the information presented in T&M e-book format (refer to Question 5, M = 3.21, SD = 1.207).

As stated by Amadieu et al. (2010), Question 1 and Question 4 measure the level of mental effort that the participants possessed when using the assigned e-book. For T&S e-book group, the total mean score for mental effort was higher (M = 5.30, SD = 0.972) than T&A (M = 3.83, SD = 1.101) and T&M groups (M = 4.14, SD = 1.256) e-book. In terms of perceived difficulty, the mean score for Question 2, Question 3 and Question 5 were calculated to show the level of extraneous load. The findings showed that extraneous load was higher in T&S e-book format (M = 5.13, SD = 1.141) compared to T&A (M = 3.24, SD = 0.959) and T&M (M = 3.25, SD = 1.729) e-book formats.

To summarize, the overall level of CL was higher for T&S group and lower for T&A and T&M e-book format groups. The results also revealed that T&S e-book format showed higher mental effort and higher extraneous cognitive load compared to T&S and T&M e-book formats. The findings suggest that animation and multimedia might be effective means to reduce the CL of participants using the e-books.

Table 4.11 *Means and standard deviations for the level of Cognitive Load*

	Overall		T&S		T&A		T&M	
	M	SD	M	SD	M	SD	M	SD
1. Using the e-book in learning certain topic(s), I invested:	4.99	1.239	5.47	1.008	4.43	1.305	5.07	1.193

Note for Q1: The items in the questions had responses in the Likert format from: 1 =Very, very low mental effort to 9 = Very, very high mental effort.

	Overall		T&S		T&A		T&M	
	M	SD	M	SD	M	SD	M	SD
2. How do you find the level of difficulty in using the e-book	4.18	1.361	5.17	1.147	3.83	1.085	3.52	1.271
3. How do you find the level of difficulty in understanding information provided by the Ti-83 graphic calculator given in the e-book?	3.66	1.322	5.00	0.947	2.93	0.828	3.03	0.981
4. In understanding the concept and content of statistics provided by the Ti-83 graphic calculator in the e-book, I find them:	3.87	1.391	5.13	0.937	3.23	0.898	3.21	1.320
5. How easy or difficult was it for you to understand the information provided for using the e-book?	3.81	1.551	5.23	1.331	2.97	0.964	3.21	1.207

Note for Q2 to Q5: The items in the questions had responses in the Likert format from: 1 = Not difficult at all to 9 = Very difficult.
Note: T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, M=Mean, and SD = Standard Deviation.

4.6 E-book formats and level of Self-Efficacy (SE)

Neill's (2008) Learning Self-Efficacy (LSE) instrument was used to collect data on the level of SE. There were 14 questions, each with a 4-point Likert scale, corresponding to from 4 = "Strongly Agree", 3 = "Agree", 2 = "Disagree", and 1 = "Strongly Disagree".

One-Way ANOVA was employed to determine the differences between the three e-book formats on the level of SE. The research question was "Are there differences in the level of SE as perceived by the students in the statistics subject for the three e-book formats?" Analysis began with evaluation of assumptions. Normality was determined by inspecting the Shapiro-Wilk test value and Levene's test for homogeneity of variances.

A One-Way ANOVA was performed to examine the differences between three e-book formats groups (T&S, T&A and T&M) as independent variables and the average scores for all three factors of SE as dependent variable. The SE data was found to be normally distributed using Shapiro-Wilks test ($p = 0.432$) and has homogeneity of variances with Levene's test ($p = 0.063$).

Table 4.12 shows the result of One-Way ANOVA among the three e-book formats and the level of SE. The total scores for the 14 questions were classified as (14.0 – 28.5 = low level; 29 - 43.5 = moderate level; 44 - 56 = high level). The effect of the three e-book formats was not significant, ($F(2, 86) = 0.188$, $p = 0.829$). The participants who used T&S, T&A and T&M e-book formats did not differ on their level of SE. Generally, the participants had moderate level of SE, with T&S group (M = 34.89, SD = 3.430), T&A group (M = 34.85, SD = 3.385) and T&M group (M = 34.31, SD = 5.095).

Table 4.12 *Results on One-Way ANOVA between three e-book formats and SE*

	Sum of Squares	df	Mean Square	F	p
Between Groups	6.123	2	3.061	0.188	0.829
Within Groups	1400.69	86	16.287		
Total	1406.81	88			

Note: 1) n = 89
2) SE = Self-Efficacy

Next, descriptive statistics were performed for each LSE factor to further comprehend the participants' level of SE and were explained based on the mean scores of 1.00 – 1.99 = low level, 2.00 – 2.99 = moderate level, and 3.00 - 4.00 = high level. The results were shown in Table 4.13. Overall, the students exhibited moderate level of SE (refer to Table 4.13; total means for each factor were between 2.0 and 3.0). In general, participants in all three e-book format groups were shown to have uniform level of LSE.

Among all the factors in LSE, the participants perceived themselves to have relatively high effort and persistence in learning (refer to factor 2 in Table 4.13, total mean of 2.96). This indicated that the participants put their best effort, worked as hard as possible when studying and would do their best to obtain the knowledge and skills taught by the instructor in the university.

In addition, the participants scored moderate level for their control expectation when studying (refer to factor 3 in Table 4.13, total mean of 2.76). The participants had positive motivation to learn certain skills and information and they were able to put aside distractions when they are engaged in study.

Finally, with respect to general SE, it was apparent that the participants had low moderate level (refer to factor 1 in Table 4.13, total mean of 2.44). For example, the participants showed lower motivation when it comes to learning new and difficult materials in the university. Moreover, the participants were not fully comfortable with the complex materials presented by their instructors. On the contrary, the participants seemed to be able to learn very fast on the important knowledge and believed they could do excellent job on assignments and tests provided by the university. Lastly, they seemed to have higher SE in mastering the skills taught by the university.

Table 4.13 *Means and standard deviations for the LSE*

Item No.	LSE statements	Overall		T&S		T&A		T&M	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
General Self-Efficacy									
1.	I can master all the skills being taught to me at university	2.52	0.605	2.63	0.556	2.67	0.606	2.28	0.649
2.	I learn the things I need to learn pretty fast	2.65	0.740	2.67	0.758	2.70	0.651	0.62	0.728
3.	I easily learn difficult material	2.17	0.607	2.17	0.531	2.30	0.750	2.17	0.759
4.	I do excellent job on assignments and tests	2.53	0.623	2.60	0.621	2.53	0.571	2.38	0.622
5.	I can understand the most difficult material presented	2.42	0.766	2.47	0.819	2.23	0.728	2.31	0.660
6.	I can understand the most complex material presented by my lecturer	2.35	0.659	2.33	0.661	2.37	0.718	2.38	0.677
Total Means and SD		2.44	0.67	2.48	0.66	2.47	0.67	2.02	0.68
Effort and Persistence in Learning									
1.	When studying, I work as hard as possible	3.03	0.682	3.00	0.695	2.73	0.785	3.10	0.673
2.	When studying, I keep working even if the material is difficult	2.78	0.719	2.77	0.728	2.87	0.681	2.79	0.726
3.	I can concentrate	2.90	0.826	2.87	0.860	2.93	0.583	2.97	0.778

	when I'm trying to learn something								
4.	When studying, I do my best to acquire the knowledge and skills taught	3.04	0.582	3.10	0.548	2.93	0.691	2.93	0.651
5.	When studying, I put in my best effort	3.07	0.654	3.13	0.629	3.17	0.531	2.93	0.704
Total Means and SD		2.96	0.69	2.97	0.69	2.93	0.65	2.94	0.71
Control Expectation									
1.	If I want to learn something very well, I can	3.15	0.762	3.17	0.699	2.90	0.803	3.10	0.900
2.	When it comes to learning, I really work hard	2.71	0.786	2.73	0.740	2.97	0.809	2.66	0.897
3.	I put aside distractions when I am studying	2.43	0.782	2.43	0.817	2.40	0.855	2.41	0.733
Total Means and SD		2.76	0.78	2.78	0.75	2.76	0.82	2.72	0.84

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, SD = Standard Deviation, and LSE = Learning Style Efficacy
2) The items in the LSE questions had responses in the Likert format with: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Agree (A) and 4 = Strongly Agree (SA).
3) For the overall mean scores, scores of 1.0-1.99 = low level, 2.0-2.99 = moderate level and 3.0-4.0 = high level.

4.7 E-book formats and the level of Statistics Anxiety (SA)

For the SA questionnaires, the instrument developed by Vigil-Colet et al. (2008)'s was chosen and modified for this study. There were 24 questions where the level of SA would be questioned, with 5-point Likert choices, corresponding from "High Anxiety" (5), "Considerable Anxiety" (4), "Moderate Anxiety" (3) "Slight Anxiety" (2) and "No Anxiety" (2). The SAS instrument included three factors, namely Examination Anxiety factor, Asking for Help factor and Interpretation factor.

One-Way ANOVA was performed to determine the differences between the three e-book formats on the level of SA. The research question was "Are there differences in the level of SA as perceived by the students in the statistics subject for the three e-book formats?" Analysis began with evaluation of assumptions. The normality of dependent variable assumption was tested and Shapiro-Wilk test value showed that there was no violation of normality ($p = 0.511$). The Levene's test was conducted for equality of variances. The p-value was 0.571, which did not violate the assumption of homogeneity of variance.

Table 4.14 shows the results of One-Way ANOVA among the three e-book formats and the level of SA.

The results showed no statistically significant difference between three e-book formats and the level of statistics anxiety were not significant (F (2, 86) = 0.015, p = 0.985). The explanation were based on 24.00 – 62.99 = low level; 63.00 – 101.99 = moderate level; 102.00 – 120.00 = high level). Overall, the participants scored a moderate level of statistics anxiety with T&S group (M = 73.21, SD = 12.929), T&A group (M = 73.22, SD = 12.301) and T&M group (M = 73.69, SD = 10.708).

Table 4.14 *Results on One-Way ANOVA between three e-book formats and SA*

	Sum of Squares	df	Mean Square	F	p
Between Groups	4.402	2	2.201	0.015	0.985
Within Groups	12907.36	86	150.08		
Total	12911.76	88			

Note: 1) n = 89
2) SA = Statistics Anxiety

The means and the standard deviations for participant's scores in Statistics Anxiety Scale (SAS) on each e-book group were obtained and summarized in Table 4.15 to Table 4.17. This is based on the criteria of 1.00 – 2.99 = low level, 3.00 – 3.99 = moderate level, and 4.00 - 5.00 = high level. In general, the participants demonstrated higher level of anxiety when it comes to examination (refer to Table 4.15, total score in Examination Anxiety factor, M = 3.36). It was obvious that the participants were worried if they realized the day before an examination that they could not solve easier questions in statistics (refer to Table 4.15, item 2 in Examination Anxiety factor, M = 3.65). Further, higher anxiety was noticed among the participants when they were preparing and studying for an examination in statistics (refer to Table 4.15, item 1 in Examination Anxiety factor, M = 3.53).

Participants scored moderate level of anxiety when they were not given sufficient time to prepare for examination. On the other hand, participants were less concerned when it comes to reading an advertisement about figures on statistics; walking to class to take a statistics test and trying to understand a mathematical demonstration (refer to Table 4.15, item 3, 4, and 5 in Examination Anxiety factor).

The overall mean score for Interpretation factor showed that the participants had moderate level of anxiety in explaining and analysing statistics data (refer to Table 4.17, Interpretation factor, total mean score = 3.14). The participants scored higher level of anxiety if they were going to a statistics exam without having enough time to revise (refer to item 7 in Table 4.17, M = 3.56). The participants also have concerned about doing final examination in statistics subject (refer to item 3 in Table 4.17, M = 3.42). The participants were anxious in a situation where the participants saw a classmate carefully studying the results of a solved problem (refer to item 6 in Table 4.17, M = 3.27). Despite the higher anxiety shown in Interpretation factor, the participants were less worried when it comes to understanding the odds in a lottery in statistics, asking one of the lecturer for help in understanding statistics and reading a journal article that includes some statistical analyses (refer to item 5, 4 and 2 in Table 4.17).

In addition, the participants exhibited moderate level of anxiety in Asking for Help factor (refer to Table 4.16, Asking for Help factor, total mean score = 3.02). Among all the items from Asking for Help factor, the participants were anxious when asking lecturers to explain a topic that they have not understood at all (refer to Table

4.16, item 2, M = 3.24). This was followed by moderate level of anxiety when asking statistics lecturer for help individually with difficult statistics topic (refer to Table 4.16, item 1, M = 3.16) and going to lecturer's office to ask for lecturers' explanations in doing exercise (refer to item 7 and 8 in Table 4.16, both item M = 3.04). However, the participants showed low level of anxiety when asking lecturers how to use a probability table and interpreting a statistics result table. They were less anxious when copying a mathematical demonstration from the Blackboard Learning System while explanation was given by the lecturer (refer to item 3, 4, 5 and 6 in Table 4.15).

Table 4.15 *Means and standard deviation for SAS factor for Examination Anxiety Factor*

Item No.	SA factors and statements	Overall Mean	SD	T&S Mean	SD	T&A Mean	SD	T&M Mean	SD
Examination Anxiety Factor									
1.	Studying for an examination in a statistics	3.53	0.854	3.47	0.860	3.33	0.922	3.66	0.857
2.	Realizing the day before an exam that I cannot do some problems that I thought were going to be easy	3.65	0.955	3.63	0.928	3.70	0.952	3.69	1.039
3.	Trying to understand a mathematical demonstration	3.13	0.956	3.13	1.042	3.17	0.834	3.14	0.789
4.	Reading an advertisement for an automobile which includes figures on gas mileage, compliance with population	3.01	1.082	3.10	1.213	2.60	1.003	2.83	0.759

	regulations, etc.								
5.	Walking into the classroom to take a statistics test	3.27	1.063	3.17	1.085	3.33	0.844	3.48	1.022
6.	Getting to the day before an exam without having had time to revise the syllabus	3.49	1.149	3.57	1.194	3.30	1.208	3.34	1.078
7.	Waking up in the morning on the day of a statistics test	3.47	1.139	3.50	1.137	3.47	1.106	3.41	1.181
8.	Realizing just before going into the exam, I have not prepared a particular exercise	3.39	1.202	3.43	1.223	3.47	1.252	3.31	1.198
Total Means and SD		3.36	1.050	3.37	1.085	3.29	1.015	3.35	0.990

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, SD = Standard Deviation, and SAS = Statistics Anxiety Scale.
2) The items in the SAS questions had responses in the Likert format with: 1 = No Anxiety, 2 = Slight Anxiety, 3 = Moderate Anxiety, 4 = Considerable Anxiety and 5 = High Anxiety.
3) For the overall mean scores, scores of 1.00-2.99 = low level, 3.00-3.99 = moderate level and 4.00 – 5.00 = high level.

Table 4.16 Means and standard deviation for SAS factor for Asking for Help

Item No.	SA factors and statements	Overall		T&S		T&A		T&M	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Asking for Help Factor									
1.	Going to ask my statistics lecturer for individual help with material I am having difficulty in understanding	3.16	1.186	3.13	1.252	3.03	0.850	3.21	1.082
2.	Asking lecturers to explain a topic that I have not understood at all	3.24	0.989	3.20	0.961	3.17	0.980	3.31	1.072
3.	Asking lecturers how to use a probability table	2.85	1.040	2.86	0.990	3.03	0.850	3.03	0.906
4.	Asking lecturers	2.99	1.071	2.83	1.117	2.80	0.761	3.31	0.930

	about how to do an exercise								
5.	Copying a mathematical demonstration from the blackboard while the lecturer is explaining it	2.96	0.903	2.97	0.964	3.07	0.980	2.93	0.799
6.	Asking lecturers for help when trying to interpret a results table	2.91	1.104	2.97	1.224	2.87	0.819	3.00	0.845
7.	Going to lecturer's office to ask questions	3.04	0.928	2.93	0.907	3.13	0.900	3.28	0.960
8.	Asking lecturers to explain how to do an exercise	3.04	1.157	2.87	1.279	3.00	1.017	3.41	0.780
Total Means and SD		3.02	1.047	3.09	1.086	3.01	0.894	3.18	0.921

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, SD = Standard Deviation, and SAS = Statistics Anxiety Scale.
2) The items in the SAS questions had responses in the Likert format with: 1 = No Anxiety, 2 = Slight Anxiety, 3 = Moderate Anxiety, 4 = Considerable Anxiety and 5 = High Anxiety.
3) For the overall mean scores, scores of 1.00-2.99 = low level, 3.00-3.99 = moderate level and 4.00 – 5.00 = high level.

Table 4.17 Means and standard deviation for SAS factor for Interpretation

Item No.	SA factors and statements	Overall		T&S		T&A		T&M	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Interpretation Factor									
1.	Interpreting the meaning of a table in a journal article	3.21	0.746	3.17	0.791	2.93	0.907	3.31	0.660
2.	Reading a journal article that includes some statistical analyses	2.97	0.923	2.97	0.928	2.90	0.885	2.97	0.944
3.	Doing the final examination in a statistics	3.42	1.096	3.47	1.137	3.50	0.900	3.31	1.039
4.	Asking one of the lecturers for help in understanding a	2.89	1.060	2.83	1.177	3.03	0.850	3.00	0.802

	printout								
5.	Trying to understand the odds in a lottery	2.79	1.163	2.77	1.194	3.00	0.983	2.83	1.136
6.	Seeing a classmate carefully studying the results table of a problem he has solved	3.27	1.042	3.47	1.008	3.20	0.961	2.86	1.026
7.	Going to statistics exam without having had enough time to revise	3.56	1.055	3.67	0.994	3.40	1.163	3.34	1.173
8.	Trying to understand the statistical analyses described in the abstract of a journal article	3.04	0.838	3.07	0.868	3.00	0.788	3.00	0.802
Total Means and SD		3.14	0.991	3.05	1.012	3.12	1.179	3.07	0.947

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, SD = Standard Deviation, and SAS = Statistics Anxiety Scale.
2) The items in the SAS questions had responses in the Likert format with: 1 = No Anxiety, 2 = Slight Anxiety, 3 = Moderate Anxiety, 4 = Considerable Anxiety and 5 = High Anxiety.
3) For the overall mean scores, scores of 1.00-2.99 = low level, 3.00-3.99 = moderate level and 4.00 – 5.00 = high level.

4.8 E-book formats and the students' achievement

The variable achievement was measured using the Mid Semester Test at Week 6 of the semester and Final Examination at the end of the 12-week semester. Both Mid Semester Test and Final Examination were considered as posttests analyses to measure the participants' achievement. Overall, a paired t-tests was done to check for possible difference between the two posttests.

For the Mid Semester Test, the scores (out of 100) had an average of 50.32 with standard deviation of 20.103, while the scores (out of 100) for Final Examination had an average of 65.37 with standard deviation of 24.231. The result implied that the participants exhibited higher scores in Final Examination than Mid Semester Test.

Another observation that was noticeable was that the two posttests (Mid Semester Test and Final Examination) results correlated well (refer to Table 4.18, r (88) = 0.743, p < 0.005) and the paired t-tests indicated that there was a significant difference between the two variables (t (88) = -8.681, p < 0.005). Cohen's d was determined to be the appropriate effect size measure to use in the context of a t-test on means. For these data, the d was calculated to be 0.679, which indicated a medium effect size, where 0.2 is generally indicative of a small effect, 0.5 a medium and 0.8 a large effect size (Cohen, 1988).

Table 4.18 *Paired t-tests of Mid-Semester Test and Final Examination Results*

Variables	N	Mean	SD	t-value	df	p-value
Mid Semester Test results - Final Examination results	89	-15.042	16.347	-8.681	88	< 0.005*

A One-Way between groups Multivariate Analysis of Variance (MANOVA) was performed to investigate the difference between the three e-book formats in the two posttests (Mid Semester test and Final Examination). The research question was

"Are there differences in the students' achievement in the statistics subject for the three e-book formats?" Analysis began with evaluation of assumptions. The six assumptions for MANOVA are (1) sample sizes, (2) multivariate normality, (3) linearity, (4) homogeneity of regression, (5) homogeneity of the variance-covariance matrices, and, (6) multicollinearity.

For the assumptions underpinning the use of MANOVA, since the sample size was greater than 30, assumptions of normality and equal variances were of little concern (Pallant, 2007). The assumptions of univariate normality were not violated because the test values for Shapiro-Wilk were found to be not significant ($p > 0.05$). For the next assumption, the multivariate outliers were detected using Mahalanobis distance, a test that requires the use of χ^2 distribution where the degree of freedom equals the number of dependent variables at $p < 0.001$ (Tabachnick & Fidell, 2007). This test failed to identify any multivariate outliers as the Mahalanobis distance of all cases was less than $\chi^2(3) = 16.27$ with $p > 0.05$. Thus, all the cases were retained.

In testing the assumption of linearity, the scatterplots in Figure 4.2 shows that the two posttests were significantly related. This is supported by the correlation which was significant between the two posttests (r (88) = 0.743, $p < 0.005$). Since the correlations among the two posttests were fairly high, the problem of multicollinearity did not exist (Coakes & Steed, 2003).

The Box test was used to test the assumption of homogeneity of the covariance matrices. The Box's M statistics test reported a value of 8.76 and p = 0.206. The result failed to reject the null hypothesis of equal matrices. Furthermore, Levene's test of equality of error variances was not significant ($p > 0.05$). Therefore, the homogeneity assumption of the covariance matrices was satisfied. Hence, no serious violations of assumption were noted.

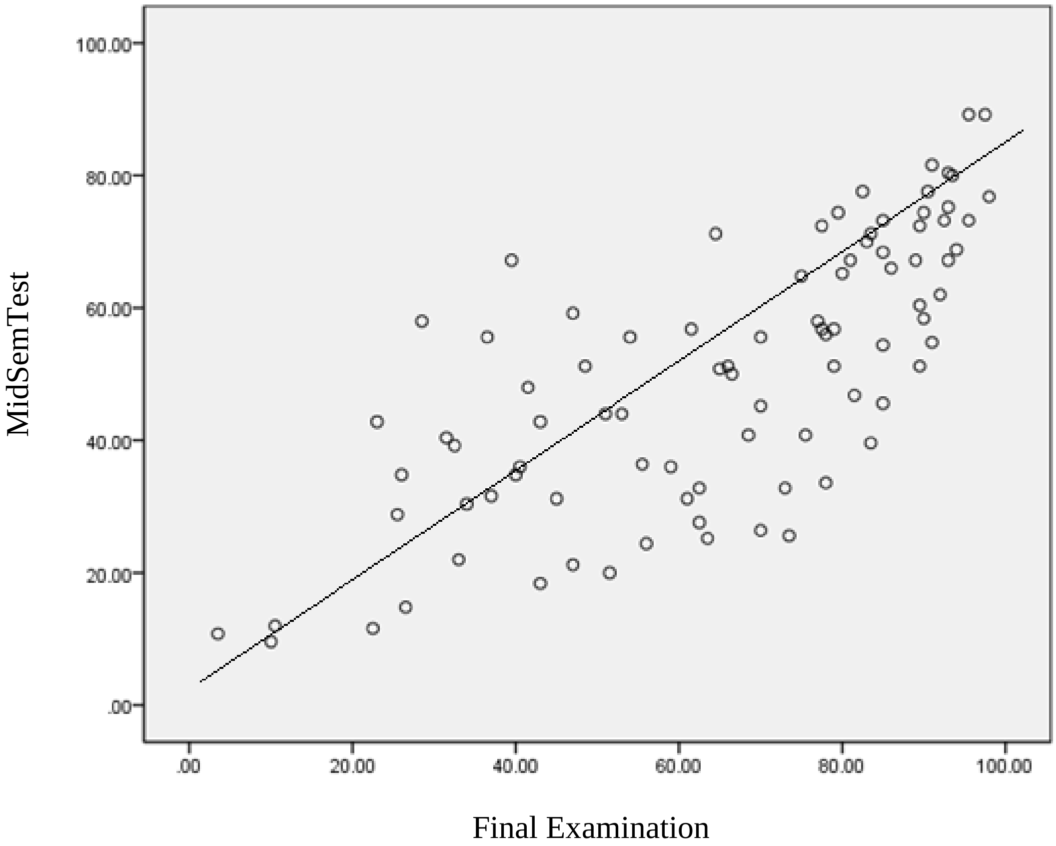


Figure 4.2: Scatterplot between two posttests.

Results from MANOVA showed that there were significant differences between the three e-book formats groups between the two posttests ($F(4, 85) = 5.48$, $p < 0.005$; Wilks' Lambda = 0.785; partial $\eta^2 = 0.11$). Given the significance of the overall test, the univariate for each posttest was examined. Significant univariate results were obtained for Mid Semester Test (F (2, 86) = 9.49, $p < 0.005$, partial $\eta^2 = 0.18$) and Final Examination (F (2, 86) = 10.24, $p < 0.005$, partial $\eta^2 = 0.19$). The values for partial eta squared were equivalent to Cohen's *d* values above 0.70, which showed medium and large effect sizes, indicating practical significant.

As stated, the result of the study points the participants in all three e-book groups have improved in their final examination, signifying that their knowledge in statistics have been enhanced, through participation in the assigned e-book.

These observations revealed a consistent trend of progression from the beginning to the end of the instructional term of 12 weeks and participants learn better in statistics by using Ti-83 calculator as the lessons progresses. Possible explanation for the lower scores in Mid Semester Test may due to the amount of time spent to use the assigned e-book format as e-book was introduced for the first time in the statistics course. Although there are only two chapters in Mid Semester Test, participants may have spent more time to learn how to use the e-book as the participants have no prior knowledge on using Ti83 graphic calculator in statistics before. Additionally, placing students in a new situation to learn statistics, particularly in different media representation in e-books, could have had a confusing and distracting effect on them before they could get used to the new learning environment (Clark & Mayer, 2011). This may explained the lower mean scores in Mid Semester Test compared to the Final Examination scores.

After 12 weeks of using the assigned e-book, the participants might have adapted and became familiar with the e-book, thus put their concentration on learning statistics and answering tutorial questions. Moreover, since there are eight chapters in the Final Examination, the participants were pre-informed by the instructor on the difficulty level. Extra lessons were allocated by the instructor to help the participants in dealing with tutorial questions. For additional practice, the participants were allowed to use the e-books outside the allocated tutorial sessions so they could spend more time in practising tutorial questions at their own time. As a result, this may likely to have positive influence on higher scores in the Final Examination.

Nevertheless, participants assigned with T&S scored the lowest in both Mid Semester Test and Final Examination as compared to participants in T&A and T&M groups scored similar results in both Mid Semester Test and Final Examination (refer to Table 4.19 for summary outcomes and Figure 4.3 for graphical illustration).

Table 4.19 *Summary of the posttest outcomes for different e-book format groups*

E-book format groups	Mean	SD	N
Mid Semester Test			
T&S	38.70	17.754	30
T&A	58.52	17.223	30
T&M	53.87	20.170	29
Final Examination			
T&S	50.73	22.690	30
T&A	74.83	19.104	30
T&M	70.72	24.060	29

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, and SD = Standard Deviation.
2) Both Mid Semester and Final Examination total scores were analysed out of 100 marks.

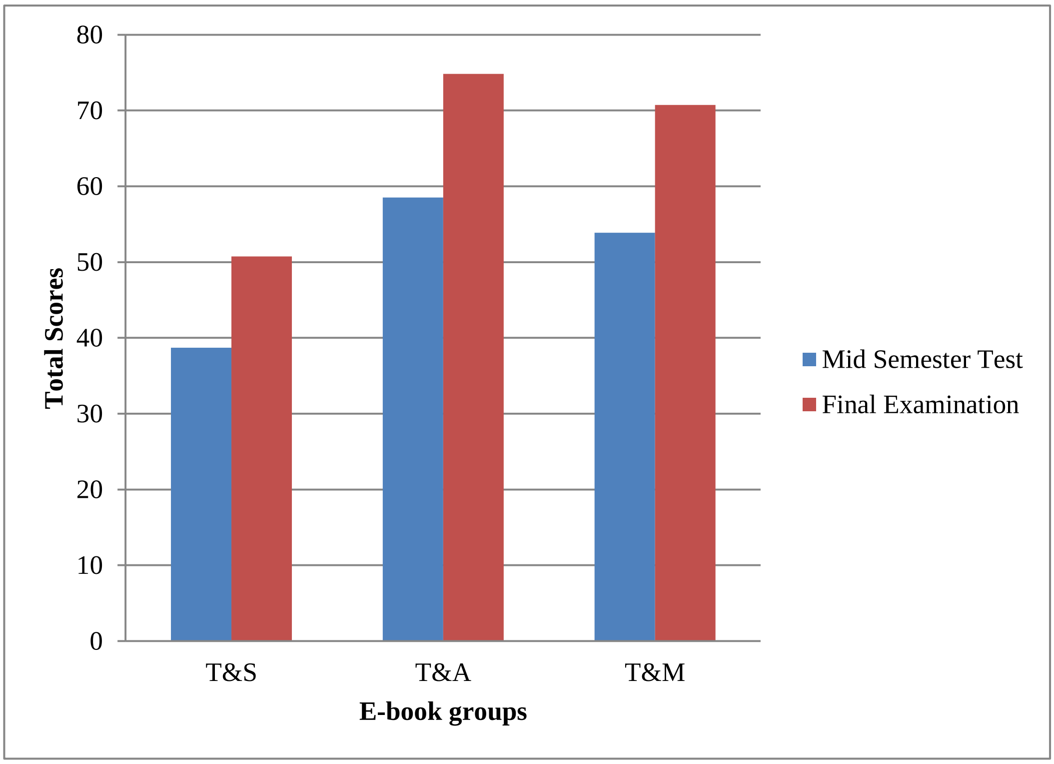


Figure 4.3: Bar charts showing the posttests scores of Mid Semester Test and Final Examination across all the e-book groups.

4.9 Effects of the three e-book formats on CL, SE, SA, and Achievement with Gender, Computer Use Experience and LS as the moderators.

To answer this objective, the examination on the students' LS was carried out first followed by hierarchical multiple regression procedures.

Determine the types of LS among the participants based on the Kolb learning model.

Learning Style Inventory (LSI) was used to determine a learner's learning type: 'Diverger', 'Assimilator', 'Converger' and 'Accommodator'. In order to identify students' LS, descriptive statistics were conducted.

As can be seen from Table 4.20, there were more students with a diverging preference (47.2%). The second most prevalent style was accommodating (33.7%), followed by distributions of converging (12.4%) and assimilating (6.7%) styles. This pattern of distributions of LS was found to be similar across all the three e-book groups. As a result, it can be proposed that the students generally like to learn through generating new ideas, observing situations from different perspectives, and bringing different ideas together (divergers). The second dominant LS was learning through carrying out experiments and taking risks (accommodators). The students rarely preferred learning through practical application like problem solving, trying to make correct decisions and least preferred to deal with technical works or problems as opposed to working with social relations (converging). They were also less focussed on abstract concepts, making reflective observation and assimilating them into an integrated explanation (assimilating).

Table 4.20 *Distributions of participants in three different e-book formats according to Kolb categories*

	Convergers	Divergers	Assimilators	Accommodators
T&S	5	13	2	10
T&A	2	16	2	10
T&M	4	13	2	10
Overall	11	42	6	30

Note: 1) T&S = Text and Static image, T&A = Text and Animation, T&M = Text and Multimedia, and SD = Standard Deviation.

Next, the assumptions of hierarchical multiple regression were discussed, followed by presentation of data for each dependent variable.

<u>Hierarchical Multiple Regression Assumptions</u>

Hierarchical regression assumptions include (1) Sample size, (2) Multicollinearity, (3) Outliers, and (4) Normality, linearity, homoscedasticity and independence of residuals (Pallant, 2007). Hierarchical regression was employed to determine if the LS, gender and computer use experience contributed a unique proportion of variance to the effects of the three e-book formats on the level of CL, SE, SA, and achievement, while using three different e-book formats. Preliminary analyses were conducted to ensure no violation of the assumptions for hierarchical multiple regression.

(1) Sample size

Stevens (1996, p. 72) recommends that “about 15 subjects per predictor are needed for a reliable equation”. Overall, a sample size of 89 was deemed adequate for the analysis given four independent variables to be included in the analysis (Tabachnick & Fidell, 2007). Thus, there was no violation on the assumption of sample size.

However, the sample sizes for two of the LS categories (Convergers and Assimilators) were fewer than 15. Therefore, the data was transformed by adding the total of samples for both Convergers and Assimilators as both have the abstract concepts (AC) learning mode (Kolb, 1985). Hence, for the purpose of this analysis, LS is grouped in 3 sub-groups (AC groups with n = 17; Divergers with n = 42 and Accommodators with n = 30).

(2) Multicollinearity

To test on this assumption, the relationship among the independent variables was evaluated. Preliminary analyses showed the assumption of multicollinearity was met as the independent variables (gender, computer use experience, learning styles and e-book formats) were not a combination of other independent variables. For example, an examination of correlations (see Table 4.21) revealed that no independent variables were highly correlated. All correlation values (*r*) were lower than 0.5.

In addition, the tolerance and Variance Inflation Factor (VIF) were also checked for the assumption of multicollinearity (Pallant, 2007). Pallant (2007) mentioned a tolerance close to 1 means there is little multicollinearity and the general rule of thumb of VIFs exceeding 10 are signs of serious multicollinearity. As the collinearity statistics (i.e., Tolerance and VIF) were all within accepted limits, the assumption of multicollinearity was considered to have been met (Coakes & Steed, 2003; Hair et al., 2007).

(3) Outliers

Outliers can be checked by inspecting the Mahalanobis distances. The analysis of Mahalanobis distance can pick up on any cases that have a strange pattern of scores across the dependent variables (Tabachnick & Fidell, 2007). A case is an outlier when the Mahalanobis distance value exceeds the critical value which can be obtained using chi square critical value table. An examination of the Mahalanobis distance scores indicated no multivariate outliers for all hierarchical multiple regressions in this study (χ_2 (5) = 20.52, p > 0.001).

(4) Normality, linearity, homoscedasticity and independence of residuals

These assumptions can be checked from examining residual and scatter plots as well as the value for Cook's Distance (Pallant, 2007). According to Tabachnick and

Fidell (2007), cases with values larger than 1 are a potential problem for Cook's Distance. The investigation on all residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied. The values of Cook's Distance for all regressions were less than 1, suggesting no major problems for undue influence on results for the model.

The result of the correlation in Table 4.21 shows a weak negative relationship between the participants' level of cognitive load and their achievement in Mid Sem Test ($r = -0.396$, $p < 0.005$) and Final Examination ($r = -0.399$, $p < 0.005$). This implies that the lower the levels of cognitive load among the participants, the higher the achievement scores. Additionally, the correlation results from Table 4.19 shows the level of self-efficacy is negatively correlated with the level of statistics anxiety among the participants ($r = -0.211$, $p < 0.005$), although it is a weak relationship. This may signify that the lower the level of self-efficacy perceived by the participants, the higher level of anxiety in statistics.

Table 4.21 *Pearson Correlation Matrix among dependent variables and independent variables*

	Gender	CompUE	LS	CL	SE	SA	EbookFormats	MidSem	Final
Gender		-0.077	-0.013	0.012	-0.040	0.101	-0.068	0.127	0.104
CompUE			-0.002	-0.006	-0.070	0.115	0.065	0.014	0.071
LS				-0.050	0.096	-0.021	0.021	-0.114	0.001
CL					0.107	0.000	-0.608(**)	-0.396(**)	-0.399(**)
SE						-0.211(*)	-0.059	0.097	0.153
SA							0.016	0.063	-0.068
EbookFormats								0.312(**)	0.340(**)
MidSem									0.743(**)

Note: (1) *. Correlation is significant at the 0.01 level; (2) **. Correlation is significant at the 0.05 level; (3) CompUE = Computer Use Experience, LS = Learning Styles, CL = Cognitive Load, SE = Self-Efficacy and SA = Statistics Anxiety

4.9.1 Predicting the level of CL from Gender, Computer Use Experience and Learning Style (LS) with three e-book formats

Hierarchical multiple regression was used to assess the ability of the three moderator variables (gender, computer use experience and learning style) and the usage of three different e-book format to predict the level of CL among the participants. Preliminary analyses were conducted and Figure 4.4 shows the scatterplot and suggests no major deviations from normality.

The results of the VIF (all less than 2.0), and collinearity tolerance (all close to 1) suggest that there were no violation of the assumptions of multicollinearity and homoscedasticity.

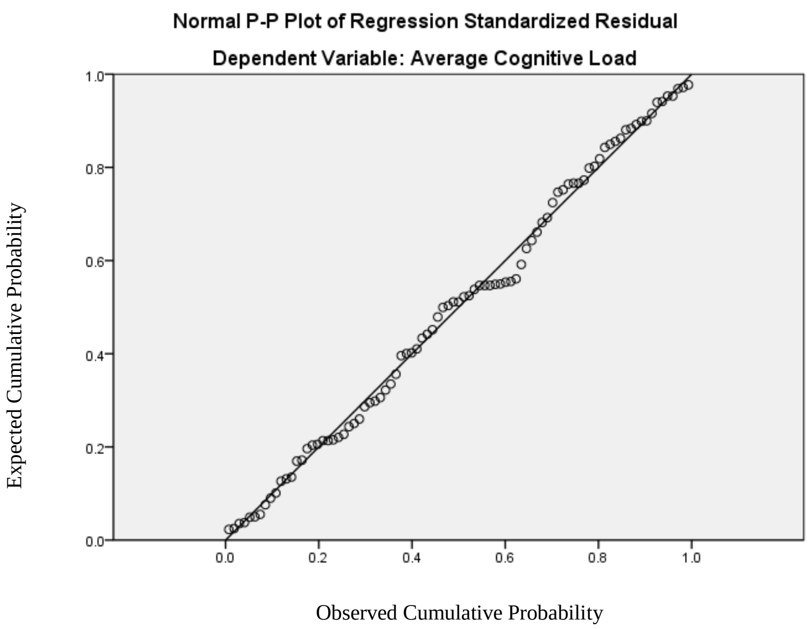


Figure 4.4: Scatterplot of the level of CL and independent variables.

The hierarchical multiple regression revealed that at Step one, gender and computer use experience did not contributed significantly to the regression model, (F (2,86) = 0.007, p = 0.993). Introducing the LS variables explained just additional 0.3% of variation in the level of CL and this change in R^2 was also not significant, (F (2,85) = 0.08, p = 0.971). After adding e-book format groups to the regression model explained an additional 37.0% of the variation in the level of CL and this change in R^2 was significant, (F (2,84) = 12.46, p < 0.005). Only e-book format groups were significant predictors of participants' level of CL (β = -0.611, p < 0.005). The regression statistics are reported in Table 4.22.

Table 4.22 *Summary of Hierarchical Regression Analysis for variables predicting the level of CL*

Variable	B	*SE* B	β	t	R	R^2 (%)	ΔR^2	F change
Step 1					0.013	0.0	0.000	0.007
Gender	0.102	0.947	0.012	0.108				
CompUE	-0.056	1.205	-0.005	-0.046				
Step 2					0.053	0.3	0.003	0.225
Gender	0.105	0.951	0.012	0.110				
CompUE	-0.120	1.218	-0.011	-0.099				
LS	-0.206	0.433	-0.052	-0.474				
Step 3					0.610	37.2	0.370	49.464*
Gender	-0.233	0.761	-0.027	-0.306				
CompUE	0.314	.0974	0.028	0.322				
LS	-0.136	0.346	-0.034	-.0392				
E-bookFormats	-3.208	0.456	-0.611	-7.033*				
Total						37.5		

Note:1) * p < 0.001; 2) CompUE = Computer Use Experience, LS = Learning Styles, CL = Cognitive Load; 3) N = 89; 4) Durbin-Watson value = 1.131; 5) Maximum Cook's Distance Value = 0.107

4.9.2 Predicting the level of SE from Gender, Computer Use Experience and LS with three e-book formats

To examine the unique contribution of gender, computer use experience, LS and e-book formats in the explanation of the level of SE, a hierarchical multiple regression analysis was performed. Figure 4.5 shows the scatterplot and there were no violations of assumptions of normality and linearity. The results of VIF (all less than 2.0), and tolerance values (all close to 1) suggest no violation of multicollinearity and homoscedasticity assumption.

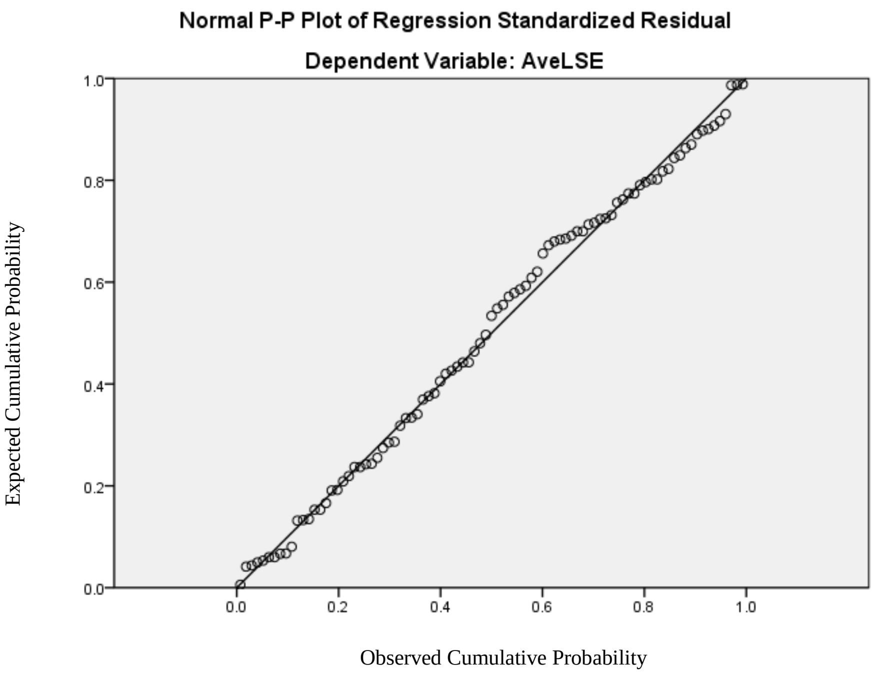


Figure 4.5: Scatterplot of the level of self-efficacy and independent variables.

The hierarchical multiple regression was conducted with SE as the dependent variable. Results from the step one regression demonstrated that the gender and computer use experience variables were not significant predictors of participants' level of SE (F (2, 86) = 0.262, p = 0.770). Similarly, by introducing LS into the model did not show any statistical significant (F (2, 85) = 0.668, p = 0.574). In the final step, the addition of e-book formats in the regression model also did not significantly improve the prediction of participants' of SE (F (2, 84) = 0.630, p = 0.642). The regression statistics are reported in Table 4.23.

Table 4.23 Summary of Hierarchical Regression Analysis for variables predicting the level of SE

Variable	B	*SE* B	β	t	R	R^2 (%)	ΔR^2	F change
Step 1					0.078	0.6	-0.017	0.262
Gender	-0.285	0.878	-0.035	-0.324				
CompUE	0.693	1.116	0.067	0.620				
Step 2					0.152	1.7	-0.011	1.477
Gender	-0.271	0.875	-0.033	-0.310				
CompUE	0.697	1.113	0.067	0.626				
LS	0.808	0.665	0.130	1.215				
Step 3					0.171	0.6	-0.017	0.527
Gender	-0.311	0.879	-0.038	-0.353				
CompUE	0.746	1.119	0.072	0.667				
LS	0.853	0.670	0.137	1.273				
E-bookFormats	-3.84	0.529	-0.079	-0.726				

Note: 1) CompUE = Computer Use Experience, LS = Learning Styles, SE = Self-Efficacy; 2) N = 89; 3) Durbin-Watson value = 1.814; 4) Maximum Cook's Distance Value = 0.201

4.9.3 Predicting the level of SA from Gender, Computer Use Experience and LS with three e-book formats

To test that gender, computer use experience, learning styles and three different e-book formats were the predictors of participants' level of Statistics Anxiety (SA), a hierarchical multiple regression analysis was performed. Figure 4.6 shows the scatter plot of the data. Results of VIF (all less than 2.0) and collinearity tolerance (all close to 1) indicated there were no violation of assumptions of normality, linearity, multicollinearity and homoscedasticity.

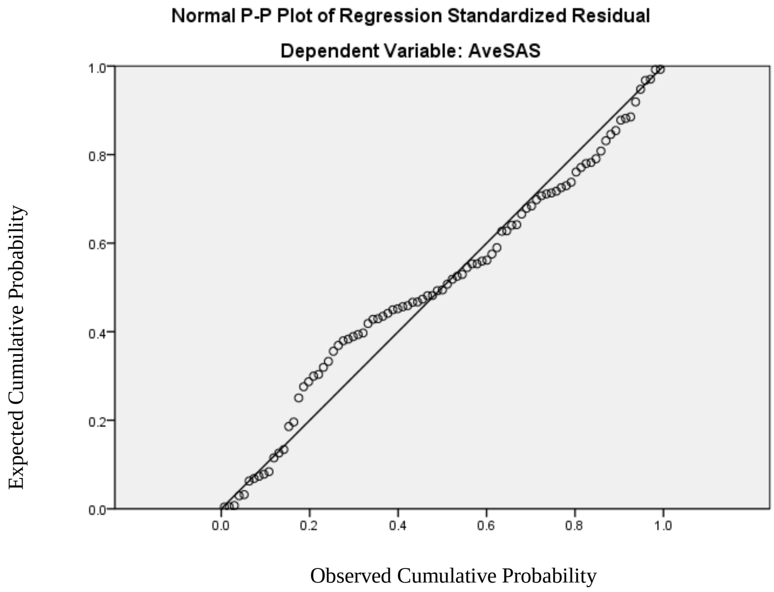


Figure 4.6: Scatterplot of the level of SA and independent variables.

Similar to the previous regression model, variables that explained the participants' level of SA (dependent variable) were entered in three steps. The results of step 1 indicated that gender and computer use experience were not significantly different from the level of SA (F (2, 86) = 1.110, p = 0.334). In step 2, the LS were entered into the regression equation and it did not significantly improve prediction (F (2, 85) = 1.497, p = 0.221). In the last step, the addition of three e-book formats towards participants' level of SA in the regression model also did not significantly improved the model (F (2, 84) = 1.130, p = 0.348). The regression statistics are reported in Table 4.24.

Table 4.24 Summary of Hierarchical Regression Analysis for variables predicting the level of SA

Variable	B	*SE* B	β	t	R	R^2 (%)	ΔR^2	F change
Step 1					0.159	2.5	0.002	1.110
Gender	2.713	2.633	0.110	1.030				
CompUE	3.860	3.350	0.123	1.152				
Step 2					0.224	5.0	0.017	2.238
Gender	2.664	2.615	0.108	1.019				
CompUE	3.845	3.326	0.123	1.156				
LS	-2.972	1.987	-0.158	-1.496				
Step 3					0.226	5.1	0.006	0.079
Gender	2.710	2.634	0.110	1.029				
CompUE	3.787	3.350	0.121	1.131				
LS	-3.024	2.006	-0.161	-1.507				
E-bookFormats	0.447	1.586	0.030	0.282				

Note: 1) CompUE = Computer Use Experience, LS = Learning Styles, SA = Statistics Anxiety; 2) N = 89; 3) Durbin-Watson value = 1.997; 4) Maximum Cook's Distance Value = 0.114

4.9.4 Predicting Mid Semester Test from Gender, Computer Use Experience and LS with three e-book formats

Hierarchical regression was run to investigate whether gender, computer use experience, LS and three different e-book formats were the predictors of participants' Mid Semester Test. Figure 4.7 shows the scatter plot of the data and no violation of normality was present. Results of VIF (all less than 2.0) and collinearity tolerance (all close to 1) showed the condition of multicollinearity and homoscedasticity were not present.

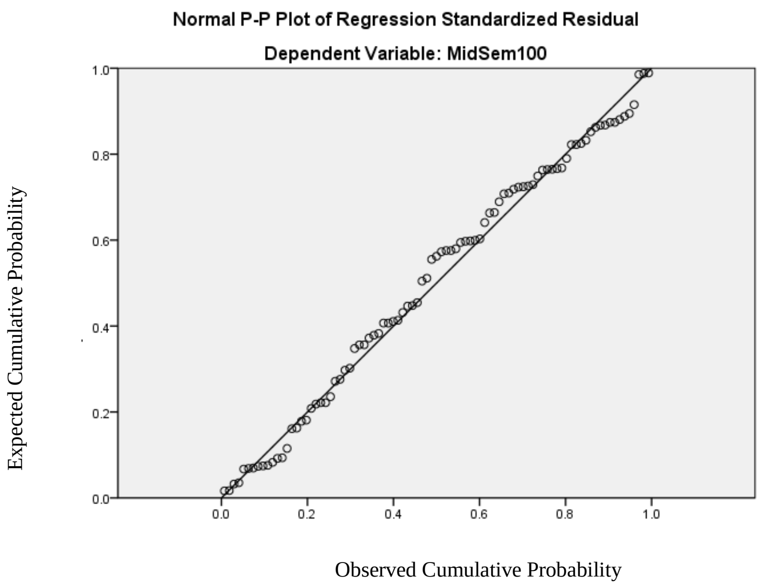


Figure 4.7: Scatterplot of the level of Mid Semester Test and independent variables.

In the first step, gender and computer use experience did not account for any significant variance in the variance of Mid Semester Test (F (2, 86) = 0.728, p =

0.486). In the second step, LS also did not account for a significant amount of additional variance in Mid Semester Test after gender and computer use experience (*F* (2, 85) = 0.532, p = 0.661). In contrast, in the final step, the e-book formats accounted for a significant additional amount of variance (10.6%) in the variance of mid sem test (*F* (2, 84) = 2.982, p < 0.005). Similar to level of CL, only e-book format groups were significant predictors of participants' Mid Semester Test (β = 0.328, p < 0.005). Table 4.25 summarizes the regression statistics.

Table 4.25 Summary of Hierarchical Regression Analysis for variables predicting the Mid Sem Test scores

Variable	B	*SE* B	β	*t*	*R*	R^2 (%)	ΔR^2	F change
Step 1					0.129	1.7	-0.006	0.728
Gender	5.268	4.389	0.129	1.200				
CompUE	1.223	5.583	0.024	0.219				
Step 2					0.136	1.8	-0.016	0.154
Gender	5.246	4.411	0.128	1.189				
CompUE	1.217	5.611	0.023	0.217				
LS	-1.317	3.352	-0.042	-0.393				
Step 3					0.353	12.4	0.083	10.159*
Gender	6.075	4.199	0.148	1.447				
CompUE	0.178	5.341	0.003	0.033				
LS	-2.246	3.198	-0.072	-0.702				
E-bookFormats	8.057	2.528	0.328	3.187*				
Total						15.9		

Note:1) * p < 0.001; 2) CompUE = Computer Use Experience, LS = Learning Styles; 3) N = 89; 4) Durbin-Watson value = 1.490; 5) Maximum Cook's Distance Value = 0.137

4.9.5 Predicting Final Examination from Gender, Computer Use Experience and LS with three e-book formats

Hierarchical multiple regression was conducted to examine whether the moderator variables (gender, computer use experience, LS) and independent variables (three different e-book formats) were the predictors of participants Final Examination score. To ensure no violation of assumptions was present. Figure 4.8 shows the scatter plot of the data and shows no violation of normality. In addition, VIF values were all less than 2.0 and tolerance values were all close to 1. This showed there were not violations of multicollinearity and homoscedasticity assumptions.

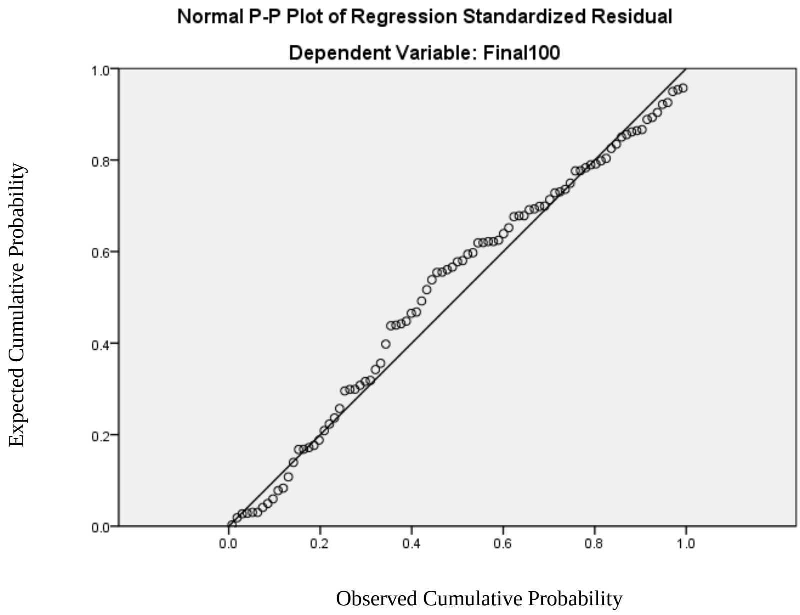


Figure 4.8: Scatterplot of the Final Examination and independent variables.

The hierarchical multiple regression revealed that at Step 1, gender and computer use experience did not contribute significantly to the regression model (F (2, 86) = 0.748, p = 0.476). Introducing the LS also did not explain any additional variance in Final Examination (F (2, 85) = 0.830, p = 0.481). Nevertheless, adding the three e-book formats to the regression model explained 11.3% of the variation in final examination and this change in R^2 was significant, (F (2, 84) = 3.453, $p < 0.005$). When all four independent variables were included in the regression model, neither gender, or computer use experience nor LS were significant predictors of Final Examination. The most important predictor of Final Examination was the three e-book formats which uniquely explained 11% of the variance of Final Examination. Together the four independent variables accounted for 18.6% of the variance in Final Examination. The details of the hierarchical regression statistics were explained in Table 4.26.

Table 4.26 *Summary of Hierarchical Regression Analysis for variables predicting the Final Examination scores*

Variable	B	*SE* B	*β*	*t*	*R*	R^2 (%)	ΔR^2	F change
Step 1					0.131	1.7	-0.006	0.748
Gender	5.435	5.289	.110	1.028				
CompUE	4.988	6.728	.079	.741				
Step 2					0.169	2.8	-0.006	0.994
Gender	5.502	5.290	.112	1.040				
CompUE	5.008	6.728	0.080	0.744				
LS	4.006	4.019	0.107	0.997				
Step 3					0.376	14.1	0.100	11.030*
Gender	6.534	5.012	0.132	1.304				
CompUE	3.716	6.375	0.059	0.583				
LS	2.851	3.817	0.076	0.747				
E-bookFormats	10.021	3.017	0.339	3.321*				
Total						18.6		

Note:1) * $p < 0.001$; 2) CompUE = Computer Use Experience, LS = Learning Styles; 3) N = 89; 4) Durbin-Watson value = 1.817; 5) Maximum Cook's Distance Value = 0.312

4.10 Summary

This chapter addressed the results of the statistical tests performed, including descriptive statistics, paired t-test, measures of effect size and statistical assumptions tests, One-Way ANOVA, One-Way MANOVA, and hierarchical multiple regression. The reliability of the research instruments and demographics of the participants were also discussed. The summary of the experiment results of the e-book formats is as follows:

(1) The usefulness of the three e-book formats was examined using PSSUQ instrument. Although, the three e-book formats were found to be moderate in terms of usability, the findings found that T&S e-book format had the lowest rating of usability compared to T&A and T&M e-book format.

(2) The findings revealed that the participants in the control group (T&S e-book format) exhibited moderate levels of cognitive load. Conversely, participants using T&A and T&M (treatment groups) e-book format showed low levels of cognitive load. Significant differences were found among the participants using three e-book formats and the level of their cognitive load from One-Way ANOVA analysis. From the post-hoc analysis, there were mean differences between participants' level of cognitive load when using T&S e-book format with T&A and T&M e-book formats. However, there were no significant mean differences among the participants' level of cognitive load between T&A and T&M e-book format usage. In addition, the level of cognitive load was moderate for participants using T&S e-book format and low for participants using T&A and T&M e-book format. This implies that the animation and multimedia may have been more effective for reducing cognitive load among participants who had learnt statistics through e-book.

(3) In terms of the level of self-efficacy, the participants did not show any significant differences when it comes to using either T&S, T&A or T&M e-book formats. All of the control and treatment groups demonstrated moderate level of self-efficacy.

(4) Similarly, no significant effect was observed for participants' level of statistics anxiety towards the usage of three different e-book formats (control and treatments). The participants' statistics anxiety was basically at a moderate level, regardless of which e-book format used.

(5) By examining participants' achievement through paired-t tests and One-Way MANOVA analyses, the results revealed that the participants improved from Mid Semester Test to Final Examination. From the descriptive data, those who were using T&A and T&M e-book formats (treatment groups) demonstrated higher achievement in both posttests than those who were using T&S e-book format (control group).

(6a) Hierarchical multiple regression showed that the demographics variables (gender and computer use experience), together with learning styles were found to impose no significant effect on participants' level of cognitive load, level of self-efficacy, level of statistics anxiety and the two posttests. The study also found that the three e-book formats did not significantly predict the participants' level of self-efficacy and statistics anxiety.

(6b) However, hierarchical multiple regression provided evidence of the relationship between the three e-book formats towards the level of cognitive load among the participants. The three e-book formats significantly explained 37% of the variance in their level of cognitive load.

(6c) The hierarchical multiple regression analysis also provided solid evidence of the relationship between the three e-book formats towards achievement (Mid Semester Test and Final Examination). The performance of the participants in the assigned e-book format towards Mid Semester Test scores significantly explained 10.6% of the variance. Likewise, the three e-book formats had a positive influence on the Final Examination scores, predicting 11% of its explained variance.

The overall summary of the open-ended were as follows:

(1) The participants agreed that the e-books were interesting and a new learning tool that they had never encountered before. Most of them were excited to use the assigned e-book.

(2) The feelings of e-book usage were generally positive among the participants, particularly from T&M e-book group. Almost half of them agreed that the e-books had helped them in learning the usage of graphic calculator and statistics.

(3) The negative comments were mainly on: (1) the physical constraints such as tiredness, fatigue and eye-strain while using e-books, particularly in T&S e-book; (2) the time constraints in a way that e-books were considered time-wasting if compared to printed textbooks, and (3) technical problems related to onscreen design and navigation of the e-books. This led to most of the participants finding the e-books were rather difficult to follow and did not significantly support their

statistics learning. These comments were pointed mainly by the participants from T&S e-book group.

(4) Some participants suggested the animation and e-book interface could potentially be further enhanced through additional interactivity features. On the other hand, participants expressed their disagreement towards video and audio quality in the T&M e-book, which could be further improved.

(5) Generally, although e-books were accepted as a mean of study among the participants which resulted in higher achievement, as reflected in the final examination scores, majority of the participants still preferred printed textbooks rather than relying on e-books entirely.

The following chapter provides a summary of the study, a discussion of the significance of the findings, and recommendations for future research.

CHAPTER 5

SUMMARY AND CONCLUSIONS

5.0 Introduction

This chapter begins with the summary of the research, discussions of the research findings reported in the previous chapter, the implications of the findings, recommendations for future research and the conclusion of the research.

5.1 Summary of the study

The primary objective of the study presented was to investigate the effects of three different e-book formats in a first year undergraduate statistics unit in the university level. A first year Quantitative Analysis unit in Bachelor of Commerce program, conducted over 12 weeks was used as a platform to investigate how the three formats of the e-book could facilitate the learning. The research study set out to examine the effects of three different e-book formats in different learning aspects and the objectives of the study were to:

1) Investigate the effects of the three e-book formats on the level of CL among the students in the statistics subject;
2) Investigate the effects of the three e-book formats on the level of SE among the students in the statistics subject;
3) Investigate the effects of the three e-book formats on the level of SA among the students in the statistics subject;

4) Investigate the effects of the three e-book formats on the students' achievement; and

5) Investigate the effects of the three e-book formats on CL; the level of SE; the level of SA; and Achievement with Gender, Computer Use Experience and LS as the moderators;

A total of 89 participants took part in the study and completed all the treatments and the questionnaires. A quasi-experimental design was adopted where the study was conducted using Non-Equivalent Group, Posttest-Only Design. The participants were divided into three tutorial groups, with control group assigned with T&S e-book. Two of the other tutorials (treatment groups) were assigned T&A e-book and T&M e-book respectively.

Data were collected using both quantitative and qualitative techniques. The e-books usability test was measured using Post-Study System Usability Questionnaires (PSSUQ) by Lewis (1995). Upon using the assigned e-book format, the participants' level of CL was measured using the Paas's (1992) Mental Effort Scale questionnaire. Next, participant's perception on their level of self-efficacy was measured by Neill's (2008) Learning Self-Efficacy (LSE) instrument. Participants were also asked to identify their level of statistics anxiety and this was based on the Statistics Anxiety Scale (SAS) by Vigil-Colet et al. (2008). The questionnaires on determining the types of learning styles were derived from Kolb and Kolb (2011)'s Learning Style Inventory (LSI). Open-ended questions were conducted to confirm the findings qualitatively. The achievement was measured through Mid Semester

Test scores (conducted during Week 6) and the Final Examination scores (taken during Week 12) as posttest analyses.

5.2 Reliability and applicability of research instruments

The Cronbach Alpha value for Post-Study System Usability Questionnaires (PSSUQ) on the e-books was above 0.90, indicating that usability test questionnaire has high reliability and each factor shown relatively moderate level of reliability. The finding was consistent with the results reported by Fruhling and Lee (2005) and Lewis (2002), where the reliability for all items in the PSSUQ exceeds 0.80.

Likewise, the Cognitive Load (CL) questionnaire in the questionnaire also had good reliability, having Cronbach Alpha values above 0.80 as reported by Clarke et al. (2005), DeLeeuw and Mayer (2008), Paas and van Merrienboer (1994) and Paas et al. (2008).

Similarly, the Learning Self-Efficacy (LSE) questionnaire was shown to have good reliability (Cronbach's $\alpha = 0.741$) as well as each factor and this was supported by Neill (2008) and Peschar et al. (1999) where their studies found the Cronbach alpha results ranged between 0.76 to 0.90.

The internal consistency of the scale (the alpha value) for Statistics Anxiety Scale (SAS) questionnaires was 0.873 and each factor has reliability above 0.60, which was acceptable. Chiesi et al. (2011), Vigil-Colet et al. (2008) and Hsiao (2010) reported a high reliability with alpha values were 0.91 for both total scale and subscales of SAS.

The reliabilities for Learning Style Inventory (LSI) in this study were lower than what were reported by Kolb (1985), Wang et al. (2006), Kolb and Kolb (2011) and Ku and Chang (2011). This could be due to the small number of participants identified in each subscale. For example, concrete experience and abstract conceptualization. Craighead and Nemeroff (2001) mentioned that the lower number of participants in a subscale may lead to lower coefficient value. Furthermore, the reliability values (alpha values of 0.71 to 0.85) reported by Kolb (1985) was based on a sample of 1446 adults between the ages of 18 and 60, which represent a more diverse background of sample population, while the participants in the sample of this study only focused on 89 first year university students. It should be noted being first year university students, it could be difficult for the students to fully identify their own learning styles at early tertiary period (Oughton & Reed, 2000) as Kolb and Kolb (2011) and Zacharis (2010) posits that learning is a developmental process and the process continues in the individual day-to-day experience. Besides, by identifying statements in the LSI instrument could not reflect one’s learning style in a short period of time (Willcoxson & Prosser, 1996). Nevertheless, the reliabilities for LSI were still acceptable for French and Poulsen (2002) and Sternberg and Zhang (2000) where if the value of coefficient is between 0.3 and 0.7, the reliability is acceptable.

Lastly, the reliability for two posttests (Mid Semester Test and Final Examination) was considered high with Cronbach's Alpha value of 0.844.

5.3 Discussions of findings

This section summarises and discusses the research findings reported in the previous chapter. The discussions are divided into seven sub sections (5.3.1-5.3.7).

5.3.1 Usability of the e-book formats

The participants were generally perceived to have a moderate level of satisfaction with the e-book usability as reported in the results of the PSSUQ factors. In relation to the finding, it is assumed that the Waterfall model used to design and develop the e-book into website was found to be effective in presenting the statistics materials in different presentation formats in the e-books. Although the "novelty effect" is present, since e-books are practically new to the participants, the e-book formats are generally acceptable among the participants and this supports the idea of Wong et al. (2011) where tailor-made e-books are largely adopted by students rather than commercial e-books.

Looking at the difference between the levels of satisfaction among the participants using the three e-book formats, quantitative findings indicated that participants using T&S e-book format were found to have lower level of satisfaction compared to participants who were using T&A and T&M e-book formats. In this case, it was evident that the participants found to have low preference for acquiring concepts of statistics via T&S e-book format, especially in learning to use Ti-83 graphic calculator. In other words, the participants were having difficulty interpreting the statistics content illustrated using static text and pictures, charts, graphs and diagrams in the e-book.

In relation to the low preference on T&S e-book format, it is consistent with a recent Springer e-Book Pilot Project study conducted by the University of California Libraries in which 500 undergraduates compared using e-books for learning (Li et al., 2011). Findings related to preference indicated that many respondents had difficulty learning, retaining and concentrating reading text from e-book (Li et al., 2011). However, the outcome did not support the notion of Kim and Gilman (2008) and Mason et al. (2013) where they viewed static visuals of text and graphics are still one of the most popular tools in e-learning environment. In some way, as proposed by Booth and Koedinger (2011) and Guan (2009), the effects of static text and diagrams did not become apparent when it comes to all learning situations and thus supporting past research outcomes where text and pictures did not significantly facilitate comprehension and influence the way of learning (Butcher, 2006; Concannon, 1975; Holliday, 1975; Spaulding, 1955).

Unlike the outcome of T&S e-book format usability result, participants using T&A and T&M e-book formats perceived themselves to be moderately satisfied with the assigned e-books. The findings suggest that e-book embedded with animation and multimedia may create effective learning for the participants in learning Ti-83 calculator. Cook et al. (2009), Despotakis et al. (2007), Eilam and Poyas (2008), Guan (2009), Kuhl et al. (2011), Lai and Newby (2012), Neumann et al. (2011) and

Wang et al. (2011) supported the notion where animation-based and multimedia formats facilitates learning among the participants and is more successful than with text and pictures format only.

The qualitative results showed the participants complaining that text and static pictures were rather difficult to comprehend, which stressed the eyes, caused fatigue and lost interest in reading from e-book. The results were consistent with the University of California Libraries study that compared using e-books to printed books for academic reading in which the participants indicated a preference to read from the printed page as reading e-book on computer screen tend to distract their focus and concentration (Li et al., 2011).

Additionally, some of the participants revealed that e-books with animation and multimedia were found to be helpful in learning statistics, which was also indicated by the higher achievement scores in both Mid Semester Test and Final Examination. This further supports Clark and Mayer's (2011) idea that animation and multimedia has positive effects towards learning.

Although e-book formats with animation and multimedia were found to be moderately acceptable by the participants, from the qualitative comments, majority of them still preferred printed textbook over e-book. Participants expressed that reading from printed textbook is easier than e-book, particularly with just text and static images. Perhaps, as suggested by Warren (2009) and Foasberg (2011), a combination of both printed textbook and e-books usage would significantly benefit learning among the participants.

5.3.2 Effects of the three e-book formats on the level of CL among the students in the statistics subject

The scores for the CL questions which queried participants about their level of self-perceived mental effort in learning statistics via different e-book formats were gathered and analysed. According to Amadieu et al. (2010) and Paas (1992), the mental effort scale help to measure the overall CL, which include intrinsic, germane and extraneous load. Among the three e-book formats, the T&S e-book format imposed higher level of CL on participants than those who used T&A and T&M e-book formats. The different CL results in three different e-book formats supported previous research showing that different amount of working memory are required across different learning conditions (Agostinho et al., 2011; Chien & Chang, 2010; Jin & Boling, 2010; Kalyuga, 2009; Kalyuga & Sweller, 2005; Mayer & Moreno, 2003; Paas, 1992; Zheng & Cook, 2012).

In examining the level of CL, participants using the T&S e-book format needed to exert greater mental effort to learn statistics and to use Ti-83 graphic calculator. It could be argued that the mental processes were associated with the intrinsic load, especially considering that the learning materials consisted of exactly the same text-based content, pictures, images, tables, figures, and charts. The high intrinsic load in T&S e-book format may have occurred because the content was naturally difficult due to the complexity of the subject matter (Clark et al., 2006). The results presented in the usability test where participants using T&S e-book format found to be less satisfied with the design of the e-book further support the finding.

Furthermore, to fully determine whether the design of the presentation formats are effective, Paas et al. (2008) explained that it depends on the performance of the participants. The results on the posttests scores indicated that the participants from T&S e-book group had significantly lower posttest scores than those who use T&A and T&M e-book format. The findings suggest that the participants consumed more load and resources to mentally visualize and fill in the gaps when processing the contents in T&S e-book format. Thus, the design of T&S e-book format did not significantly promote germane load, which help in information retention (Meissner & Bogner, 2013; Sweller, 2010).

Based on the results from mental effort scale, the participants in T&A and T&M groups required similar amount of CL during the learning task. As such, it could be argued that equal mental processes were imposed when learning from the animation and multimedia e-book formats as supported by some of the previous studies (Clark & Mayer, 2011; Mayer, 2010; Paas & van Gog, 2006). The results also highlighted that the contents presented in T&A and T&M e-book formats formed lower level of intrinsic load as compared to T&S e-book format as learning contents may have improved using animation and multimedia. For example, the learning tasks in T&A and T&M e-book formats were developed and segmented into a more manageable series of lessons (Meissner & Bogner, 2013; Pollock et al., 2002). Furthermore, the higher posttest scores also indicated that the participants in T&A and T&M group attained greater effectiveness in the learning, thus attributed to promoting germane cognitive load. As observed by Aryes and van Gog (2009), contents presented in animation and multimedia formats help to retain information and increase germane load.

From the findings of this study, similar pattern was detected for the extraneous load, where the participants using T&S e-book format experienced higher load during the learning task but not for the participants in T&A and T&M groups, who experienced equal amounts of mental burdens. The scores calculated from the perceived difficulty scale further provide the evidence. The results associated with extraneous CL occurred differently for T&S with one possible reason. For instance, the T&S participants may have incurred split-attention and a dual-tasking burden of reading a continuous document from a computer screen and switching their attention back and forth between text and image, which may have occupied much CL to process the switching. A sense of disorientation (Lambert et al., 2009) may occur, thus making learning and concentration harder for the participants.

The situation is different for T&A and T&M participants, as they could retrace their learning memory supported by animation and multimedia formats. In the context of Clark and Mayer's (2011) split-attention principle, animation and multimedia do help participants to learn more deeply rather than just reading from text alone. The understanding of split-attention principle serves as further evidence that learners tend to have better accuracy of information retention by animated graphics and multimedia formats rather than text only format (Clark et al., 2006; Mayer, 2001).

Overall, the findings of the higher level CL by participants from T&S e-book was supported by Chang and Yang (2010), where their study on web-based instruction and cognitive load showed the mental effort spent on online test which consisted of text and static graphics only, was the highest across other curriculum components, such as video, animations, discussions and chat rooms. According to Chang and Yang (2010), text and graphics only could not enhance learning performance and increase cognitive load level because learners could not store knowledge in long term memory and have a hard time in accommodating themselves to the learning environment. Similar findings were found by Spanjers et al. (2011) where students in learning probability using text format and Aldalalah (2012) study on learning music using text and images, invested more effort in learning and higher cognitive load. Therefore, text and static image does not provide adequate support for e-book.

In contrast, the results also showed that the participants using T&A and T&M did not significantly differ in terms of CL level. Participants from both T&A and T&M e-book formats were found to require lower or similar level of mental effort in learning Ti-83 calculator from the assigned e-book formats. This suggests that animation and multimedia (video and audio) formats helped in reducing participants' mental effort. A similar result was found in a previous study by Chang and Yang (2010) where students who engaged with animation and video in a web-based instruction exhibited lower level of cognitive load. This also provides further evidence to the recent studies that animation and multimedia leads to less mental effort (Mayer & Moreno, 2003; Paas, 1992; Spanjers et al., 2011; Yeh et al., 2012). Finally, although both T&A and T&M e-book formats shows lower level of cognitive load, the results also found no difference with respect to whether animation or videos is more effective in reducing the level of cognitive load in e-book. As commented by Lambert et al. (2009) and Kim and Gilman (2009), the outcome has found to be inconsistent.

Hence, significant effects were found in different e-book formats on the level of cognitive load. Only T&A and T&M e-book formats were found to reduce cognitive load among the participants. It is found that high intrinsic, germane and extraneous cognitive load affect working memory, information retention and performance. The results also provide solid evidence for the benefits of presenting content with animation and multimedia in e-book, which helps to reduce the level of cognitive load, at least the perception of it.

5.3.3 Effects of the three e-book formats on the level of SE among the students in the statistics subject

An increased in e-learning including e-book as a tool has prompted researchers to consider how SE impact learning among the students (Abulibdeh & Syed Hassan, 2011; Ferla et al., 2009; Vuong et al., 2010). Evidence from this study indicated that the significant main effect of the three e-book formats on participants' level of SE clearly did not indicate any difference. In other words, the participants observed similar perception on their ability to achieve the tasks given by any of the e-book formats and the result did not support previous studies relating to SE when learning in an e-learning environment (Liang & Tsai, 2008; Tsai et al., 2010; Vuong et al., 2010).

Researchers believed that appropriate usage of technology in e-learning such as different formats of information presentation like multimedia, can enhance the students' level of SE to facilitate the learning process and problem solving skills (Ferla et al., 2009; Vuong et al., 2010; Zheng et al., 2009) but this was not found in the results of the study. It also seems that text, static graphics, animation and multimedia in e-book do not have significant influence towards the level of SE among the participants. Based on the results from the mean scores, all participants from the three e-book format groups have moderate degree of SE.

One possible reason to the non-significant difference findings of SE with different e-book format is that information presented in e-learning environment (digital audio, video, and animation) as embedded in the e-book, has become enmeshed in the everyday activities of the average person. Some researchers assert that becoming proficient with the technology related to e-learning has become simpler and SE can improve rapidly over a short period of time (DeTure, 2004; Puzziferro, 2008). It is reasonable to believe that the average person's perception in his or her ability to utilize e-books was somewhat similar even with different format of information presentation.

Another factor that may have influenced the results of the study is the data collection instrument itself. Instrument such as Neill's (2008) LSE that focused on academic SE in universities may yield results that are somewhat homogeneous. The students' reluctance to reveal their SE frankly for this study and afraid to show their weakness in order to stay on par with other students may also contribute to the results. Some researchers assert that academic SE measures should not only assess perceived motivation, self-control or general efficacy, but should also include components that assess critical thinking, technical skills or task related (Hung et al., 2010). Using an instrument that focused on general learning SE may have also contributed to the findings. Accordingly, future research may consider statistics SE to yield better understanding in the context of learning statistics using e-books.

Still, since studies relating e-book are still relatively few, understanding students' SE in using e-book may have considerable impacts (Liang & Tsai, 2008) since SE is identified as one of the key components of students' motivation that enables academic success in e-learning environment (Tsai et al., 2010).

5.3.4 Effects of the three e-book formats on the level of SA among the students in the statistics subject

Because statistics courses are typically consider difficult to learn by many students (Garfield & Ben-Zvi, 2007), researchers have tried to incorporate new way of presenting materials to drive greater statistics learning, particularly in an e-learning environment (Everson & Garfield, 2008; Johnson & Dasgupta, 2005, Mills & Raju, 2011). The present study was carried out to investigate possible effect of different presentation formats for statistics in e-books namely, T&S, T&A and T&M formats towards participants' level of statistics anxiety. The results of this study clearly indicate no evidence that participants using different e-book formats had a direct effect on the level of statistics anxiety. Based on the results from the mean scores, conclusion can be drawn that all the participants in the three e-book format groups have a moderate degree of SA.

The results contradicted the findings of Dykeman (2011), Garfield and Ben-Zvi (2007), Keeley et al. (2008), Moore (1997a), Nasser (2004) and Neumann et al. (2011), where they posited that different presentation formats in statistics such as combination of text, pictures, animation and multimedia could enhance interaction, stimulate interest and evaluate statistics in which may lead to reducing SA among the students.

The fact that no significant impact was discovered suggests that participants receiving any of the three e-books experienced similar level of SA during the whole semester. It is possible, due to the participants' prior impact of SA, which becomes an accepted factor for the fundamental nature of how anxiety is perceived (Macher et al., 2012; Nasser, 2004). Furthermore, one plausible explanation on why there is no difference in anxiety level when using e-books is because the e-books were developed to show how to use Ti-83 graphic calculator for learning statistics. Participants might not feel anxious on the examples set in the e-books on Ti-83 graphic calculator usage because in general, the capabilities of Ti-83 graphic calculator with statistical facilities may assist in helping students to overcome their anxiety (Handal et al., 2011). Another possible reason could be the participants' reluctance to frankly reveal their SA level for this study, being reluctant to show their own weakness in order to stay on par with other participants, which indirectly influence the result study.

Despite the findings showed no difference between the levels of SA among the participants using three e-book formats, given that the moderate level of statistics anxiety found among the participants, further research is needed to explore what instructors can do to help alleviate this anxiety. Schou (2007) suggested that instructors can alleviate anxiety by utilizing effective design of how statistics materials to engage students' interaction. In addition, Pan and Tang (2005) noted that when the instructors pay extra attention to the students' anxiety in class, statistics anxiety was decreased.

5.3.5 Effects of the three e-book formats on the students' achievement

The results revealed that achievement differed significantly across e-book formats. The results pointed to an improvement over Mid Semester Test to Final Examination scores. In the present study, the paired t-test results on the Mid Semester Test scores and the scores of the Final Examination have shown that significant improvement was noticed for all three e-book formats. Thus, the participants in all three e-book formats have improved significantly at the end of the unit compared to the Mid Semester Test, proving that through using the assigned e-book format, their knowledge in statistics and Ti-83 calculator usage have been enhanced.

While the results shows that all participants from the three e-book formats scored higher in Final Examination than Mid Semester Test, the findings also showed that participants from T&A and T&M e-book formats attained higher learning outcome than the participants in the T&S e-book format. Therefore, using e-book with animation and multimedia is a more effective than using text and static image from e-book.

These results were consistent with findings by Hsieh and Dwyer (2009), Paas (1992), Paas et al. (2010) and van Gog and Rummel (2010), who found that certain learning materials used in different presentation of information were more effective than others based on performance score differentials. For instance, Kuhl et al. (2011) and Chen and Sun (2012) found that learners scores were significantly better when it came to applying what they had learned after receiving animation multimedia formats rather than a text-only format. Other groups of researchers (Chandler & Sweller, 1991; Chandler & Sweller, 1996; Kalyuga et al., 2003; Mayer & Moreno, 2003; Sweller, 1994; Sweller et al., 1998) confirmed these results. Similarly, Lee and Rha (2009) reported that students who were exposed to interactive instruction (animation and video) achieved higher examination scores than text only instructions in a web-based distance education.

However, as noted by many researchers, to increase students' achievement, multiple representations of animation and multimedia must be used properly (Connor et al., 2007; Kim & Gilman, 2009).

5.3.6 Effects of the three e-book formats on CL; SE; SA and Achievement with Gender, Computer Use Experience and LS as the moderators.

First, the learning styles among the participants are discussed. The findings of the study were found to be theoretically consistent with the predictions of the Kolb learning style model. According to the findings, there were more students with a diverging preference and the second most prevalent style was accommodating in using e-book. However, there were fewer students with converging and assimilating preferences. As the most dominant learning style of the students while using e-book, divergers are best at viewing concrete situations from many different perspectives and would combine it with reflective observation in order to come up frequently with a creative solution. As the second dominant learning style, accommodators prefer learning by hands-on experience. The participants using the e-books rarely prefer learning through finding practical uses for ideas and understanding a wide range of information and putting it into a concise and logical form (convergers and assimilators). As a result, it can be proposed that the participants favoured intuitive approach and emphasizing feeling in their learning (divergers and accommodators).

Generally, the finding showed dominant learning style (diverging) across the participants using e-book and this may be a sign to improve the development of e-book in the future. It can be suggested that online instructors and e-book designers should offer opportunities for students to interact among each other; for example, participation in the e-learning communities through e-book to encourage collaborative learning.

Nevertheless, Zacharis (2010) suggested that the effective learner can use each of the learning styles in different learning situations rather than relying on his/her preferred learning. Learning is an on-going and holistic process of adaptation to the environment; hence students have the ability to move back and forth between different modes of thinking, feeling, perceiving and behaving through transformation of learning experience (Ku & Chang, 2011; Platsidou & Metallidou, 2009).

Next, hierarchical multiple linear regressions were performed for each of the four dependent variables based on e-book formats, demographic variables and learning styles. Only two dependent variables showed statistical significance, that being cognitive load and achievement. An examination of the individual predictors revealed that the three e-book formats was a significant predictor of participants' perception of the level of cognitive load and their achievement. The findings further support the results discussed in Section 5.3.2 and Section 5.3.5 previously. The level of cognitive load was perceived to be moderately high among the participants using T&S e-book as compared to participants in T&A and T&M e-book formats, although the difference in the level of cognitive load among the participants in T&A and T&M e-book format group was not significant. In other words, text and static graphics consumed more cognitive resource to mentally visualize and fill in the gaps when processing the content in the e-book (Sweller et al., 2011; Yeh et al., 2012).

In relation to achievement, participants using T&A and T&M e-book formats had higher scores in both Mid Semester Test and Final Examination than participants using T&S e-book format. In other words, animation and multimedia formats helped participants in learning statistics compared to just static text and images (Chen & Sun, 2012; Kuhl et al., 2011).When taking the performance scores from Mid Semester Test and Final Examination into consideration, the results revealed that most of the participants showed improvement after working through the e-book.

Although all participants improved in their posttests performance, it can be concluded that the participants' working memory while using T&S e-book was burdened, thereby resulted in lower performance as compared to participants using T&A and T&M, who may have used fewer working memory resources. In short, the results indicated that the efficiency of the e-book design vary among different learners. There were clear differences in the effects of cognitive stress, in interaction with the animation and multimedia on learning outcomes. Animation and video format of e-book required less mental effort and that the performance of the participants in the group with T&A and T&M e-book format was higher than participants in T&S e-book format. Mayer and Moreno (2003) and Miller (2005) stated that incorporation of multimedia and animation formats could have greater influence on achievement. The result supports the idea that the information presented in the e-book especially animation and multimedia is beneficial and improves learning. One explanation is that majority of the participants had more than 5 years of experience with computers and it is not surprising that they are comfortable with the usage of e-books embedded with animation and multimedia. Also, the “novelty effect” explains the notion that participants may feel excited in using T&A and T&M e-book formats, thus resulting in higher achievement if compared to T&S e-book format.

The finding was supported by the correlation results where participants’ perceived cognitive load was negatively associated with their achievement. When participants’ perceived lower levels of cognitive load, they showed better achievement in their Mid Semester Test and Final Examination. Such negative relationship was substantiated by van Gog and Rummel (2010), Wästlund et al. (2008), Lee and Rha (2009), Kim and Gilman (2009) and Guan (2009) who found a significant relationship between cognitive load and students’ learning achievement in e-learning settings. Their results showed that participants who perceived higher mental effort in an e-learning environment, achieved lower scores in examination. A similar result was found in Chang and Yang’s (2010) study where high level of cognitive load students displayed no gain at all on the online test, while lower cognitive load level students had a more modest gain on the online test. However, DeTure (2004) and Downing (2005) reported that different types of formats (audio and video) did not help learners enhance their achievement in online courses.

Findings from this study showed that none of the moderating variables were significantly associated with participants' level of self-efficacy and statistics anxiety. This showed that the self-efficacy and statistics anxiety level among the participants remained constant with different e-book formats usage and had no direct effect towards their working memory and achievement, even though self-efficacy has been found to be highly correlated with performance in e-learning environment (Tsai et al., 2010). This finding were not consistent with Ford et al. (1998), Joo et al. (2000) and Zheng et al. (2009) studies which reported different format, especially multimedia improved self-efficacy level and lowered the statistics anxiety among the students, leading to better performance outcome because they were more motivated to learn. This also indicated that different way of presenting statistics materials such as text, graphics, animation and multimedia do not necessarily had a direct effect towards the level of self-efficacy and statistics anxiety as the participants possibly shared similar levels of efficacy and anxiety prior or while using the assigned e-books (Vuong et al., 2010).

Nevertheless, Onwuegbuzie et al. (2010) believes that it is important to identify learners' level of statistics anxiety and self-efficacy in order to understand the learning situation that the learners faced. With this, instructors are encouraged to identify which format is more effective and to provide a supportive learning environment so that the learners can devote their complete working memory resources to the learning tasks.

Despite the findings, the effects of cognitive load, self-efficacy and statistics anxiety in different e-book formats and their effects on achievement need to be investigated further.

Learning Styles, Gender and Computer Use Experience as Moderators

This study did not show learning styles, gender and computer use experience as predictors to the level of cognitive load, self-efficacy, statistics anxiety and achievement.

Although in this study, learning styles was not significant in predicting the level of cognitive load among the participants using e-books, it is still essential to recognise learning styles in order to improve learning. As suggested by Kalyuga et al. (2003), identifying learner's learning style may help to improve the design on how information is presented by reducing the level of mental load among the learners with different learning style preferences.

Much of the literature supports the notion that recognizing the learner's learning styles are necessary to increase the level of self-efficacy and to reduce statistics anxiety (Boldaji, 2008; Ramsden, 1992; Sloan et al., 2002), but the findings of this study showed otherwise. Hence, there is a need for more research on whether and how students' learning styles preferences in e-learning environment, particularly e-book has affected the learner's level self-efficacy and statistics anxiety.

The findings also indicated that learning styles was not significant in predicting achievement. This result was not in agreement with previous research conducted by Shaw (2012), Zacharis (2010), and Wang et al. (2011), who found that, ideally, identifying learning styles among the students could help them to achieve better in an e-learning environment.

Since this study showed that learning styles was not a moderating factor, it was suggested that this area may be further investigated. As mentioned by Zacharis (2010) and Kolb and Kolb (2011), learning is a continuous process grounded in experiencing and identifying learning styles of the participants using different e-book formats in just one semester may not be sufficient. The identification of learning styles would be a challenge, since first year students might not be able to understand their learning style preferences (Kucuk, 2012; Oughton & Reed, 2000). Participants should be given ample time to review the e-book and to discover their learning styles associated with their learning manners. Nevertheless, as suggested by Lu et al. (2007), being aware of students' learning styles, instructors or course designers can design e-books to accommodate effectively with students' wide variety of learning needs.

Demographics such as gender and computer use experience were recorded and analysed to see if they impacted on the level of cognitive load, self-efficacy, statistics anxiety and achievement. Results indicated that gender was not a moderating factor towards the level of cognitive load, self-efficacy, statistics anxiety and achievement. Similar findings have been reported by Arroyo et al.

(2006) that gender had little or no impact upon the level of cognitive load when using the e-books. The results again showed gender had no influence in the level of self-efficacy. There were limited studies in the literature regarding gender and self-efficacy level and statistics anxiety. It includes Kumar and Lai (2006), Goodwin et al. (2009), Hall et al. (1999), Baloglu et al. (2011), Onwuegbuzie (2004), and Hsiao and Chiang (2011), which yielded similar results showing gender did not influence self-efficacy and statistics anxiety as found in the present study. Although Bandura (1997) and DeCesare (2011) have suggested that gender may predict self-efficacy level and statistics anxiety respectively, this study suggests that gender is not a predictor. However, Ismail and Zainab (2005) noted that there were concerns about how different gender learns in different learning environment, especially in e-book usage. Hence, further research needs to be conducted on whether gender differs in terms of learning statistics using different presentation formats in e-book.

Evidence from this study indicated that computer use experience had no moderating effect on the level of cognitive load, self-efficacy, statistics anxiety and achievement among the participants. The impact of computer use experience has not received much attention in literature. Nevertheless, majority of the students have computer experience for more than five years and these results should not be surprising. With more than 61% of Malaysian population using the Internet and around 26.9% of households in Malaysia owing a personal computer, which is increasing rapidly each year (International Telecommunication Union, 2013), it is reasonable to assume that the use of a computer is becoming more common every day. The fact that the sample was comprised of students at first year course may have used computers and Internet frequently as part of their study. As suggested by Warren (2009) and Li et al. (2013), learners with high levels of computer experience have greater advantage in using e-book and they show a great level of comfort with navigating the e-book. It would be interesting to examine at a future date to see if different level of undergraduate students in university, for example final year students shows significant influence of computer use experience in e-book usage.

5.4 Implications of the study in e-learning context

Encouraging and designing an e-learning course which includes animation and multimedia presentations, has been the focus of many studies (Clark and Mayer, 2011; Li et al., 2013; Shaw, 2012). Within the literature reviewed for this research, no studies were located that addressed the preferences of text and static images, animation and multimedia presentation formats in an e-book setting. In considering how the study results impact e-learning practice, the results of this study offer another option for experts on e-learning practices into considering animation and multimedia presentations in an e-book format.

The results of this study also indicated that using animation and multimedia as a way of presenting information in e-book, as envisaged by some of its proponents may be a challenging task, particularly for the instructors and educational textbook publishers. The following implications for practice and future research are made for instructors and researchers in e-learning context.

5.4.1 Implications for instructors and educational textbook publishers

There are still relatively few studies relating to e-books in Malaysia, although the e-book is a promising way of learning especially in higher education. The results of this study have the potential to impact the decision made by both higher educational institutions and textbook publishers. The research implies that students are generally satisfied with using the e-book to learn statistics. This result helps to provide educational institutions with information to consider purchasing e-books in libraries and for teaching and learning purposes.

The findings of this study also help instructors and educational textbook publishers to consider developing their courses using e-books and developing strategies related to the preferred e-book formats for usage as recommended by Wong et al. (2011) on tailor-made e-books and Smith and Kukulska-Hulme (2012) on distance learning programmes. Since e-books can be customized, instructors and educational textbook publishers can take the initiative of converting printed-textbooks to e-books and embedding animation and multimedia to make it more interactive. It is also cost effective, considering that the conversion of printed text-book to digital copy does not require high expenses.

The current study adds to the body of knowledge by supporting the suppositions of Baddeley and Hitch's (1974) information processing theory, Mayer's (2001) multimedia principle and Paivio's (1989) dual-coding theory, as indicated by the performance of the participants, especially in the treatment groups. Based on these, it is evident that animation and multimedia used in the e-book made a difference in managing cognitive load and improved learning among the participants. As an implication to instructors or designers, it is important to be aware of the cognitive requirement of the design imposed in an e-book (Mayer, 2001). Mandic (2010) supported the notion that instructors should possess the required skills such as programming and video editing skills to ensure the design focus, to add value to the learning experience. Thus, the future design of materials presented in an e-book for statistics courses could emphasize the use of animation and multimedia. Doing so can help create an environment that will ensure a meaningful learning engagement among students especially in an e-learning environment using the e-book.

It may be assumed that this study provides information to mitigate the presentation formats that affect cognitive load, especially in the use of text and static images only. Of the three types of cognitive load (intrinsic, germane and extraneous), the study discovered that the T&S e-book format produced higher intrinsic and extraneous cognitive load. Based on this result, it is possible to justify that the text and static images have a negative impact on mental load and conclusions were drawn that the e-book designer should minimize text and static images only in the e-book in order to reduce both intrinsic and extraneous cognitive load. The findings show high germane cognitive load in the T&S e-book format, but, as suggested by Meissner and Bogner (2013) and Sweller (2010), germane cognitive load can be beneficial for information retention and learning. Hence, the results of this study provides glimpses that educational materials, if planned and designed properly, may provide a better learning environment for students, especially in an e-learning environment using the e-book as a tool.

This study was one of the few studies to investigate the preferences of e-book formats among students in Malaysia, particularly in business statistics. As mentioned by Arroyo et al. (2006), statistics education is one discipline that has benefited from the use of multimedia. Thus, this finding could contribute to the literature and also to the practices in e-learning education on statistics learning. The findings of this study also have implications for planning and teaching introductory statistics in higher learning institutions.

Although the study shows no significant influence of e-book formats towards the level of self-efficacy and statistics anxiety, it is still important to identify the effects of both. Vuong et al. (2010) and Baltes et al. (2010) posit that identifying students who demonstrate low self-efficacy and high statistics anxiety allows instructors to prepare themselves to adapt positive teaching attitudes and provide teaching and learning support. For example, instructors can design remedial statistics courses embedded with animation and multimedia in e-books in order to reduce the struggle associated with learning statistics and boost students' self-esteem. This is because animation and multimedia formats appear to have a positive impact in improving self-efficacy and reducing statistics anxiety (Dykeman, 2011; Tsai et al., 2010). This, in turn, may help to improve achievement in statistics.

Finally, even though the results did not show that learning styles, gender and computer use experience had moderating effects on the level of cognitive load, self-efficacy and statistics anxiety, the understanding of individual learning styles, gender and computer use experience allows instructors the opportunity to evaluate students' different learning needs (Amadieu et al., 2010; Malik, 2010; Zacharis, 2010). Such efforts to understand the students could assist instructors to design effective ways of presenting information and to address particular learning needs in the e-book to facilitate learning.

5.4.2 Implications for Future Research

As e-books are increasingly adopted by tertiary institutions in Malaysia, knowledge on preferences of e-book formats is important. Even though an e-book may be an exact replica of the hardcopy textbook, other additional formats such as animation and multimedia could change the way learning is delivered. Several questions emerged while conducting this research resulting in the following proposals for further study.

Future research could determine if results differed with an alternative or larger population, random sample of participants, rather than a convenience sample, other demographic variables, such as age, ethnicity, local and international students and different grade levels (for example, different levels of undergraduate and postgraduate levels). For instance, a common conception is that younger students learn better by reading from an e-book than older students (Karim & Hasan, 2007).

Future research could include pretests to see the difference between students' level of cognitive load, self-efficacy, statistics anxiety and their performance at the beginning of the experiment. It is reasonable to believe that the person's perception in his or her ability to utilize e-books is somewhat different than it would have been (Baumann, 2010). This will help to differentiate pretest and posttest results to detect any improvement throughout the learning process.

Further, reliance on only one method of assessment in the Mid Semester Test and Final Examination (written examination) as is the case in the current study, may not allow for adequate evaluation of student performance (Gal & Garfield, 1997). Schau and Mattern (1997a) have argued that in order to properly assess student performance in statistics, various assessment methods, for example, assignments and group projects should be applied in order to reveal students' understanding of statistics and their ability to select and adequately apply statistical tools when making sense of realistic data.

Moreover, other factors such as motivation level could also be carried out in the future study. According to Kuhl et al. (2011), motivation can also be a factor in determining the learning process, and have a significant impact towards the level of confidence in an e-learning environment. Hence, it is important to determine the motivational affects in e-books to help e-designers predict which presentation format will maximize learning (Sweller et al., 2011).

Finally, e-books involve a new, dynamic approach in the learning environment (Foasberg, 2011). Even though the text, animation and multimedia was developed specifically using PDF format, Flash animations and RealMedia, it is conceivable that adapted versions of these e-books can be created for other knowledge domains and be modified to work for a better user graphic interface or allow learners to socially interact and collaborate, thus adding another important factor for a constructive learning experience (Neumann et al., 2010; Li et al., 2013; Smith & Kukulska-Hulme, 2012). Additional features from McGraw-Hill Smartbook and KnoMe software from Kno.com for e-textbook, for example, self-quizzes, group sharing and peer-to-peer discussion can be integrated into the e-book to be examined (Empson, 2013; Trew, 2013) in the future. Further, in realistic settings, such as in an e-learning environment, the conditions of learning cannot be controlled or influenced (Hsieh & Dwyer, 2009; Ozcinar, 2009) and can differ significantly as technology changes over time. As such, it is important to consider other possible environmental factors, such as eye fatigue and handheld reading devices for e-book or e-reader during the research to determine whether, or not, mental effort, self-efficacy, statistics anxiety and performance results differ.

5.5 Conclusion

The study explored the effects of the e-book in different presentations of Ti-83 graphic calculator usage in statistics into text and static image, animation and multimedia towards first year students of statistics unit over a period of 12 weeks. The convenience sample included 89 participants from three different tutorial groups enrolled in a statistics unit in the Malaysian campus of an Australian university. The post-test only experimental design was applied in this study with the control group assigned with the T&S e-book format. The other two tutorial groups were assigned with animation and multimedia e-book formats respectively.

In general, the participants were satisfied with the usage of the e-book assigned to them. The study evaluated the level of cognitive load, self-efficacy, statistics anxiety and types of learning styles among the participants. The results showed participants using the T&S e-book had a higher level of cognitive load, though there was no difference found among the participants using the animation and multimedia e-book. The mental effort and difficulty results indicated that a more efficient learning condition tends to be produced while using the T&A and T&M e-book formats. It has been pointed out that higher intrinsic, germane and extraneous cognitive loads have significant negative effects on learning.

In terms of the level of self-efficacy and statistics anxiety, the findings found no significant differences between the participants from the three e-book formats. While participants were found to have improved from the Mid Semester Test to Final Examination, participants exposed to the T&S e-book were found to have lower scores than the other two e-books. With respect to learning styles, there were more participants with diverging and accommodating learning styles, suggesting that the participants in all three e-book formats favoured an intuitive approach, emphasizing feeling and reflection in their learning. Gender, computer use experience and learning styles of the participants proved to be insignificant predictors for the participants' level of cognitive load, self-efficacy, statistics anxiety and achievement while using the e-books. It did, however, highlight trends in the literature and results noting possible developments to examine in the future.

The level of cognitive load was found to be negatively correlated with the achievement of the participants, signifying the lower the cognitive load, the higher the achievement. Furthermore, the level of self-efficacy was also found to be negatively correlated with the level of statistics anxiety, which proved that participants with higher level of self-efficacy will most likely have a lower level of anxiety towards statistics. The results of both correlations, however, were remarkably weak.

It is reasonable to conclude that the results of this study are in general, consistent with findings reported in the literature. The findings from participants' use of the e-book formats with animation and multimedia show promise because participants show better achievement and they faced less cognitive stress compared to those using the text and static image only e-book format. However, this conclusion should be empirically tested in a cross-cultural study, which is recommended for future research. It is also important to indicate that although modest, the results of the current study contributed to the scant knowledge about the development of e-books and furnish the basis for the further research that is needed to address unresolved questions involving learning statistics using the Ti-83 graphic calculator.

Although e-books have been available for more than 40 years, the use of and research on the e-book in a formal way of learning is still in its infancy. As more and more higher educational publishers transform learning content into interactive materials that leverage on recent technological innovations, the future holds exciting possibilities in the way e-books will be used for learning.

It is hoped that this study and its findings could provide some practical suggestions for the implementation of statistics materials using the e-book in general and in particular in the local context. The findings could also spur further research into some of the issues raised in the findings to enrich the literature of e-books in the Asian and Malaysian contexts, as the use of e-books could help to facilitate greater learning acquisition.

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APPENDIX A: QUESTIONNAIRE

SECTION 1: DEMOGRAPHICS BACKGROUND

(Please circle the appropriate response to each question. Like all the other responses given by you, the answers are completely confidential.)

1. Female Male

2. Select your commerce major:

1	Bachelor of Commerce (Accounting)
2	Bachelor of Commerce (Marketing)
3	Bachelor of Commerce (Human Resource)
4	Bachelor of Commerce (International Business)
5	Bachelor of Commerce (Double Majors) Please state:
6	Bachelor of Commerce (Information Systems)
7	Bachelor of Computing & Design
8	Others: Please state:

3. How long have you use computer?
A. Less than 5 years
B. over 5 years

SECTION 2: The Post-Study System Usability Questionnaire (adapted by Lewis, 1995)

Key: **1** = Strongly Disagree **2** = Disagree **3** = Agree **4** = Strongly Disagree

	Statement	Responses			
1	Overall, I am satisfied with how easy it is to use this eBook.	1	2	3	4
2	It was simple to use this eBook.	1	2	3	4
3	I was able to understand the statistic concepts quickly using this eBook.	1	2	3	4
4	I was able to efficiently follow the instructions quickly using this eBook, particularly for Ti83 calculator.	1	2	3	4
5	I was able to efficiently complete the tasks using the instructions and procedures on the Ti83 calculator using this eBook.	1	2	3	4
6	I felt comfortable using this eBook.	1	2	3	4
7	It was easy to learn to use this eBook.	1	2	3	4
8	I believe I could become productive quickly using this eBook.	1	2	3	4
9	The error messages in this eBook were clear.	1	2	3	4
10	Whenever I made a mistake using the eBook, I could recover sassily and quickly.	1	2	3	4
11	The information (such as on-screen messages, procedures in using Ti83 calculator and statistics concepts) provided with the eBook was clear.	1	2	3	4
12	It was easy to find information I needed.	1	2	3	4
13	The information provided by the eBook was easy to understand.	1	2	3	4
14	The information by the eBook was effective in helping me to understand the statistics concepts and Ti83 calculator.	1	2	3	4
15	The information and instructions by the eBook was clear.	1	2	3	4
16	The interface of the eBook was pleasant to follow.	1	2	3	4
17	I liked using the interface of this eBook.	1	2	3	4
18	This eBook has all the statistics information and functions to the Ti83	1	2	3	4

	calculator that I expect it to have.				
19	Overall, I am satisfied with this eBook.	1	2	3	4

SECTION 3: COGNITIVE LOAD QUESTIONNAIRE (CL) modified from Paas & van Merrienboer 1994

No	Statement
1	Using the e-book in learning certain topic(s), I invested: (1) (2) (3) (4) (5) (6) (7) (8) (9) Very, Very Low Mental Effort — Neither Low nor High Mental Effort — Very, Very High Mental Effort
2	How do you find the procedures in using the e-book? (1) (2) (3) (4) (5) (6) (7) (8) (9) Not Difficult at all — Averagely Difficult — Very Difficult
3	How do you find the procedures in using the Ti83 calculator given in the e-book? (1) (2) (3) (4) (5) (6) (7) Very Easy — Neither Easy nor Difficult — Very Difficult
4.	In understanding the concept and content of statistics given in the e-book, I find them: (1) (2) (3) (4) (5) (6) (7) (8) (9) Not Difficult at all — Averagely Difficult — Very Difficult
5.	How easy or difficult was it for you to understand the instruction provided for using the e-book? (1) (2) (3) (4) (5) (6) (7) Very Easy — Neither Easy nor Difficult — Very Difficult

SECTION 4: LEARNING SELF-EFFICACY QUESTIONNAIRE (LSE), Neill, 2008

Key: **1** = Strongly Disagree **2** =Disagree **3** = Agree **4** = Strongly Agree

No	Statement	Responses			
1	I can master all the skills being taught to me at university	1	2	3	4
2	When studying, I work as hard as possible	1	2	3	4
3	I learn the things I need to learn pretty fast	1	2	3	4
4	I easily learn difficult material	1	2	3	4
5	If I want to learn something very well, I can	1	2	3	4
6	I do excellent job on assignments and tests	1	2	3	4
7	When studying, I keep working even if the material is difficult	1	2	3	4
8	I can concentrate when I'm trying to learn something	1	2	3	4
9	I can understand the most difficult material presented	1	2	3	4
10	When it comes to learning, I really work hard	1	2	3	4
11	I put aside distractions when I am studying	1	2	3	4
12	When studying, I do my best to acquire the knowledge and skills taught	1	2	3	4

13	I can understand the most complex material presented by my lecturer	1	2	3	4
14	When studying, I put in my best effort	1	2	3	4

SECTION 5: STATISTICAL ANXIETY SCALE QUESTIONNAIRE (SAS)
Vigil-Colet, Lorenzo-Seva & Condon, 2008

Key: **1** = No Anxiety **2** = Low Anxiety **3** = Slight Anxiety
4 = Moderate Anxiety **5.** Considerable Anxiety

No	Statement	Responses				
1	Studying for an examination in a statistics course	1	2	3	4	5
2	Interpreting the meaning of a table in a journal article	1	2	3	4	5
3	Going to ask my statistics lecturer for individual help with material I am having difficulty in understanding	1	2	3	4	5
4	Realizing the day before an exam that I cannot do some problems that I thought were going to be easy	1	2	3	4	5
5	Asking lecturers to explain a topic that I have not understood at all	1	2	3	4	5
6	Reading a journal article that includes some statistical analyses	1	2	3	4	5
7	Asking lecturers how to use a probability table	1	2	3	4	5
8	Trying to understand a mathematical demonstration	1	2	3	4	5
9	Doing the final examination in a statistics course	1	2	3	4	5
10	Reading an advertisement for an automobile which includes figures on gas mileage, compliance with population regulations, etc.	1	2	3	4	5
11	Walking into the classroom to take a statistics test	1	2	3	4	5
12	Asking lecturers about how to do an exercise	1	2	3	4	5
13	Getting to the day before an exam without having had time to revise the syllabus	1	2	3	4	5
14	Waking up in the morning on the day of a statistics test	1	2	3	4	5
15	Realizing just before going into the exam, I have not prepared a particular exercise	1	2	3	4	5
16	Copying a mathematical demonstration from the blackboard while the lecturer is explaining it	1	2	3	4	5
17	Asking one of the lecturers for help in understanding a printout	1	2	3	4	5
18	Trying to understand the odds in a lottery	1	2	3	4	5
19	Seeing a classmate carefully studying the results table of a problem he has solved	1	2	3	4	5
20	Going to statistics exam without having had enough time to revise	1	2	3	4	5
21	Asking lecturers for help when trying to interpret a results table	1	2	3	4	5
22	Trying to understand the statistical analyses described in the abstract of a journal article	1	2	3	4	5
23	Going to lecturer's office to ask questions	1	2	3	4	5
24	Asking lecturers to explain how to do an exercise	1	2	3	4	5

SECTION 6: LEARNING STYLES (LS), Kolb 1984

Please rate (1 to 4) the following activities of how anxious they make you feel

Statements	**Choices**			
EXAMPLE				
1. When I learn	I like to deal with my feelings	I like to think about ideas	I like to be doing things	I like to watch and listen

	☐	☐	☐	☐
2. I learn best when	I listen and watch carefully ☐	I rely on logical thinking ☐	I trust my hunches and feelings ☐	I work hard to get things done ☐
3. When I am learning	I tend to reason things out ☐	I am responsible about things ☐	I am quiet and reserved ☐	I have strong feelings and reactions ☐
4. I learn by	feeling ☐	doing ☐	watching ☐	thinking ☐
5. When I learn	I am open to new experiences ☐	I look at all sides of issues ☐	I like to analyze things, break them down into their parts ☐	I like to try things out ☐
6. When I am learning	I am an observing person ☐	I am an active person ☐	I am an intuitive person ☐	I am a logical person ☐
7. I learn best from	observation ☐	Personal relationship ☐	Rational theories ☐	A chance to try out and practice ☐
8. When I learn	I like to see results from my work ☐	I like ideas and theories ☐	I take my time before acting ☐	I feel personally involved in things ☐
9. I learn best when	I rely on my observations ☐	I rely on my feelings ☐	I can try things out for myself ☐	I rely on my ideas ☐
10. When I am learning	I am a reserved person ☐	I am an accepting person ☐	I am a responsible person ☐	I am a rational person ☐
11. When I learn	I get involved ☐	I like to observe ☐	I evaluate things ☐	I like to be active ☐
12. I learn best when	I analyze ideas ☐	I am receptive and open-minded ☐	I am careful ☐	I am practical ☐

SECTION 7: Please share your feedback.

1. Looking back on your experience of using the e-book, please share the problems that you have encountered.
   ____
   ____
   ____

2. In your opinion, is the e-book useful for your learning?
   ____
   ____
   ____

3. Any other comments that you would like to address in using this e-book?
   ____
   ____
   ____

Thank you for your participation.

APPENDIX B: HMB110 QUANTITATIVE ANALYSIS UNIT OUTLINE

Unit of Study Outline
Sarawak Campus

School of Business and Design

Higher Education Division

Unit of Study Outline

Semester 1, 2011 **Version date (21 February, 2011)**
HMB 110 Quantitative Analysis

SWINBURNE UNIVERSITY OF TECHNOLOGY
SARAWAK CAMPUS

Unit of study code	HMB 110
Unit of study name	Quantitative Analysis
Teaching Term/Semester & Year	2011, Semester 1
Contact Hours (hrs/wk) or total contact hours	4 hours / week
Prerequisites	None
Corequisites	None
Credit Points	12.5

Aims
The aim of the unit is to provide students with knowledge of basic financial mathematics and statistical techniques and the skills to analyse and interpret the results of statistical analysis.
Learning Objectives
After successfully completing this unit, you should be able to:

1. Solve financial problems concerning compound interest, mortgages, annuities, loans and investment.
2. Summarise quantitative and qualitative data in graphical and numerical forms.
3. Interpret cross-tabulations of two and three variables.
4. Calculate and interpret simple probabilities using tree diagrams and contingency tables using the ideas of mutually exclusive events, independent events and conditional probability.
5. Explain the concept of a random variable and the probability distribution of a random variable and calculate and interpret the expected value and standard deviation of a discrete random variable.
6. Apply the basic properties of the normal probability distribution and solve problems that utilise the normal probability distribution.
7. Find point estimates of population parameters using sample statistics.
8. Calculate and interpret confidence intervals for a mean and for a proportion.
9. Calculate sample sizes needed to estimate population means and proportions.

10. Carry out and interpret tests of hypotheses concerning population means and proportions from one population or from two populations, using a z-test or t-test, as appropriate.

11. Test for a relationship between two categorical variables using a Chi-square test.

12. Calculate the line of best fit for a set of bivariate data, test for the significance of the gradient and, if significant, use the line for prediction.

13. Calculate and interpret coefficients of correlation and of determination.

14. Analyse time series using the multiplicative model, including fitting linear and exponential trend lines, deseasonalising using seasonal indices and forecasting.

15. Calculate the different types of index numbers.

Content

Week	Lecture Topic	Lab/Tutorial Topic	Assessment
1	Introduction/ Financial Mathematics	Interest, Investment and Loans, Compound Interest	
2	Financial Mathematics	Annuities, Amortisation, Discounted Cash Flow Analysis	
3	Descriptive Statistics	Introduction to Statistics, Visual Displays and Summarising Quantitative Data	
4	Descriptive Statistics	Measures of Location and Dispersion, Describing Data Sets, Cross Tabulation	Assignment Part A Due
5	Probability	Tree Diagrams, Probabilities from Data, Relationship between Events, Discrete Probability Distributions	
6	Normal probability	Probability Density Curve, Normal Density Curve, Standardisation, Normal Probabilities	Test
Mid Semester Break			
7	Sampling and Estimation	Simple Random Sample, Sampling Distributions, Central Limit Theorem, Interval Estimation, Estimating Proportions, Sample Size	
8	Testing Hypotheses	Hypothesis testing for a single population mean, hypothesis testing for a single proportion	
9	Testing Hypotheses	Hypothesis tests for comparing two populations, Interpreting Computer Output, Chi-Square Test	
10	Correlation and Regression	Correlation and Regression, coefficients of correlation and determination, least squares regression line, prediction, hypothesis test for Rho	
11	Time Series/ Index Numbers	Linear and exponential Trend line, seasonal variation, forecasting, price index	
12	Revision Week		Assignment Part B Due

Teaching Staff

Name	Role	Campus & Room No	Phone No	Email Address	Consultation Times
Esther Lo Chiu Mei	Unit of Study Convenor	E326	082-260863	elo@swinburne.edu.my	By Email

Blackboard Site for this Unit of Study

Important information concerning this unit of study is placed on a website on the Swinburne course management system (Blackboard), accessible via http://blackboard.swinburne.edu.my

It is your responsibility to access on a regular basis

- the Blackboard site for your unit of study,
- the Announcements section on Blackboard, and
- Any emails sent by the teaching staff to your email address via Blackboard.

- It is your responsibility to ensure that your email address on Blackboard is set to your preferred email address. To set your email address on Blackboard, go to this unit of study on Blackboard, click on TOOLS > PERSONAL INFORMATION > EDIT PERSONAL INFORMATION

Assessment

a. Assessment Task Details:

Major Assessment	Name of Task	Weightage
Component 1	Final Examination	60%

Component 2	Mid Semester Test	25%
Component 3	Assignment Part A and B	15%

Learning and Teaching Structure

2 hours lectures and 2 hours tutorial per week. In a Semester, you should normally expect to spend, on average, twelve and a half hours of total time (formal contact time plus independent study time) a week on a 12.5 credit point unit of study.

Swinburne Graduate Attributes:

Swinburne graduate attributes signify that the university intends that its teaching programs assist all its graduates to be:• capable in their chosen professional, vocational or study areas;

- entrepreneurial in contributing to innovation and development within their business, workplace or community;
- effective and ethical in work and community situations;
- adaptable and able to manage change; and
- aware of local and international environments in which they will be contributing (eg socio- cultural, economic, natural).

Participation requirements

Students are expected to attend all scheduled lectures and tutorial classes. Subject notes, tutorial questions, and the TI-83 graphics calculator or equivalent calculator should be brought along to the lectures and tutorial classes.

c. Minimum requirements to pass this unit of study:

In order to achieve a pass in this unit of study, you must obtain an aggregate mark for the subject of 50% or more.

d. Assessment criteria:

- Assessment criteria will be provided for assessment tasks as appropriate.
- In tests and examination full marks are awarded for fully correct answers which show all working. If an answer is not fully correct but has some correct steps then marks may be awarded. Incorrect work consequential on an earlier error may also receive some marks

e. Submission of Assignments:

- Assignments and tasks should be handed in to the lecturer on the submission day.
- Assignments must be word processed and page numbers must be included.
- An Assignment Cover Sheet and Marking Sheet have to be attached to your assignment for submission.
- The students are required to follow the format required in the assignment tasks.
- You are advised to keep photocopy of your work as record or backing up electronic data.

f. Extensions and Late Submissions:

In order to maintain equity with other students, applications for assignment extensions will only be granted on the basis of severe and genuine hardship in meeting the deadline. Applications must be made at least two working days before the due date. Students may be required to produce documentary evidence in support of their application. Only the subject convener can approve an extension.

Assessable material submitted after the due time and date will normally lose 20% of the allocated mark per day or part thereof up to the maximum of 100%.

g. Availability of Assessment Results, Retention of Assessed Materials:

Assessed material will be returned to you, but you must retain all assessed material that contributes to the final grade up until such time as the final grades are published. The assessed material must, after a reasonable time, be produced on demand for review by the Convenor. Non- compliance with this requirement may result in loss of all credit for the assessed material not so produced.

h. Groupwork Guidelines:

A group project is the collective responsibility of the entire group, and if one member is temporarily unable to contribute, the group should be able to reallocate responsibilities to keep to schedule. In the event of longer-term illness or other serious problems involving a member of a project group, it is the responsibility of the other members to make the project supervisor aware of the situation straight away.

Group project reports must be submitted with the project cover sheet, signed by all members of the group.

All group members must be satisfied that the work has been correctly submitted. Any penalties for late submission will apply to all group members, not just the person who submitted.

i. Swinburne University of Technology's definition of plagiarism:

Plagiarism is the action or practice of taking and submitting or presenting the thoughts, writings or other work of someone else as though it is your own work. Plagiarism includes any of the following, without full and appropriate acknowledgment to the original source(s):

(i) The use of the whole or part of a computer program written by another person;

(ii) the use, in essays or other assessable work, of the whole or part of a written work from any source including but not limited to a book, journal, newspaper article, set of lecture notes, current or past student's work, any other person's work, a website or database;

(iii) the paraphrasing of another's work;

(iv) the use of musical composition, audio, visual, graphic and photographic models, (v) The use of realia, that is objects, artefacts, costumes, models and the like.

Plagiarism also includes the preparation or production and submission or presentation of assignments or other work in conjunction with another person or other people when that work should be your own independent work. This remains plagiarism whether or not it is with the knowledge or consent of the other person or people. It should be noted that Swinburne encourages its students to talk to staff, fellow students and other people who may be able to contribute to a student's academic work but that where independent assignment is required, submitted or presented work must be the student's own.

Enabling plagiarism contributes to plagiarism and therefore will be treated as a form of plagiarism by the University. Enabling plagiarism means allowing or otherwise assisting another student to copy or otherwise plagiarise work by, for example, allowing access to a draft or completed assignment or other work.

The information outlined in this section above is covered in more detail in Swinburne Sarawak's Plagiarism Policy and Procedure. Students must be familiar with the Policy and Procedure, found at http://www.swinburne.edu.my/ppd/docs/student_information/Plagiarism.pdf?recnum=POL/2007/36

j. Assessment and Appeals Policy and Procedure

The information outlined in the Assessment sections above is covered in more detail in Swinburne Sarawak's Assessment and Appeals Policy and Procedure. Students must be familiar with the Policy and Procedure, found at http://www.swinburne.edu.my/ppd/docs/student_information/Assessment%20and%20Appeal.pdf?recnum=P OL/2007/19

The Policy and Procedure provides details about:

- Assessment issues such as the conduct of examinations, plagiarism policies and details explaining how to apply for a review of results and other appeals, and
- Student progress issues such as unsatisfactory academic progress and early intervention procedures, and
- Information for students with disabilities and special needs and procedures for applying for special consideration.

Students should make themselves familiar with all aspects of the Policy and Procedure, as failure to do so is not grounds for appeal.

Student Feedback:

Swinburne seeks student feedback in a number of ways, including through periodic "Student Feedback on Units" and "Student Feedback on Teaching" surveys, as part of the university's approach to quality assurance and improvement. Possible improvement based on both student and staff feedback is considered by Unit Convenors, Unit Panels made up of relevant teaching staff, Program Panels, Faculty Academic Committees, and the Academic Programs Quality Committee, as appropriate.

Safety Standards and Conduct Requirements:

The University executes safety drills without warning. Be prepared to follow instructions from staff and/or wardens to evacuate the building in a safe and orderly manner.

All students are expected to respect the rights and sensibilities of their fellow students and teaching staff. This also applies in respect of the content of video and audio work submitted for assessment. The University had implemented anti-discrimination and harassment policies and procedures to promote a discrimination and harassment free work and study environment for all staff and students. The University had implemented anti-discrimination and harassment policies and procedures to promote a discrimination and harassment free work and study environment for all staff and students: http://policies.swinburne.edu.au/ppdonline/showdoc.aspx?recnum=POL/2008/125

Safety procedures in laboratories must be followed. For your own safety, bare feet, thongs and other open sandals are forbidden. Eating, drinking or smoking in laboratories is not allowed. A mature, sensible attitude and a healthy respect for the equipment is always required. Juvenile, ill-mannered or reckless behaviour will not be tolerated, and the laboratory supervisor has the right to exclude students from the laboratory should their behaviour constitute a danger to themselves or others. Such behaviour would result in forfeiture of all marks for that experiment. The playing of computer games is not allowed in the computer labs.

Special Needs

If you have special needs you should advise your Faculty and the Unit of Study Convenor by the end of the second week of the teaching period. In addition, you are recommended to notify the Equity Office if you have not already done so.

See also the Sarawak "Students with Disabilities and Special Needs" Section of the Assessment and Appeals Policy & Procedure, at http://www.swinburne.edu.my/ppd/docs/student_information/Assessment%20and%20Appeal.pdf?recnum=P OL/2007/19

Resources and Reference Material.

1. Notes, slides, and Tutorial Questions.
- These are available on course unit Blackboard
2. Texas Instruments TI-83 (or TI-83+) graphics calculator.
- The subject will be taught and assessed using this calculator. They may be loaned from the Finance Department or bought it from UBS in the campus. There are equivalent brands but students should not choose an alternative without first checking its capabilities with the lecturer.

References

There are numerous basic statistics texts in the Library, many with a Business emphasis. Some of these are listed below and more specific references are given in the text at the end of each topic.

1. McLean, A., Stephens, B., Business Mathematics and Statistics, Longman 1996.
2. John S. Croucher, Introductory Mathematics and Statistics for Business, 4th Edition, McGraw Hill/Irwin 2002.
3. Peter Waxman, Business Mathematics & Statistics, 4th Edition, Prentice Hall 1998.
4. Francis A., Business Mathematics & Statistics, 6th Edition, Thomson 2004.
5. Anderson D.R., Sweeney D. J., Williams, T. A., Statistics for Business and Economics, Ninth Edition, South-Western 2005.

APPENDIX C: LETTER FROM SUHREC

From: Ann Gaeth [AGAETH@groupwise.swin.edu.au]
Sent: Thursday, October 28, 2010 6:20 AM
To: Bibiana ChiuYiong Lim
Cc: Resethics
Subject: SUHREC Project 2010/195 Ethics clearance

To: Ms Bibiana Lim Chiu Yiong - Sarawak

Dear Ms Lim,

Re: SUHREC Project 2010/195 E-Book Technology: An empirical study relationships between cognitive load, self efficacy, statistics anxiety and learning styles among undergraduate students

Ms Bibiana Lim Chiu Yiong - Sarawak
Approved duration 01/01/2011 To 31/12/2012

I refer to the ethical review of the above project protocol undertaken by a SUHREC Subcommittee (SHESC3). Your responses to the review, as e-mailed on 28 September and 25 October 2010 with attachment, were approved inline with the guidelines set by a SUHREC delegate(s).
I am pleased to advise that, as submitted to date, the project may proceed in line with standard on-going ethics clearance conditions here outlined.

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the current National Statement on Ethical Conduct in Research Involving Humans and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/ clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.

- A duly authorised external or internal audit of the project may be undertaken at any time.

Please contact me if you have any queries about on-going ethics clearance. The SUHREC project number should be quoted in communication. Chief Investigators/Supervisors and Student Researchers should retain a copy of this email as part of project record-keeping.

Best wishes for project.

Yours sincerely,

Ann Gaeth
Secretary, SHESC3

Ann Gaeth, PhD
Administrative Officer (Research Ethics)
Swinburne Research (H68)
Swinburne University of Technology
P.O. Box 218
HAWTHORN VIC 3122
Tel: +61 3 9214 5935
Fax: +61 3 9214 5267

APPENDIX D: CONSENT INFORMATION STATEMENT

Project Title
E-Book Technology: An empirical study of relationships between cognitive loads, self-efficacy, statistics anxiety and learning styles among undergraduate students

Investigators
Bibiana Lim Chiu Yiong, Lecturer, School of Business and Design, Swinburne University of Technology, Sarawak Campus

Introduction to Project and Invitation to Participate
There are claims by literature that there is a massive growth in e-books technology and that downloadable textbooks maybe the wave of the future for learning. Hence, the importance of e-book technology cannot be overstated because it is the most significant tool in the e-learning environment. There is a lack of empirical knowledge related to different formats of e-book technology and little research has been conducted with students who have had experience using several formats of e-books, namely text, images and multimedia presentation. Also, little is known about the performance of students in relation to e-book technology towards the level of cognitive loads, the level of the students' self-efficacy and statistics anxiety together with their learning styles. You are invited to participate in this research project voluntarily.

What this project is about and why it is being undertaken
The purpose of this study is to learn about how different versions of e-book technology (text and static image, text and animation and text and multimedia) can have significant influence towards students' cognitive load, self-efficacy, statistics anxiety and learning styles.

Project and researcher interests
This study is to satisfy the requirements for the researcher's academic qualification in thesis dissertation. The outcomes of the research project hope to enhance teaching and learning in the higher learning institutions especially in Swinburne University. The researcher hopes to design a better teaching and learning delivery mode and that will contribute in high quality of teaching and high experience of learning for students.

What participation will involve – time, effort, resources, costs, compensatory payments, etc
Participation for this study is on voluntarily-basis. Your participation or not in this study will have no bearing on your time at Swinburne, including no effect on your results or treatment. You will be asked to view one of the three versions of e-book technology, namely text and static image, text and animation and text and multimedia on a statistic chapter for 1 hour. At the end of the e-book presentation, please find a quiet place in the room where you would not be disturbed for 20-30 minutes. You will be given questionnaires and are invited to give your best answers in the questionnaires. Specific instructions are given at the start of each section. Please answer all the questions because complete information is required for the analysis later. The data will be analysed in group form and the findings of the study will show only collective results and not as individuals. Therefore, your response is also kept absolutely confidential. Your attendance for this project, completion and submission of the anonymous questionnaire will signify your consent to participation in this project. Please do not write any identifiable information to preserve anonymity.

Participant rights and interests – Risks & Benefits/Contingencies/Back-up Support
The questionnaires are designed to ask for your perceptions of the issues concerned, and there are no right or wrong answers. Furthermore, this study carries no identification of the participants; hence there will be no/minimal risk to the participants. Participants will be given the opportunity to experience the use of e-book technology. Moreover, they can learn a new way of learning through e-book technology and address their understanding in terms of cognitive loads, self-efficacy, statistics anxiety and learning styles.

Participant rights and interests – Free Consent/Withdrawal from Participation
All students enrolling in Bachelor of Commerce programs are invited to participate voluntarily in this study. You may also choose not to participate in this study and there will be no coercion in your decision to participate in this study. Your participation in this study will have no bearing on your results transcript. If you wish to withdraw participation, you are free to stop anytime without obligation. The students participated cannot be identified through the questionnaires and data collected and as such there may not be conflict of interest.

Participant rights and interests – Privacy & Confidentiality
All questionnaires will be submitted to the researcher and all electronic data will be kept in electronic format, on a password-protected disk drive or external drive owned personally by the researcher. Any hardcopy of the questionnaires will be kept in a locked cabinet in the researcher's office room. The participants' responses will be kept confidential. All materials or data will be kept for at least 5 to 7 years after publications and will be kept in a locked cabinet in the researcher's residence. The results of any analysis will be stored in CD/ DVD format. Anonymity of the participants is maintained upon completion of the study.

Research output
The data will be used for thesis dissertation and potential conference or journal papers in the future. Should you show any interest in the findings of the study, you may contact the researcher through email at blim@swinburne.edu.my.

Further information about the project
If you would like to obtain further information about the research project, please do not hesitate to contact: Bibiana Lim Chiu Yiong, Lecturer, School of Business and Design, Swinburne University of Technology Sarawak Campus, Jalan Simpang Tiga, 93350 Kuching, Sarawak, Malaysia Telephone: +60 82260704, Email: blim@swinburne.edu.my

Concerns/complaints about the project
This project has been approved by or on behalf of Swinburne's Human Research Ethics Committee (SUHREC) in line with the National Statement on Ethical Conduct in Human Research. If you have any concerns or complaints about the conduct of this project, you can contact: Research Ethics Officer, Swinburne Research (H68), Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122. Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au

APPENDIX E: MID SEMESTER TEST QUESTIONS

HMB 110 Quantitative Analysis Semester 1_2011 Test Solutions

1. How much would an investment of RM 800 accumulate to in three years if interest were paid at

For first year	*For Second Year*	*For third year*
N = 1 *I = 6* *PV =-800* *PMT =0* *FV = 0* *P/Y = 1* *C/Y = 1* *PMT: END* ***2 marks*** *Solve for FV = RM 848*	*N = 1* *I = 10* *PV =-848* *PMT =0* *FV = 0* *P/Y = 1* *C/Y = 1* *PMT:END* ***2 marks*** *Solve for FV = RM 932.8*	*N = 1* *I = 15* *PV =-932.8* *PMT =0* *FV = 0* *P/Y = 1* *C/Y = 1* *PMT: END* ***2 marks*** *Solve for FV = RM1072.* ***1 mark***

6% per annum for the first year, 10% per annum for the second year and 15% per annum for the third year?

2. A student registers for a four-year course. She has a fund of RM 40,000 to cover expenses over the next four year. Calculate the amount of periodic withdrawals if she withdraws the money monthly. Assume the interest rate is 4.5% compounded monthly.

   N = 48
   I = 4.5
   PV =0
   PMT =0
   FV = 40 000
   P/Y = 12
   C/Y = 12
   PMT: END ***2 marks***
   Solve for PMT = RM 762.14 ***1 mark***

3. What interest rate would an investor need to earn in order to double his or her investment in seven years?

   N = 7
   I = 0
   PV =-1
   PMT =0
   FV = 2
   P/Y = 1
   C/Y = 1
   PMT: END ***2 marks***
   Solve for I = 10.41% ***1 mark***

4. Project A and B involve the following net cast flows

	Year 0	Year 1	Year 2	Year3	Year 4
Project A	600 000	- 300	650 000	885 000	- 2000
Project B	4045	2000	2500	3000	3500

(a) Determine which project is the most profitable by IRR method.
L1 → (-300, 650000, 885000, -2000)
L2 → (2000, 2500, 3000, 3500) ***1 mark***

For Project A, IRR(-600 000, L1) = 44.88% ***2 marks***
For Project B, IRR(-4045, L2) = 49.66% ***2 marks***

Project B is most profitable cost it returns hight IRR (49.66%). ***1 mark***

(b) Calculate the NPV for the most profitable project if cost of capital is 25%.
npv(25, -4045, L2) = 2124.60 ***2 marks***

(6 + 2 = **8 marks**)

5. Eunice received her credit card statement and the outstanding balance of RM 2,589.85 was shown. She asks her sister's help to pay the bill for her as she needs to go overseas for three months. The interest was 16.75% p.a. compounded on a daily basis.

(a) Calculate the effective interest rate.
Eff(16.75, 365) = 18.23% ***2 marks***

(b) Unfortunately her sister forgot to settle the bill for her when she was away. What is the balance shown on the latest statement when she receives it after back from overseas?
N = 0.25
I = 16.75
PV =-2589.85
PMT =0
FV = 0
P/Y = 1

C/Y = 365
PMT: END **2 marks**
Solve for FV = RM 2700.58 ***1 mark***

(2 + 3 = **5 marks**)

6. A family wants to buy a KIA Sorento with manufacturer's suggested retail price of RM145 000. The buyer gets a RM 25 000 credit for her trade-in and finances the balance of the price at her local bank with a 5-year, 2.55% loan. Determine the amount of the monthly car payment.
   N = 60
   I = 2.55
   PV =120 000
   PMT =0
   FV = 0
   P/Y = 12
   C/Y = 12
   PMT: END ***2 marks***
   Solve for PMT = RM 2132.33 ***1 mark***

7. Government has announced that for those first time house buyers with a family income less than RM3000 per month need not pay the 10% down payment under the My First House Scheme (SKIM Rumah Pertamaku) home loan. The monthly financing repayment sum must also be not more than one-third of the applicants' monthly gross income. This will allow the first time buyers to obtain 100% home loan with will enable them to buy houses costing between RM100,000 and RM220,000 with a repayment period of up to 30 years.

   Steven has decided to buy a single storey terrace house at Tabuan area, Kuching, costs RM 180 000. His gross income is RM 2700 per month.

   (a) What is the maximum monthly repayment that Steven is affordable to pay under this Scheme?

   Maximum monthly repayment = $RM\ 2700 \times \frac{1}{3} = RM\ 900$ ***2 marks***

   (b) Steven has surveyed interest rate offered by various banks in Kuching. Finally he decided to take the offer from ABC Bank, who offers the rate of BLR – 1.95%. The BLR (Base Lending Rate) of this bank is 6.3%.
   Calculate the monthly repayment if Steven is taking 100% home loan for 30 years.
   N = 360
   I = 4.35
   PV =180 000
   PMT =0
   FV = 0
   P/Y = 12
   C/Y = 12
   PMT: END ***2 marks***
   Solve for PMT = RM 896.06 ***1 mark***

   (c) How much is the total repayment for 30 years?
   Total repayment = RM 896.06 x 360 = RM 322, 581.60 ***2 marks***

   (d) Calculate the total interest paid for the life of the loan.
   Total interest paid = RM 322, 581.60 – RM 180, 000 = RM 142, 581.6
   OR
   Σ Int(1, 360) = RM 142, 582.04 ***2 marks***

   (e) How much principal is paid for the fifth year?
   Σ Prn(49, 60) = RM 3547.29 ***2 marks***

   (f) How much would still owe after five years of payment?

   bal(60) = RM 163, 708.16 ***2 marks***

   (g) After five years, Steven decided to pay part of the debt off from his saving. How long (in years) Steven needs to pay if he is paying RM 30 000 off and the monthly repayment remain the same?

   N = 0
   I = 4.35
   PV = 133708.16
   PMT = -896.06
   FV = 0
   P/Y = 12
   C/Y = 12
   PMT: END ***2 marks***

   Solve for N = 215.15 months ***1 mark***

   (h) How much interest will be saved by paying part of the loan off in (g)?

   <u>Old Scheme</u>
   RM 896.06 x 360 = RM 322, 581.60 ***1 mark***

New Scheme

[RM 896.06 x (60+215.15)]+RM30,000 = RM 276, 550.90 ***2 marks***

Interest saved = RM 322, 581.60 – RM 276,550.90 = RM 46,030.7 ***1 mark***

(2 + 3 + 2 + 2 + 2 + 2 + 3 + 4 = **20 marks**)

8. If the cost of the project was RM1 million, calculate the equal cash flow for the next five years so that it can reach a required rate of return of 20% p.a.

N = 5
I = 20
PV = 1 00 0000
PMT =0
FV = 0
P/Y = 1
C/Y = 1
PMT: END ***2 marks***

Solve for PMT = RM 334,379.70 ***1 mark***

9. In an interview of 40 randomly selected employees, data on their average weekly expenditure (RM) in the staff canteen was obtained, as shown below.

22	25	32	20	25	0	25	30
18	21	9	0	10	15	0	22
15	15	13	10	5	15	35	15
23	23	15	15	2	4	10	18
30	5	10	24	15	20	15	25

(a) Construct a stem and leaf plot including count column (cumulative frequency) to represent these data.

8	0|	0 0 0 2 4 5 5 9
(16)	1|	0 0 0 0 3 5 5 5 5 5 5 5 5 5 8 8
16	2|	0 0 1 2 2 3 3 4 5 5 5 5
4	3|	0 0 2 5

3 marks

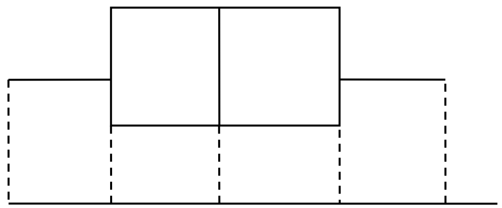
(b) Obtain the FIVE number summary.

Min = 0
Q1 = 10
Median = 15
Q3 = 23
Max = 35
2.5 marks

(c) Comment on the analysis obtained in (b).

The range is from RM 0 to RM35. ***0.5 mark***
50% of the employees' average weekly expenditure (RM) in staff canteen is less than RM 15 and another 50% of the employee's average weekly (RM) is more than RM 15. ***1 mark***
The middle 50% of employees' average weekly expenditure (RM) cover the spam of RM 13. ***1 mark***

(d) Draw a box and whisker plot to represent these data.



Min =0 Q1=10 Med= 1 Q3= 23 Max= 35

3 marks

(e) Describe the distribution of average weekly expenditure (RM) of employees in the staff canteen.
The distribution is skewed to the right. ***1 mark***

(3 + 2.5 + 2.5 + 3 + 1 = **12marks**)

10. A survey of workers in a particular industrial sector produced he following table:

Weekly Income (RM)	**Number of workers**	**Midpoints**	**Percentage frequency (2 decimal places)**	**Cumulative percentage frequency (two decimal places)**

200 – < 250	16	225	13.33	13.33
250 – < 300	24	275	20.00	33.33
300 – < 350	40	325	33.33	66.66
350 – < 400	15	375	12.50	79.16
400 – < 450	12	425	10.00	89.16
450 – < 500	8	475	6.67	95.83
500 – < 550	3	525	2.50	98.33
550 – < 600	2	575	1.67	100.00

1 mark ***1 mark*** ***1 mark***

(a) Complete the columns containing midpoints, percentage frequency and cumulative percentage frequency columns to 2 decimal places.

(b) Using the completed table in the above, answer these questions:

(i) What proportion of workers has weekly income less than RM 350?

66.67% ***1 mark***

(ii) What proportion of workers has weekly income more than RM 400?

100% - 79.16% = 20.84%

OR

10.00% + 6.67% + 2.5% + 1.67% = 20.84% ***1 mark***

(iii)What is the range of the weekly salary for the top 5% of the workers? *RM 450 – RM 600* ***1 mark***

(c) Calculate

(i) Mean = *RM 337.08* ***1 mark***

(ii) Median = *RM 325* ***1 mark***

(iii) Standard Deviation = *RM 81.22* ***1 mark***

(iv) IQR = *Q3 – Q1 = RM 375 – RM 275 = RM 100* ***2 mark***

(d) If the mode of the data above is RM 320, comment on the shape of the distribution.

The distribution is approximately symmetric. ***1 mark***

(e) Calculate the coefficient of variation. Interpret the value.

$$coefficient\ of\ variation = \frac{standard\ deviation}{mean} \times 100$$

$$= \frac{81.22}{337.08} \times 100 = 24.09\%$$

2 marks

The CV is approximately 25%, the data is moderately variable. ***1 mark***

(3 + 3 + 5 + 1 + 3 = **15 marks**)

11. 400 television program viewers were asked to indicate the type of program they most enjoy. The results are shown in the following table.

Age	**Program preferred**			
	News	**Drama**	**Sport**	**Total**
Under 20	46	32	82	160
20 – 40	28	59	73	160
Over 40	26	29	25	80
Total	100	120	180	400

(a) What is the independent variable?

Age ***1 mark***

(b) Convert the table to percentages (correct to 2 decimal points).

Age	**Program preferred**			
	News	**Drama**	**Sports**	**Total**
Under 20	28.75%	20.00%	51.25%	100%
20 – 40	17.50%	36.88%	45.63%	100%
Over 40	32.50%	36.25%	31.25%	100%
Total	25.00%	30.00%	45.00%	100%

1 mark ***1 mark*** ***1 mark***

(c) Does there appear to be a relationship between age and program preferred?

Explain your answer.

Yes, there appear a relationship between age and program preferred. ***1 mark***

For News, the viewer aged over 40 is 1.13 times more than the viewer aged under 20. The viewer aged under 20 is 1.64 times higher than the viewer aged 20-40. ***1 mark***

For Drama, the viewer aged 20-40 is 1.02 times (approximately equal) more than viewer aged over 40. The viewer aged over 40 is 1.81 times more than viewer aged under 20. ***1 mark***

For Sports, viewer aged under 20 is 1.12 times more than viewer aged 20-40. The viewer aged 30-40 is 1.46 times more than viewer aged over 40.

1 mark

(1 + 3 + 4 = **8 marks**)

END OF TEST QUESTIONS

APPENDIX F: FINAL EXAMINATION QUESTIONS

HMB110 Quantitative Analysis Final Exam Marking Scheme Semester 1_2011

1. In an experiment, 200 randomly selected patients are administered pain relief medications A, B or C. The patient are asked to rate the effectiveness of the medication as excellent, good or no effect. The results are summarized in the following table.

Rate	**Medication**			
	A	**B**	**C**	**Total**
Excellent	18	45	18	**81**
Good	25	22	30	**77**
No effect	12	13	17	**42**
Total	**55**	**80**	**65**	**200**

(a) Calculate the probability that a randomly selected patient rated the administered medication as no effect.

P(no effect) = $\frac{42}{200}$ *=0.21* ***1 mark***

(b) Calculate the probability that a randomly selected patient was administered medication C and rated the effectiveness as good or excellent.

P(medication C and rated the effectiveness as good or excellent)

= $\frac{18+30}{200}$ *= 0.24* ***1 mark***

(c) Calculate the probability that a randomly selected patient was administered medication B.

P(medication B) = $\frac{80}{200}$ *=0.4* ***1 mark***

(d) What is the probability that a patient was administered medication A if it is known that they rated the effect as excellent?

P(A|rated the effect as excellent) = $\frac{P(A \cap excellent)}{P(excellent)}$ ***0.5 mark***

$= \frac{\frac{18}{200}}{\frac{81}{200}} = \frac{18}{81}$ *=0.2222* ***0.5+0.5+0.5=1.5***

mark

(e) Are the events 'excellent' and 'medication C' independent? Explain your reason.
P(Excellent) = 81/200 = 0.405 ***0.5 mark***
P(Medication C) = 65/200 = 0.325
0.5 mark
P(Excellent) x P(Medication C) = 0.405 x 0.325 = 0.1316 ***0.5 mark***
P(Excellent $\cap$ *Medication C) = 18/200 = 0.09* $\neq$ *0.1316* ***1 mark***
$\therefore$ *The events 'excellent' and 'medication C' are not independent* ***0.5 mark***

(1 + 1 + 1 + 2 + 3 = 8 marks)

2. A bakery shop, Taca Bakery offers special decorated cakes for birthdays, weddings, and other occasions. The following table gives the total number of cakes sold per day and the corresponding probability.

Number of Cakes Sold in a Day	**Probability**
12	0.25
13	0.40
14	0.25
15	0.10

(a) Calculate the expected value for the number of cakes sold per day (round your answer to the next integer).
E(X) = 13.20

≈ 14 *cakes* **1 mark**

(b) Assume that each cake sold generates RM55 in revenue and the cost to make a cake is RM28. How much the bakery gain or lose in a day if the number of cake made per day is based on the expected value and the actual sales is only 9 cakes?

Cost = 14 x RM 28 = RM 392 **1 mark**
Revenue = 9 x RM 55 = RM 495 **1 mark**
Profit = Revenue – Cost **0.5 mark**
= RM 495 – RM 392 **0.5 mark**
= RM 103

(1 + 3 = 4 marks)

3. The average number of hours worked by women in paid employment are Normally distributed with a mean of 32.4 hours per week and a standard deviation of 3.84 hours.

(a) Calculate the percentage of women who work

(i) More than 40 hours.
Pr(X > 40) = normalcdf(40, 1E99, 32.4, 3.84) **1 mark**
= 0.0239 **0.5 mark**
= 2.39% **0.5 mark**

(ii) Between 35 and 40 hours
Pr(35 < X < 40) = normalcdf(35, 40, 32.4, 3.84) **1 mark**
= 0.2252 **0.5 mark**
= 22.52% **0.5 mark**

(b) A researcher randomly selected a sample of 150 women in the paid employment.

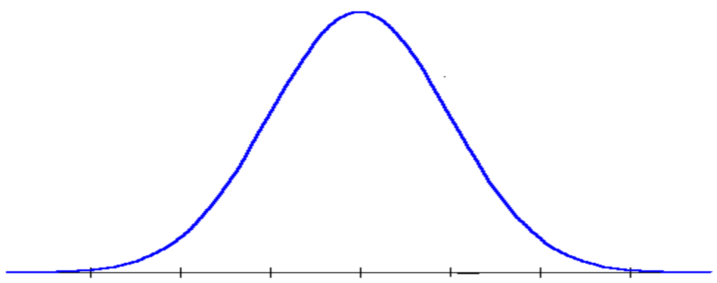
(i) What is the expected mean and standard deviation of hours worked by these 150 women?

$E(\overline{X}) = \mu$ *= 32.4 hours* **1 mark**

$\sigma_{\overline{X}} = \dfrac{\sigma}{\sqrt{n}} = \dfrac{3.84}{\sqrt{150}}$ *= 0.3135 hours* **1 mark**

(ii) Sketch the sampling distribution of the sample mean hours worked of these 150 women.

(iii)



(iv)

(v) Calculate the probability of a women who work less than 32.5 hours per week.

$Pr(\overline{X} < 30)$ *= normalcdf(-1E99, 32.5, 32.4, 0.3135)* **1 mark**
= 0.6251 **1 mark**

(vi) How many of those selected work less than 32.5 hours per week?
Number of women = 0.6251 x 150 **1 mark**
= 93.765
=94 **1 mark**

(4 + 8 = 12 marks)

4. The average mileages of 15 company vehicles are recorded during a given week. The data are shown in the table below in the nearest kilometer.

128	119	153	110	98	204	158	138
173	176	144	161	105	168	126	

(a) (i) Construct a 95% confidence interval for the average mileages of the company vehicles and interpret your answer. What assumption did you make to construct this interval?

TInterval is (127.43 , 160.71) km **1 mark**

The 95% confidence interval for the average mileages of the company vehicles lies between 127.43 and 160.7 kilometers . **1 mark**

Normality assumption. ***1 mark***

(ii) Is it likely that the true mean mileage of the company vehicles is 170 kilometers? Explain.
No, the true mean mileage of the company vehicles is not 170 km because 170 km lies outside the range of the confidence interval. ***1 mark***

(b) What sample size would be required to estimate the average mileage to within ± 10 with 97% confidence? It was known from the previous study that population standard deviation was 30 kilometers.

$$z = invnorm(0.985) = 2.17$$

1 mark

$$n = \left(\frac{z\sigma}{E}\right)^2 = \left(\frac{2.17 \times 30.04}{10}\right)^2 = 6.51868^2$$ ***1.5 marks***

$$= 42.49$$

Sample size = 43 ***0.5 mark***

((3 + 1) + 3 = 7 marks)

5. A manufacturer that produces cereal and states on the packaging that the weight of the cereals is 500g. The quality control inspector suspects that the average weight of packets is lower than this. To check his suspicion he draws a random sample of size 25 packets of cereals, with the average weight of 497g and the standard deviation of 10.5g. Test at the 5% level of significance whether this result confirm the suspicious of the quality control inspector.

H_0: $\mu = 500$ ***½ mark***
H_1: $\mu < 500$ ***½ mark***
t-test ***½ mark***
$\alpha = 0.05$ ***½ mark***
p-value = 0.083 *t-value =-1.429* ***1 mark***
p-value > α*, do not reject* H_0. ***1 mark***
At 5% level of significance, there is insufficient evidence to conclude that the average weight of the cereals is less than 500g. This does not confirm the suspicious of the quality control inspector.

1 mark
(5 marks)

6. Two models of washing machine, Panasonac and Toshibi, were tested for a specified range of faults. In a sample of 200 Panasonac machines, 60 were found to have such faults and in a sample of 250 Toshibi washing machines, 52 were found to have such faults. Do you consider the two models of washing machine to be equally prone to such faults? Test the hypothesis by using 1% level of significance.

Let P_1 *be the proportion of Panasonac and* P_2 *be the proportion of Toshibi.*

H_0: $P_1 = P_2$ ***½ mark***

H_1: $P_1 \neq P_2$ ***½ mark***

Test statistic: 2 proportion Z Test, $\alpha = 0.01$ ***1 mark***

x1 =60, n1 =200, x2 = 52, n2 = 250 ***1 mark***
p-value = 0.0249 *z-value =2.24* ***1 mark***
p-value > α*, do not reject* H_0. ***1 mark***

At 1% level of significance, there is sufficient evidence to conclude that the two models of washing machine are equally prone to such faults. ***1 mark***
(6 marks)

7. A survey analyzing the relationship between the choice of newspapers and occupation was undertaken. A random sample of 300 newspaper readers was taken. Readers were asked about their choice of papers and their respective occupation. Their responses are recorded in the table below:
Carry out a suitable hypothesis test at the 5% level of significance to determine whether there is an association between the choice of newspaper and occupation of the reader.

H_0 *: Choice of newspapers and occupations class are independent.* ***½ mark***
H_1 *: Choice of newspapers and occupations class are associated* ***½ mark***

χ^2*-test,* $\alpha = 0.05$
1 mark
$\chi^2 = 3.384$*, d.f = 2,* *p -value = 0.1842* ***1 mark***

p-value > α*, do not reject* H_0.
1 mark
At 5% level of significance, there is insufficient evidence to conclude that there is an association between the choice of newspapers and occupations class. ***1 mark*** (5 marks)

8. Ten applicants for a job were interviewed by two personnel officers who were asked to give marks on a scale of 1-10 to one aspect of the candidates' performance. A summary of the marks given is shown below.

Candidate	Candidates' performance marks	
	Interviewer A	**Interviewer B**
1	8	7
2	6	7
3	8	9
4	7	7
5	6	4
6	9	8
7	7	6
8	5	4
9	8	6
10	7	8

Based on the above data, is there a significant difference between the standards being applied by the two interviewers? Test using 5% significance level.

H_0: $\mu_d = 0$
½ mark

H_1: $\mu_d \neq 0$
½ mark

d = Interviewer A's grading – Interviewer B's grading ***1 mark***

Matched pair T-test or T-test on differences ***½ mark***

$\alpha = 0.5$
½ mark

p-value = 0.2126 t-value = 1.3416 ***1 mark***

p-value > α, do not reject H_0. ***1 mark***

At 5% level of significance, there is no difference between the standards being applied by the two interviewers.
1 mark (6 marks)

9. A dispute exists between workers on two production lines. The workers on production line A claim that they are paid less than those on production line B. The company investigates the claim by examine the monthly pay of 25 workers from each production line. The results were as follows.

	Production line	
	A	**B**
Mean	RM 878.00	RM 878.50
Standard deviation	RM 6.00	RM 7.50

Test the hypothesis using 10% level of significance.

H_0: $\mu_1 = \mu_2$ ***½ mark*** *μ_1 = mean monthly pay of production line A*
H_1: $\mu_1 < \mu_2$ ***½ mark*** *μ_2 = mean monthly pay of production line B*
2-sampleT-test ***½ mark***
$\alpha = 0.10$ ***½ mark***

n_1 =25, $\overline{x}_1$ =878, s_1 =6; n_2 =25, $\overline{x}_2$ =878.5, s_2 =7.5; ***1 mark***

Pooled: Yes
½ mark

p-value = 0.3979 t-value = -0.2603 df = 48 ***1½ mark***

p-value > α, do no reject H_0
1 mark

At 10% level of significance, there is insufficient evidence to conclude that workers on production line A are paid less than those on production line B. The workers claim on production A is not supported.
1 mark (7 marks)

10. Small Bean Limited provides various ranges of coffee drinks in cans for distribution through retail outlets in Malaysia. Below are unit price data and quantities sold (cases of 1 dozen) for 2008, 2009 and 2010.

Coffee	Price (RM)			Quantity (cases of 1 dozen)		
	2008	**2009**	**2010**	**2008**	**2009**	**2010**
Lattee	46	48	50	540	1000	1200
Americano	54	50	52	360	380	400
Expresso	70	75	80	250	300	350

(a) Taking 2008 as the base year, calculate the simple aggregate price index for year 2009.

$$I_{1,0} = \frac{\sum_{i=1}^{n} p_{i1}}{\sum_{i=1}^{n} p_{i0}} * 100 = \frac{48+50+75}{46+54+70} \times 100 = \frac{173}{170} = 101.76$$

2 marks

(b) Taking 2009 as the base year, calculate the Laspeyres index for year 2010 and interpret the value.

$$L_{1,0} = \frac{\sum_{i=1}^{n} p_{i1} q_{i0}}{\sum_{i=1}^{n} p_{i0} q_{i0}} \times 100 = \frac{(50 \times 1000) + (52 \times 380) + (80 \times 300)}{(48 \times 1000) + (50 \times 380) + (75 \times 300)} \times 100$$

$$= \frac{93760}{89500} \times 100 = 104.76$$

2 marks

There is an increase of 4.76% in the prices of 2010 compared to the prices of 2009, assuming the quantity sold in 2010 remains the same as in 2009. ***1 mark***

(c) Taking 2009 as the base year, calculate the Paasche index for year 2010 and interpret the value.

$$P_{1,0} = \frac{\sum_{i=1}^{n} p_{i1} q_{i1}}{\sum_{i=1}^{n} p_{i0} q_{i1}} \times 100 = \frac{(50 \times 1200) + (52 \times 400) + (80 \times 350)}{(48 \times 1200) + (50 \times 400) + (75 \times 350)} \times 100$$

$$= \frac{108800}{103850} \times 100 = 104.77$$

2 marks

There is an increase of 4.77% in the prices of 2010 compared to the prices of 2009, assuming the quantity sold in 2010 remains the same as in 2009. ***1 mark***

(d) Taking 2009 as the base year, calculate the Fisher's index number for the year 2010.

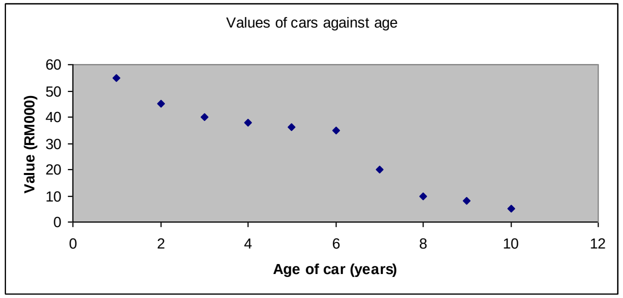
$$F_{1,0} = \sqrt{L_{1,0} * P_{1,0}}$$

$$= \sqrt{(104.76)(104.77)} = 104.77$$

1 mark (2 + 3 + 3 + 1= 9 marks)

11. An insurance company wants to know whether the current value of a motor vehicle is related to its age. The following data gives the price of used cars and its value.

Age of cars (Years)	**Value (RM '000)**
3	40
6	35
5	36
2	45
4	38
7	20
8	10
1	55
10	5
9	8



(a) Comment on the relationship between the age and the value of the car based on the above scatter diagram.
The age and values of car are strong, negative linearly correlated. ***1mark***

(b) Find the equation for the least squares regression line of the value of car on age.

Value (RM '000) = 59.667 – 5.539 × age ***2 marks***

(c) Interpret the value of the slope coefficient obtained in the above regression line.

For every year increased in age, on average the value of the car will decrease by RM 5539. ***1 mark***

(d) Calculate the coefficient of determination for this data. Interpret your answer.
$r^2 = 0.9454$ ***1 mark***
94.54 % of the variation in the value of car can be explained by the variation in age. This leaves 5.46% of the variation in the value of car remain unexplained. ***1 mark***

(e) Using your regression equation in (b), predict the value of a car for a car aged 7.5 years old. Is the prediction reliable? Explain.

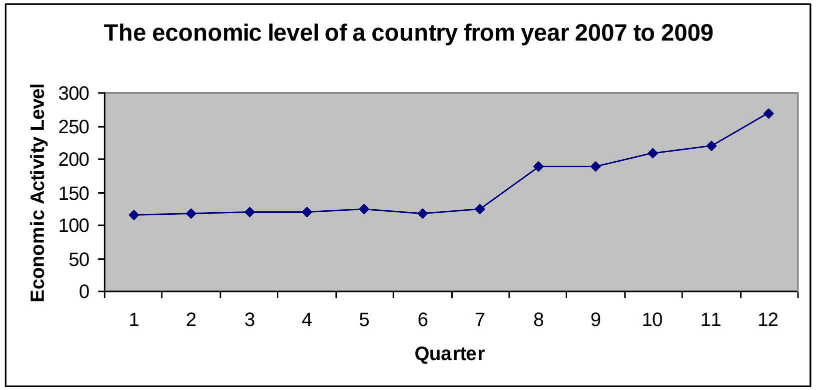
Value (RM '000) = 59.667 – 5.539 × age
= 59.667 – 5.539 × 7.5 ***½ mark***
= 18.1245 ***½ mark***
=RM 18124.5
(or Y1(7.5) = 18.1212=RM 18121.2)
The prediction is reliable as the age of 7.5 falls inside the range of the data. ***1 mark***

(f) Conduct a hypothesis test to determine whether there is a negative linear relationship between the age of car (years) and the value of the car at 1%level of significance.
H_0: $\rho = 0$ *There is no linear relationship between the age and the value of the car.* ***½ mark***
H_1: $\rho < 0$ *There is a negative linear relationship between the age and the value of the car.* ***½ mark***
Linear regression t-test $\alpha = 0.01$ ***1 mark***
p-value = 1.239×10^{-6} *df = 8* *t-value = -11.7737* ***1.5 mark***
p-value $< \alpha$, *reject* H_0.
1 mark
At 1% level of significance, there is sufficient evidence to conclude that there is a negative linear relationship between the age(years) and value of the car. ***1 mark***
This relationship is negatively correlated as correlation coefficient is negative. ***0.5 mark***
(1 + 2 + 1 + 1+ 2 + 6 = 14 marks)

12. The level of economic activity in a region has been recorded over a period of three years, and the data is presented below.

Year	**Quarter**	**Activity level**
2007	1	115
	2	118
	3	119
	4	120
2008	1	124
	2	117
	3	125
	4	189
2009	1	190
	2	208
	3	220
	4	270

(a) Draw a time series plot for the data above.



Scale and title - ***1 mark*** *Mark and line –* ***1 mark*** *x-axis, y-axis –* ***1 mark***

(b) Find the exponential trend equation model with r^2.
$T = 91.27(1.082)^t$ ***2 marks***
$r^2 = 0.8308 = 83.08\%$ ***1 mark***

(c) Find the linear trend equation model with r^2.
$T = 73.24 + 13.28\,t$ ***2 marks***
$r^2 = 0.8091 = 80.91\%$ ***1 mark***

(d) Which model would you recommend for forecasting the economic activity for year 2010? Give reasons for your answer.
Exponential, as $r^2 = 83.081\%$ which is higher than that of linear model. ***2 marks***
Use the model you selected in (d) to forecast the economic activity level for the fourth quarter of for 2010..
For fourth quarter 2010, $t = 16$ ***1 mark***
$T = 91.27\,(1.082)^{16} = 322.08$ ***1 mark***
OR
Y1(16) = 321.95 (3 + 3 + 3 + 2 + 2 = 13 marks)

13. The following table represents the number of components produced (in '000 units) by a factory every quarter from 2006 to 2008.

	Quarters	Components produced ('000 Units)	Seasonal Index
2006	1	250	0.9432
	2	300	0.9868
	3	420	1.0898
	4	400	0.9803
2007	1	350	0.9432
	2	400	0.9868
	3	320	1.0898
	4	280	0.9803
2008	1	420	0.9432
	2	400	0.9868
	3	520	1.0898
	4	500	0.9803

(a) Deseasonalise the data for the fourth quarter of 2008.

Deseasonalised data for fourth quarter of 2008 = $\frac{500}{0.9803}$ *= 510.05* ***1 mark***

(b) A linear trend was fitted to the deseasonalised data giving this equation:

$T = 283 + 14.72\,t$, $t = 1$ for Quarter 1 in 2006, $r^2 = 0.4549$

(i) Comment on the value of r^2.

$r^2 = 45.49\%$ is a moderate r^2, close to 50%, hence, this model might not be a good fit for the data. ***1 mark***

(ii) Forecast the components produced for the third quarter of 2009.
$t = 15$ $T = 283 + 14.72\,(15) = 503.8$ ***1 mark***
The components produced for the third quarter of 2009
= 503.8 x 1.0898
= 549.04 ('000) unit ***1 mark***

(1 + (1+2) = 4 marks)

End of Marking Scheme

APPENDIX G: LETTER FROM SUPERVISOR

19th May, 2010

The Chair,

Human Research Ethics Committee (SUHREC) or Subcommittee (SHESC)

Swinburne University of Technology,

P O Box 218,

Hawthorn Victoria 3122

Australia

Subject: Student status of Bibiana Lim Chiu Yiong

Please be informed that Bibiana Lim Chiu Yiong with student ID: 10011461, has been a Doctoral student, registered under the Faculty of Cognitive Sciences and Human Development, University Malaysia Sarawak (UNIMAS), supervised by me from January 2010. As part of her Doctoral thesis on "E-Book Technology: An Empirical Study on the Relationships between Cognitive Load, Self-Efficacy, Statistics Anxiety and Learning Styles among Undergraduates Students.", she collects data from the first year students enrolled in commerce programs of Swinburne University of Technology, Sarawak Campus. I assure you that the data will be used under my supervision.

Thank you for your support,

Assoc. Prof. Dr. Hong Kian Sam,

Faculty of Cognitive Sciences and Human Development,

University Malaysia Sarawak,

Kuching Sarawak, Malaysia.

Email: hksam@fcs.unimas.my

Phone : +6 082-581522.

Dr Hong Kian Sam
Associate Professor
Faculty of Cognitive Sciences and Human Development
Universiti Malaysia Sarawak

APPENDIX H: SEVEN FACTORS OF PSSUQ

Seven Factors of Post-Study System Usability Questionnaire Factors with questionnaires items (Lewis, 2002)

Factor 1: Design and Layout

Item No.	Statement in the questionnaires
15	The information and instructions by the eBook was clear.
16	The interface of the eBook was pleasant to follow.
17	I liked using the interface of this eBook.

Factor 2: Functionality

Item No.	Statement in the questionnaires
3	I was able to understand the statistic concepts quickly using this eBook.
4	I was able to efficiently follow the instructions quickly using this eBook, particularly for Ti-83 calculator.
5	I was able to efficiently complete the tasks using the instructions and procedures on the Ti-83 calculator using this eBook.
8	I believe I could become productive quickly using this eBook.

Factor 3: Ease of Use

Item No.	Statement in the questionnaires
2	It was simple to use this eBook.
11	The information (such as on-screen messages, procedures in using Ti-83 calculator and statistics concepts) provided with the eBook was clear.
12	It was easy to find information I needed.

Factor 4: Ability to Learn

Item No.	Statement in the questionnaires
7	It was easy to learn to use this eBook.
13	The information provided by the eBook was easy to understand.

Factor 5: Satisfaction

Item No.	Statement in the questionnaires
1	Overall, I am satisfied with how easy it is to use this eBook.
6	I felt comfortable using this eBook.
19	Overall, I am satisfied with this eBook.

Factor 6: Future Use

Item No.	Statement in the questionnaires
14	The information by the eBook was effective in helping me to understand the statistics concepts and Ti-83 calculator.
18	This eBook has all the statistics information and functions to the Ti-83 calculator that I expect it to have.

Factor 7: Errors

Item No.	Statement in the questionnaires
9	The error messages in this eBook were clear.
10	Whenever I made a mistake using the eBook, I could recover sassily and quickly.

APPENDIX I: THREE FACTORS OF STATISTICS ANXIETY SCALES

Factor 1: Examination Anxiety

Item No.	Statement in the questionnaires
1	Studying for an examination in a statistics
4	Realizing the day before an exam that I cannot do some problems that I thought were going to be easy
8	Trying to understand a mathematical demonstration
10	Reading an advertisement for an automobile which includes figures on gas mileage, compliance with population regulations, etc.
11	Walking into the classroom to take a statistics test
13	Getting to the day before an exam without having had time to revise the syllabus
14	Waking up in the morning on the day of a statistics test
15	Realizing just before going into the exam, I have not prepared a particular exercise

Factor 2: Asking For Help Anxiety

Item No.	Statement in the questionnaires
3	Going to ask my statistics lecturer for individual help with material I am having difficulty in understanding
5	Asking lecturers to explain a topic that I have not understood at all
7	Asking lecturers how to use a probability table
12	Asking lecturers about how to do an exercise
16	Copying a mathematical demonstration from the blackboard while the lecturer is explaining it
21	Asking lecturers for help when trying to interpret a results table
23	Going to lecturer's office to ask questions
24	Asking lecturers to explain how to do an exercise

Factor 3: Interpretation Anxiety

Item No.	Statement in the questionnaires
2	Interpreting the meaning of a table in a journal article
6	Reading a journal article that includes some statistical analyses
9	Doing the final examination in a statistics
17	Asking one of the lecturers for help in understanding a printout
18	Trying to understand the odds in a lottery
19	Seeing a classmate carefully studying the results table of a problem he has solved
20	Going to statistics exam without having had enough time to revise
22	Trying to understand the statistical analyses described in the abstract of a journal article