

DEVELOPING AN INTEGRATED MODEL FOR MOBILE LEARNING USABILITY EVALUATION – CASE OF eBOOKS

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Declaration

I, Boniswa Mafunda, hereby declare that this work has not been previously accepted in substance for any degree and is not being concurrently submitted for any degree. This dissertation is being submitted in fulfilment of the requirements for the degree Master's in Information Technology at the Department of Information Technology, Central University of Technology. This dissertation is the result of my own work, except where otherwise stated. Other sources are acknowledged by giving explicit references. A reference list is appended.



Boniswa Mafunda

March 2018

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Dedication

I dedicate this dissertation to my dear mother, Nompendulo Mafunda. Your unending support and motivation has contributed to the completion of this dissertation. You believed in me even when I did not believe in myself. Throughout my studies, you have been my anchor.

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Abstract

Mobile computing, as prognosticated in the ubiquitous computing vision, is increasingly becoming a predominant aspect of contemporary computing in organisations and society. The penetration of mobile phones in sub-Sahara Africa has occurred with amazing rapidity: for many young people, they now represent a very significant element of their daily lives. Africa has a booming global cell phone penetration, at 67.5%, the fastest growing mobile market in the world. Adoption of these emerging technologies for socio-economic development may contribute to the betterment of people's lives. Mobile learning has the potential to transform higher education through the adoption of mobile devices which support ubiquitous learning.

The purpose of this current study is to develop an Integrated Framework Model (IFM) for mobile learning usability (MLU) evaluation of e-books through the integration of the Technology Acceptance Model and Task Technology Fit theory. The Technology Acceptance Model is widely used in studies relating to technology acceptance. The Task-Technology Fit theory has been used in Information Systems together with usability as a measure of performance. Two additional constructs, namely, Social Influence and Perceived Enjoyment were adopted from the Unified Theory of Acceptance and Use of Technology model and from Motivational Models. Integrating the Technology Acceptance Model and Task-Technology Fit theory provides a model that includes the individual characteristics (Technology Acceptance Model) and the technology and task characteristics (Task Technology Fit).

A quantitative research design was primarily employed. A pilot study was administered as a guide for the main study questionnaire. The questionnaire was based on the constructs in the IFM. The pilot study consisted of participants registered for a module, called Computer Security, at the Central University of Technology. The main study participants were students registered for Oracle and CCNA short courses. The results of the study reveal that individual characteristics, task characteristics and technology characteristics positively influence the usability of e-books in higher education. Usability positively influences adoption, which in turn influences performance among students in higher education.

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List of Abbreviations

AMOS	- Alpha Micro Operating System
ATU	- Attitude Towards Use
AVE	- Average Variance Extracted
CR	- Composite Reliability
CUT	- Central University of Technology
DOI	- Diffusion of Innovations
IS	- Information Systems
IT	- Information Technology
ML	- Mobile Learning
PE	- Perceived Enjoyment
PEoU	- Perceived Ease of Use
PU	- Perceived Usefulness
SEM	- Structural Equation Model
SI	- Social Influence
TAM	- Technology Acceptance Model
TecC	- Technology Characteristics

TPB	- Theory of Planned Behaviour
TRA	- Theory of Reasoned Action
TsC	- Task Characteristics
TTF	- Task-Technology Fit
UNISA	- University of South Africa
UTAUT	- Unified Theory of Acceptance and Use of Technology

CHAPTER 1: BACKGROUND AND INTRODUCTION

According to an *Ambient Insight* report, the five-year compounded annual growth rate for the mobile market in Africa for the years 2010-2015 was at 45%, which is the highest in the world. The report also indicates that income revenues were expected to grow more than five times to reach US\$530.1 million by 2017, up from the US\$102.4 million reached in 2012 (Adkins, 2013). Country-level adoption and usage rates suggest that, in many countries, mobile-phone usage, even in poor households, is rapidly becoming an everyday part of life (Porter et al., 2012). Figure 1.1 (mobile phone ownership percentages) depicts the penetration of mobile devices in Africa for the year 2012. The high usage rate of mobiles (Castellano, 2014) may well be a contributing factor to the use of mobile learning in higher education.

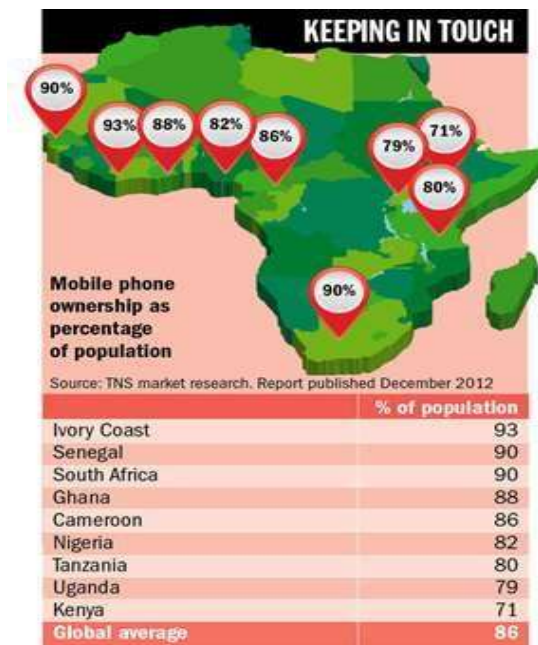


Figure 1.1: Mobile phone ownership in Africa – as percentage of population

(Source: TNS market research, 2012)

The concept of mobile learning has been researched in many countries. In South Korea, research was conducted with the purpose to investigate the effects of mobile instant messaging on

collaborative-learning processes and outcomes. The predominant findings of that study revealed that interactions on the Bulletin Board System group were of a cognitive and metacognitive nature while those on the Mobile Instant Messaging and Personal-Computer Instant Messaging groups were of a social and affective nature (Kim, Lee et al., 2014). One aspect of mobile learning includes e-books, according to Kissinger (2013).

E-books are an electronic version of printed hard cover textbooks which can be read on handheld devices and other computer devices (Gilbert and Fister, 2015). E-books can be categorized under mobile learning (Kissinger, 2011). E-books are not only limited to mobile learning or mobile devices. They can be accessed via desktop devices as well. The Task Technology Fit (TTF) theory has also been used to establish the usability and fit of e-books (D'Ambra, Wilson and Akter, 2013; Jardina, 2016). However, these studies focused on TAM and TTF as individual constructs. Furthermore, usability techniques are often defined according to different images of usability, depending on the context in which they are used. There are a few framework models which are dedicated to evaluating e-books in tertiary institutions (D'Ambra, Wilson and Akter, 2013). However, there are few or no framework models for MLU evaluation of e-books that include the TAM and TTF theory along with additional constructs, such as Social Influence and Perceived Enjoyment. This current study aims to address this.

Usability became apparent as a concept in an era when accumulating product complexity and rate of technological advancement gave rise to an increasing number of products that provided the functionality that was needed but were rather difficult to use (Hertzum, 2010). According to Hertzum (2010), usability has no clear-cut definition and is defined according to the context in which it is used. Usability is often used in conjunction with evaluation. In this current study, MLU evaluation of e-books is evaluated. In Taiwan, a study on the usability of e-books and mobile application in engineering courses was conducted. The aim of the study was to determine whether e-books and mobile applications are useful for college-level engineering courses in the classroom setting. The study also investigated the relationship between learning styles and usability of e-books and the mobile application. The results of the study revealed higher ratings for task-technology fit for e-books usability (Huang, Jou, Tenyson and Wang,

2016). Additionally, student's previous experience in the use of e-books did influence its adoption and mobile application usability.

Usability studies usually include some or other models or theories, which include the TAM, TTF, UTAUT and many more (Davis, 1989; Foasberg, 2011; Jin, 2014). There are MLU evaluation studies that have applied the Technology Acceptance Model (TAM) as constructs to establish the usability of e-books (D'Ambra, 2013). Previous research shows that the TTF theory was developed to explore how individual task and technology profiles improve user performance and technology utilisation (Yu and Yu, 2010). The TAM was applied in a study that investigated the usability of e-books in an engineering course while the TTF was applied in a study that investigated the usability of e-books by academics (D'Ambra, Wilson and Akter, 2013). The TTF theory was also used to determine if there is task-technology fit for the use of simulation in military training (Cane, McCarthy and Halawi, 2010). Another study was conducted in Canada which applied the TAM to measure users' perceived benefits of a picture archiving and communication system (PACS) upgrade and comparing their responses to those predicted by developers (Lepanto, Siccote and Lehoux, 2011). Furthermore, a study was conducted in Hong Kong using the TAM to examine students' behavioural intention to use an electronic portfolio system (Shroff, Deneen and Ng, 2011), while it was also used in a study conducted in Oman to determine the main factors that influence students' learning through websites (Sharma and Chandal, 2013). In addition, a study in Taiwan applied the TAM as its theoretical framework, with the TTF theory being one of the external variables. The study was aimed at discovering ways to improve knowledge management systems and their adoption (Kuo and Lee, 2011). The widespread use of the TAM and TTF theory makes them suitable for this current study.

In this current study, a proposed IFM is to be developed using the TAM and the TTF theory in order to evaluate the MLU of e-books. This could improve the usability and adoption of e-books by academics and students in higher education. The reason for applying these two models is substantiated in chapter 2.

1.1 Problem Statement

Usability is a term that is vaguely defined and it is usually defined according to the context in which it is used. Even though there are general usability evaluation techniques, there are not many integrated framework models that exist which are solely dedicated to evaluating e-books usability. This may provide insight into factors that could enhance the adoption of mobile learning using e-books in higher education.

1.2 Research Questions

The following research questions were formulated for this study:

- What is the relevance of the Technology Acceptance Model and Task-Technology Fit theory in developing an appropriate model for evaluating MLU of e-books?
- What other constructs should be included in the IFM for evaluating MLU of e-books?

1.3 Research Objectives

The objectives of this study are as follows:

- To construct an IFM based on the Technology Acceptance Model and Task-Technology Fit theory, dedicated to evaluating MLU of e-books.
- To evaluate the Technology Acceptance Model in order to explore the acceptance of e-books by students.
- To evaluate the Task-Technology Fit theory in order to explore how individual task and technology profiles improve user performance and technology utilisation.
- To evaluate the IFM in order to deduce its effect on e-books usability.

- To perform a pilot study and analyse its results in order to determine any concerns or deficiencies in the data collection instrument.

1.4 Important Definitions

Task-Technology Fit: The TTF theory focuses on measuring how a certain system or technology fits a certain task (Kulkarni and Robles-Flores, 2013).

Technology Acceptance Model: The TAM is reported to be among the earliest models to incorporate psychological factors that affect technology acceptance (Teo, 2012). It initially came to be with the idea to perform the prediction of individuals' adoption and use of technologies (Behrend, Wiebe, London and Johnson, 2011).

Adoption: Adoption (pre-adoption or post-adoption) is a concept of usage behaviour based on perceptions of usefulness, ease of use, instrumental belief of usefulness, etc. (Shubham and Bibhas, 2013).

Mobile Learning: A type of learning delivered or supported solely or mainly by handheld and mobile technologies such as personal digital assistants, smartphones or wireless laptops (Traxler, 2007).

Usability: Holden and Rada (2011) define usability as a system's proficiency to be used by people in an effective manner and with ease. According to previous research, usability is the capability, efficiency and satisfaction of a specific technology (Li and Bai, 2010).

Evaluation: The systematic determination of the quality or value of something (Davidson, 2004).

1.5 Value of the Research

The research may have a social impact in that specific constructs that promote the adoption of e-books in higher education can be identified that, if emphasized, may subsequently lead to enhanced adoption of mobile learning. This current study may further contribute to integrating theory into practice as the body of knowledge for the TTF theory and the TAM will be integrated into a singular IFM for specifically evaluating MLU of e-books. Furthermore, the study has the potential to contribute to enhanced academic awareness of the benefits that may arise from adopting e-books in South African tertiary institutions.

1.6 Methodology and Research Design

The study adopts an exploratory research design. Exploratory designs are used to explore research questions and are performed in order to gain a better understanding of a situation, phenomenon, community or person (Bel, 2010). The researcher hoped that through the exploratory design, she would gain a better understanding of the use of e-books in higher education by using the proposed IFM.

A quantitative research method is employed. Quantitative research is an approach that emphasises objective measurements and mathematical, statistical analysis of data collected through survey questionnaires (Heyvaert, Maes and Onghena, 2011). The quantitative approach objectively tests theories and hypotheses and looks at relationships between variables (Michel et al., 2011).

The target population of the study was composed of Information Technology (IT) students at the Central University of Technology (CUT) who had been introduced to e-books as an alternative to traditional textbooks. Descriptive statistics are used as a technique for data analysis. Descriptive statistics help in describing, showing or summarising data or findings in

a meaningful manner and allow for a simpler interpretation of the findings in the form of graphs or patterns (Bedeian, 2014).

A pilot study was done before the official questionnaire was sent out to participants. A pilot study is a small-scale study for helping to design a further confirmatory study (Araim, Campbell, Cooper and Lancaster, 2010). The pilot study helped in detecting flaws and in correcting those flaws prior to the main study, which continued after the pilot study had been completed (Burgess, 2001). The purpose of the main study was to obtain feedback regarding the perceptions of the target population towards using e-books. The participants were students who were registered for an Oracle and CCNA short course. Paper-based questionnaires were distributed during one of the classes. The total number of questionnaires distributed was 196 of which 144 were valid. Data is analysed using the IBM SPSS statistical analysis software tool. Both questionnaires (pilot and main study) were developed from the study’s proposed IFM, as illustrated in Figure 1.2.

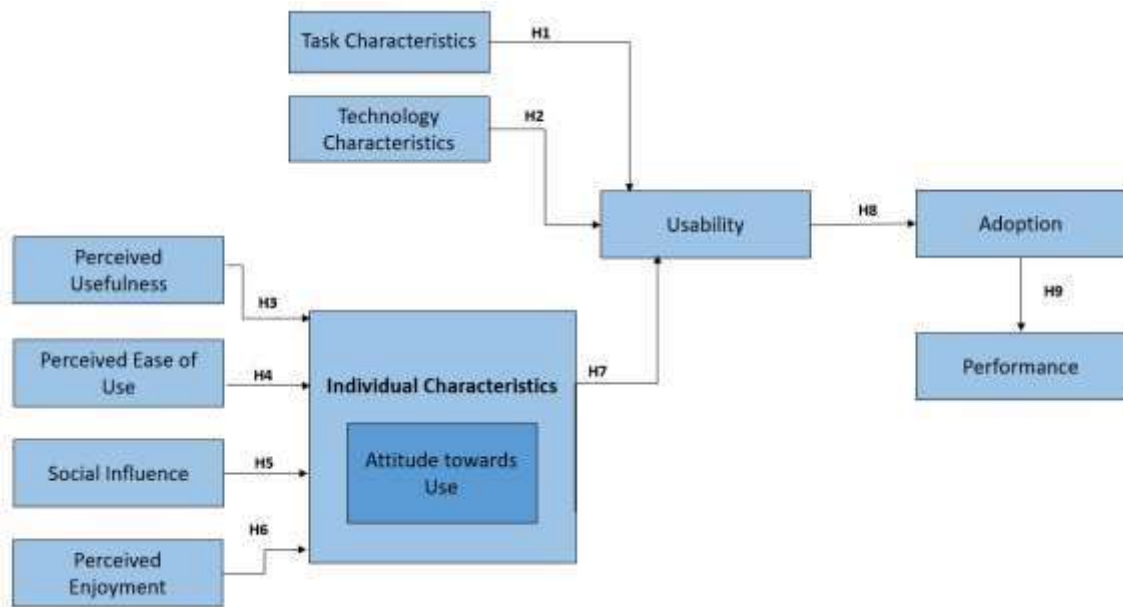


Figure 1.2: Proposed Integrated Framework Model

The proposed IFM in Figure 1.2 has nine hypotheses elaborated as follows:

- H1: Task Characteristics have a positive influence on Usability
- H2: Technology Characteristics have a positive influence on Usability
- H3: Perceived Usefulness has a positive influence on Attitude towards Use
- H4: Perceived Ease of Use has a positive influence on Attitude towards Use
- H5: Social Influence has a positive influence on Attitude towards Use
- H6: Perceived Enjoyment has a positive influence on Attitude towards Use
- H7: Attitude towards Use has a positive influence on Usability
- H8: Usability has a positive influence on Adoption
- H9: Adoption has a positive influence on Performance

1.7 Delimitations of the study

Literature on extensive e-learning methods, such as electronic response systems, instant messaging and learning management systems was not included in this current study. Emphasis was primarily placed on using the TAM and TTF theory to create the proposed IFM. In addition, the research only focused on MLU evaluation of e-books in tertiary institutions, where students mostly access e-books via their mobile devices, including desktops, to engage with course content.

1.8 Outline of the Study

This dissertation is divided into five chapters.

Chapter 1: This chapter covers the background and introduction to this current study. Firstly, this chapter highlights the problem statement, followed by the research questions and research objectives. Additionally, important terms and concepts are defined. Lastly, the value of the research, methodology and research design, delimitations of the study are also elaborated on.

Chapter 2: This chapter covers the literature review of the study and mainly focuses on usability, adoption of e-books, applicable models for this current study and the proposed model and constructs. The section on e-book adoption includes previous studies on e-book adoptions as well as common theories of technology adoption. The section on applicable models for this current study consists of previous studies on the TAM and the TTF.

Chapter 3: This chapter consists of the research methodology of the current study. It covers the research paradigms, research approaches (quantitative, qualitative and mixed-methods approaches), research type and design (correlational study and structural equation model), data collection and ethical considerations. The section on data collection includes the data collection instrument, target population, sampling technique, reliability and validity of the study and the pilot study.

Chapter 4: This chapter focuses on the data analysis and results of the current study. It has four main sections (participant demographics, instrument validation, path coefficients, and descriptive statistics). Instrument validation includes the measurement model analysis. The descriptive statistics section includes all the statistics of the constructs in the IFM, with graphs to represent the results graphically.

Chapter 5: This chapter presents the discussion, conclusion and recommendations of the study. The chapter includes the following sections: findings, research questions answered contributions of the study, implications of the study, limitations of the study and conclusions. The conclusions section entails concluding remarks on the TAM, the TTF, the IFM and the research objectives.

1.9 Summary

In this chapter, the background and introduction to the study were discussed. Firstly, the problem statement was described, followed by the research questions which the study aims to answer. Additionally, the research objectives were described and some important definitions were given. Furthermore, the value of the research, which includes social impact and contribution to the body of knowledge, was explained. This was followed by the methodology and research design. Lastly, the delimitations of the study were presented.

The next chapter entails the literature review of the study, which includes a review on usability, adoption of e-books, applicable models for this current study and the proposed model and constructs.

CHAPTER 2: LITERATURE REVIEW

The previous chapter was an introduction to the study and covered the background of the study as well as the research questions and objectives. Furthermore, the methodology of the study was briefly discussed, as well as the value of the research and delimitations of the study. This chapter presents the literature review, which covers usability, adoption of e-books, adoption models and applicable models in the study. This chapter will further outline the challenges and benefits of adopting e-books.

Current usability evaluation techniques are based on traditional methodologies which were designed primarily for computing technologies. These evaluation methodologies have been applied to emerging technologies, but to a limited degree. According to Nielsen and Molich (1990), usability is a generic name for a set of cost-effective ways of evaluating user interfaces to identify problems and possible solutions. Maguire (2001) argues that designing for usability includes activities of establishing the requirements of the users for the new system or artefact, and having a prototype of the user interface as well as testing it with representative users. Nielsen (1994) stresses that usability inspection methods can be taken into consideration when performing usability evaluation. Usability inspection methods include heuristic evaluation, cognitive walkthroughs, formal usability inspection, feature inspection, consistency inspection and standard inspection. According to Wiredu (2014), for a technology to be adopted, it has to be usable. Therefore, usability is related to adoption.

The notion of being “technologically savvy” is gradually being incorporated into mandated curricula, compelling performance studies of technology adoption at many educational institutions (Straub, 2009). The adoption of a technology is explained as the acceptance of an artefact (Plouffe, Hulland and Vandenbosch, 2001). Researchers have used technology adoption models to study the adoption of technologies (Scott 2008, Sharma and Chandal, 2013). The current study’s focus is on the MLU evaluation of e-books with the intention of enhancing adoption of e-books.

The technology adoption models that are reviewed in this chapter are Diffusion of Innovations (DOI), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT) and Task Technology Fit (TTF) theory. Each of the models are briefly discussed. From these models, the applicable models for this current study, being the TAM and TTF theory, are then selected and described in more detail.

The TAM is the most widely used theoretical model for explaining system usage and adoption (D'Ambra and Wilson, 2004). It is based on the TRA and was developed by Davis (1989) with the objective of strengthening the prospective user's behavioural intention to use a technology (He and King, 2006). The TTF theory is successful "when a technology provides features and supports 'fit' requirements of a task" (Goodhue and Thompson, 1995). It was developed by Goodhue and Thompson (1995). The proposed IFM of this current study integrates these two theories.

The IFM of this current study capitalises on the constructs of both the TAM and TTF theory. The TAM incorporates two fundamental constructs – perceived ease of use and perceived usefulness (Park, 2009) and focuses on the individual's perceptions of a technology. The constructs of the TTF theory are task characteristics and technology characteristics (which have a positive influence on task technology fit). The TTF theory influences performance impact and utilisation, while capitalising on the technology used. Together, the TAM and TTF theory form an IFM that incorporates both the individual's perceptions and the technology being used. In the next section, the concept of usability is discussed.

2.1 Usability

IT usability has remained the object of numerous exploration studies for the past thirty years (Freire, Arezes and Campos, 2012). According to Freire et al. (2012), these studies have emphasised an excessive diversity of perspectives from various fields, including Design, Ergonomics, Education and Computer Science. The term usability has been defined and applied

in various and contradicting ways by different researchers in the past (Lee and Chen, 2011, Dubey, Gulati and Rana, 2012, Alonso-Ríos, Vázquez-García, Mosqueira-Rey and Moret-Bonillo, 2010). As a result, the usability concept is vaguely defined to date and there remains no mutual agreement on its definition (Bringula and Basa, 2011).

In an attempt to define usability in software design, Dubey et al. (2012) developed a cohesive model for usability of software. This is measured using six elements, namely, explicitness, satisfaction, effectiveness, safety, efficiency, and comprehensibility. For human-computer interaction, Alonso-Ríos et al. (2010) mention that usability is derived from the concept of ‘user friendliness’. It is described in terms of ease of use in relation to user experiences (Alonso-Ríos et al., 2010). In the virtual world, it is defined as the degree to which a computer-generated space assists users in accomplishing particular objectives with efficiency and fulfilment (Lee and Chen, 2011). Shubham and Bibhas (2013) proclaim that usability studies are often linked to adoption. According to Wiredu (2014), optimum usability is accomplished when there is coordination between the harmony of technology application and tasks involved. Wiredu (2014) posits that user adaptation and adoption are essential contributors to technology usability. According to Nielsen and Molich (1990), any technology intended for people ought to be easy to absorb and recall, operative, and pleasurable to use. Nielsen and Molich (1990) also state that there are usability guidelines that must be used for designing technology interfaces in order to enhance its usability. These guidelines are said to be comprehensive.

According to Kissinger (2013), preliminary investigation indicates that students prefer to use e-books due to their portability, financial affordability and ease of navigation on different electronic devices. Students furthermore indicated that the e-books should be effective for their learning needs and that the e-books should meet their individual student needs, since student needs vary from student to student (Kissinger, 2013). Following this background, usability as related to the current study is defined as the degree to which e-book technology characteristics, learning (task) characteristics and individual characteristics (perceived usefulness, perceived ease of use, perceived enjoyment, Social Influence and attitude towards e-book usage) provide a fit suitable for promoting e-book adoption.

Behrend et al. (2011) conducted a study in North Carolina, USA with the aim of examining the aspects that drive the adoption of cloud computing in rustic and municipal community colleges. They used the TAM (version 3) and their measurements were based on actual use and future intentions. According to Behrend et al. (2011), usefulness and ease of use have an effect on the usage of cloud computing. No substantial association was found between perceived usefulness and learner usage, while perceived ease of use was considerably related to perceived usefulness. The study also reveals that perceived usefulness and perceived ease of use do affect learner beliefs about future usage. Furthermore, concerning learner attitudes towards technology, the findings of the study indicate that anxiety towards new technologies has a momentous undesirable outcome on perceived usefulness. Many of the participants indicated their anxiety regarding new technologies, perceiving simulated cloud computing to be less useful. However, according to Behrend et al. (2011), their anxiety did not have a substantial influence on usefulness or ease of use.

A study was conducted at the University of Loughborough with the aim of recording students' initial reactions after using Rocket e-books, manufactured by NuvoMedia and Glassbooks (Bevan, Carter and Harker, 2015). The initial study (May 2000) measured scholar and staff assessment of the e-book readers. A follow up study was undertaken in December 2009, with participants being members of the Harborough Community library (scholars and staff). The participants' perceptions of e-book readers were evaluated based on their prospective use of the Rocket e-books for loaning amenities. The results indicate that the staff were not as comfortable as the students with using Rocket e-books.

Du Toit and Bothma (2009) from the University of South Africa (Unisa) investigated the effectiveness, efficiency and satisfaction of the website of the Department of Marketing and Retail Management (DMRM) at the university. The aim of the study was to determine the superlative usability guideline practices pertaining to the construction of an enhanced marketing department website for the university. The results of the study indicate that the navigation of the DMRM website was unpleasant and not user-friendly. Navigating to the DMRM website from the university's website was difficult and the terminology used on the website was confusing.

E-books have been chosen for this current study as a mobile learning technology, which can be accessed via mobile phones or via notebooks. The next section deals with the adoption of e-books in higher education.

2.2 Adoption of e-Books

According to literature, e-books are classified as a mobile learning technology (Pachler, Cook, Bachair, Kress, Seipold, Adami and Rummler, 2010). Adoption of a technology is defined as the way in which users accept the technology (Davis, Bagozzi and Warshaw, 1989). Venkatesh, Thong, Chan, Hu and Brown (2011) explain that adoption can result from a user's perception of the technology after having used it. According to Shubham and Bibhas (2013), adoption refers to the acceptance of and one's willingness to use a given type of technology. De Silva, Ratnadiwakara and Zainudeen (2011) denote adoption as explaining decisions of persons by applying perceptive and social models of decision-making. Shroff et al. (2011) argue that adoption is a person's conduct relating to a certain technology. For the current study, adoption refers to the acceptance and use of e-books for academic purposes.

Experiences associated with an individual's characteristics regarding e-book usage will be used in determining the adoption of e-books. This may indicate a usability fit in association with task and technology characteristics.

D'Ambra, Wilson and Akter (2013) claim that the poor adoption of e-books is a disadvantage, which may have been caused by a lack of awareness. The disadvantages listed in their study of e-book adoption included onscreen reading, digital rights management, navigation issues, battery life issues, and search issues. According to Sarker and Valacich (2010), the complexity of a technology may have serious implications for technology adoption. E-book readers or digital screens may possibly cause eyesight problems (Rosenfield, 2011). Chong, Lim and Ling (2009) proclaim that regardless of higher education institutions' demands to implement e-books in their academic libraries, literature has demonstrated the toil in perusing and reading an e-book using unfriendly user interfaces. Furthermore, Chong et al. (2009) declare that a hurdle

to the acceptance of e-books is the inadequate design of e-book technologies. For the South African market, however, e-books may be a viable alternative due to their affordability (D'Ambra et al., 2013).

Way (2016) argues that when an e-book is readable, it is said to provide effective and efficient learning. It is more preferable to navigate through e-books than through other publication types (Getto and Amant, 2014). Some other advantages of e-books, as discovered in a study by D'Ambra et al. (2013), are accessibility, personalised learning, portability, search ability and environmental sustainability. E-book characteristics may have the potential to enhance the teaching and learning process. Based on the above information, it is important that academic stakeholders campaign for e-book adoption since the advantages of using e-books outweigh the disadvantages thereof. This adds to why usability evaluations of adopting e-books as a mobile learning technology are required.

2.2.1 Previous studies on the adoption of e-books

Gerlach and Buxmann (2013) conducted a study in Hawaii that examined how well e-books “fit” an individual reader. The researchers proposed a research model that was aimed at investigating individuals’ e-book acceptance choices. One-hundred and eighty participants provided profound insights as to what the diverse drivers of e-book acceptance are. Davis’ (1989) TAM constructs were added to test how e-books are accepted. Perceived usefulness was defined as the degree to which an individual trusts that using e-book technology would assist them to successfully read the related information, with perceived ease of use as the extent to which an individual trusts that using e-book technology would be effortless. Behavioural intention was a dependent variable, demonstrating the acceptance of e-books. Behavioural intention to use was defined as the idea of a person to use e-books regularly in the future. Different compatibility constructs were also considered. The results of the study indicate a substantial link between the compatibility with standards and objectives to use e-books. For the TAM constructs, perceived usefulness was correlated to usage objectives of using e-books. The results could not validate that perceived ease of use has a positive influence on students’

intentions to use e-books. In conclusion, perceived ease of use presented a substantial influence on the perceived usefulness of e-books.

Allen and Kaddu (2014) administered a survey with the objective of establishing the prevalence of e-books and e-Lending (their obtainability and usage) in Africa. The aim of the study was to establish the significance of e-books and e-Lending on the African continent. The study targeted 25 countries where associates of their community libraries or clusters would be well known; however, only 11 countries fully participated in the online self-conducted questionnaire. Ten did not participate but replied that they had no knowledge about e-books and were unaware whether e-books were present in their community libraries. The remaining three countries specified that they were uncomfortable with the English used in the questionnaire.

Allen and Kaddu (2014) posit that, although Africa has a remarkable growing interest in and use of ubiquitous technologies, social media and blogs, e-books are beginning to show signs of future potential. The authors also ascertain that many Africans, including those who have e-reading devices, are comfortable with printed, hardcopy books. It may be that e-books in Africa exist predominantly in educational and research libraries. ICT infrastructure may further present a hurdle to e-book procurement and availability. The prices of e-books and absence of finances remain as encounters that are hindering their obtainability and use.

At a South African university, the University of Western Cape (UWC), Zinn and Langdown (2011) performed a study with the purpose of investigating the use of e-books amongst educational librarians. The participants in this study were educational librarians from UWC and other universities. The researchers determined which e-books were obtainable to educational librarians and their reasons for choosing that format. Furthermore, they determined what influence e-books had on the librarians' expert practise and what usage arrangements existed. An online questionnaire comprising closed-ended, partly closed and open-ended questions was conducted. All participants were members of the Library and Information Association of South Africa (LIASA). The South African universities' librarians and council of research libraries, who were subscribed to the LIASA mailing list, shaped the sample (n =

25) of the study. According to Zinn and Langdown (2011), their findings indicate that educational librarians do use e-books. In addition, the educational librarians read e-books by “plummeting in and out of numerous chapters”, allowing them to read several documents at a time. Twelve of the respondents whose institutions purchased e-books stated that they would regularly choose e-books over printed books if the e-format is readily available. Since South African university librarians are adopting e-books, it is important for the current study to report on the common theories of technology adoption, which are discussed in the next section.

2.2.2 Common theories of technology adoption

The technology adoption theories that are discussed in this section are Diffusion of Innovations (DOI), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), Task-Technology Fit (TTF) and the Unified Theory of Acceptance and Use of Technology (UTAUT). This is by no means an exhaustive list of theories of technology adoption, but the ones mentioned are sufficient for the purposes of this current study.

2.2.2.1 Diffusion of Innovations

The Diffusion of Innovations (DOI) theory originates from the German-Australian and the British schools of diffusionism in anthropology and was developed in 1962 in the United States by Everett Rogers, a rural sociologist and professor of communication studies (Hoffmann 2011). Members (academia) of these schools noted that most variations in society result from the outline of innovations from supplementary societies. Furthermore, French sociologists suggested incorporating the S-shaped diffusion curve and the role of estimation leaders in the progression of “imitation” (Rogers 1976).

Greenhalgh, Robert, Macfarlane, Bate and Kyriakdou (2004) define the DOI theory as a theory that seeks to explain how technology spreads through culture. Furthermore, it seeks to explain the rate at which new technology and ideas are adopted (Greenhalgh et al., 2004). According to Wejnert (2002), the DOI theory denotes a range of intellectual ideas and notions, methodological information, and definite practises in a social system. It clarifies where the

range indicates movement from a basis to an adopter, usually through communication and impact.

The DOI model is depicted in Figure 2.1. The DOI theory, according to Rogers (1976), is a procedure which explains how an idea spreads and gains momentum over time. The interconnection occurs over certain channels during a specific period between the affiliates of the social-order system. Through succeeding clusters of consumers accepting the new technology (blue line in Figure 2.1), its market share (yellow line) will eventually reach the saturation level (Rogers, 1976). Rogers (1976) posits that in mathematics terminology, the yellow curve is called the logistic.

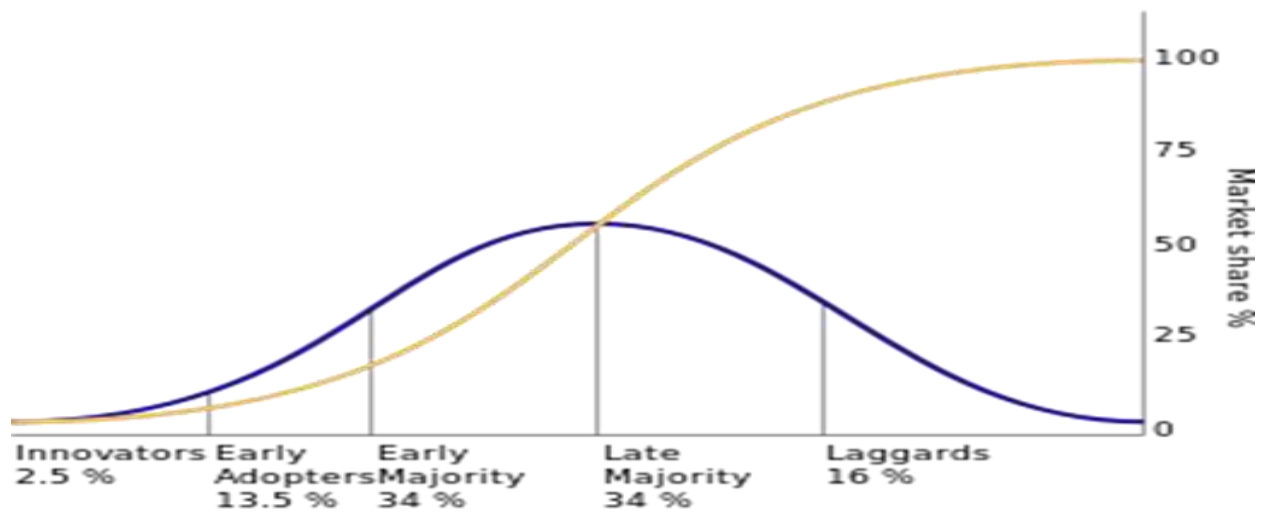


Figure 2.1: Diffusion of Innovations Model (Rogers, 1976)

The curves in Figure 2.1 are divided according to the following sections of adopters:

- Innovators – These are people who are willing to take risks and who want to be the first to try the innovation.
- Early adopters – These people represent opinion leaders who enjoy leadership roles and embrace change opportunities.
- Early majority – These are people who adopt ideas before the average person.

- Late majority – These are people who try an innovation after it has been tried by other people, and who are skeptical of change.
- Laggards – These people are sceptical of change and are bound by tradition and are very conservative.

According to Figure 2.1, the majority of the general population tends to fall in the middle section. Researchers have established that individuals who primarily adopt an innovation (early adopters) comprise more diverse individualities than individuals who adopt an innovation long after its production (early majority) (Jwaifell and Gasaymeh, 2013). Jwaifell and Gasaymeh (2013) denote that when introducing an innovation for the first time, it is essential to recognise the individualities of the target population, which will aid or deter the adoption of an innovation.

2.2.2.2 Theory of Reasoned Action

Martin Fishbein and Icek Ajzen proposed the Theory of Reasoned Action (TRA) in 1975 as a derivative of a previous study that began as an attitude theory (Vallerand, Pelletier, Deshaies, Cuerrier and Mongeau, 1992). According to Vallerand et al. (1992), the TRA is a popular model in the domain of social psychology.

The theory proposes that an individual's behavioural intention is subject to their attitude concerning behaviour and subjective norms (Fishbein and Ajzen, 1975). In addition, if an individual anticipates an action, then it is probable that the individual will engage with the action. The model and its constructs are depicted in Figure 2.2.

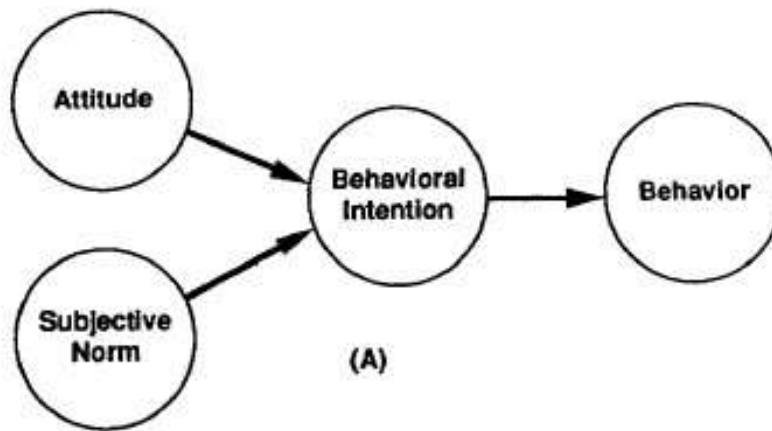


Figure 2.2: Path Model for Theory of Reasoned Action (Fishbein and Ajzen, 1975)

The TRA consists of three general constructs: behavioural intention, attitude, and subjective norm. Behavioural intention measures one's relative intention to execute an action or specific behaviour. Attitude entails the beliefs about the shortcomings of executing the behaviour multiplied by one's evaluation of the shortcomings (Fishbein and Ajzen, 1975). Subjective norm is the perceived societal pressure caused by one's perception and refers to the social pressure a person experiences in carrying out or not carrying out a specific behaviour (Fishbein and Ajzen, 1975). According to

Figure 2.2, an individual's attitude and subjective norm influence their behavioural intention. Once there is a behavioural intention, the individual will perform the behaviour.

2.2.2.3 Theory of planned behaviour

According to Francis et al. (2004), the Theory of Planned Behaviour (TPB) was developed in 1988 by Icek Ajzen to improve the predictive power of the TRA. The TPB connects human principles and behaviour and is devised from the psychology subsidy; it also lengthens the limiting conditions of wholesome volition stated in the TRA (Madden, Ellen and Ajzen, 1992).

Madden et al. (1992) report that the TPB comprises beliefs concerning the proprietorship of mandatory resources and prospects for execution of a given behaviour. The theory states that an individual's attitude towards behaviour, subjective norm and perceived behavioural control shape their behavioural intention and behaviours (Yu and Yu, 2010). Figure 2.3 represents the TPB, where attitude, subjective norm and perceived behavioural control will predict intention to perform a behaviour.

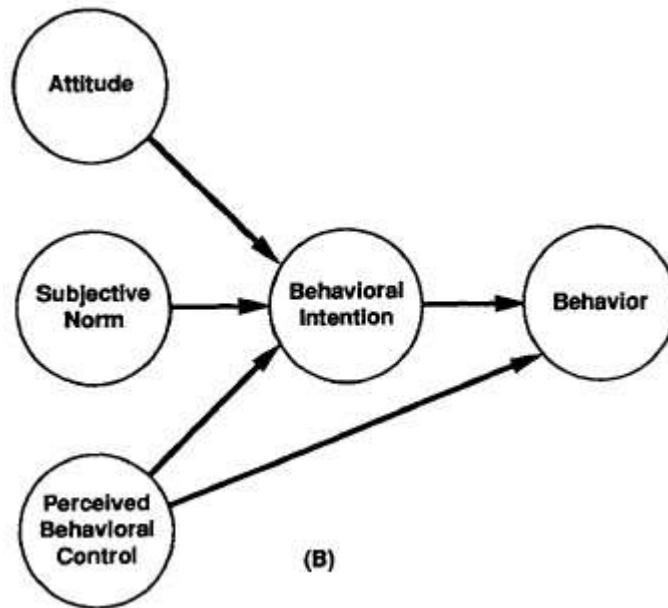


Figure 2.3: Path Model for Theory of Planned Behaviour (Fishbein and Ajzen, 1975)

According to the TPB, human behaviour is guided by two types of concerns: behavioural beliefs and normative beliefs (Madden et al., 1992). Behavioural beliefs relate to the probable results of the behaviour and the assessment of these results. Normative beliefs concern the normative anticipations of others and the drive to conform to these anticipations. According to Ajzen (2002), attitude concerning the behaviour, subjective norm, and perceived behavioural control results in the realisation of behavioural intention. In conclusion, given an adequate amount of definite mechanism over the behaviour, it is anticipated that individuals perform their intent when the occasion arises. Intentions are the predecessors of behaviour. The constructs of this model reflect psychological constructs that have a distinctive implication for the theory (Vallerand et al., 1992).

2.2.2.4 Technology Acceptance Model

The Technology Acceptance Model (TAM), which was developed by Fred Davis in 1986, is the most prominent extension of Ajzen and Fishbein's TRA. Surendran (2012) ascertains that the TAM is one of the theories that has been based on the TRA and has been used to explain an individual's acceptance behaviour. Teo (2013) argues that the TAM is one of the most prominent additions of Ajzen and Fishbein's TRA. According to Kashi and Zheng (2013), the TAM has substituted several of the TRA's attitude measures with two technology-acceptance measures, ease of use, and usefulness (see Figure 2.4 for the original TAM). The model suggests that apparent usefulness and apparent ease of use include a person's intention to make use of a system with the "intention to use" serving as an intermediary of real system use (Shroff et al., 2011). Furthermore, perceived usefulness is hypothetically subjective to perceived ease of use and is linked to the four other constructs of the TAM.

Park (2009) declares that the core factors essential to perceived ease of use are design and features of a technology, while the main factor influencing perceived usefulness is exertion-reduction. According to Al- Adwan, Al- Adwan and Smedley (2013), the TAM is acknowledged as one of the well-known models related to technology acceptance and use. It has presented great potential in unfolding and predicting the actions of users of a technology (Al- Adwan et al., 2013).

According to Robles-Gómez et al. (2015), the TAM is a model that simulates how users come to adopt and use a technology. The TAM is further designed for demonstrating user approval of information systems (Davis et al., 1989). Wu and Ke (2015) declare that the TAM is a model that can efficiently describe user behaviours relative to new technologies. Wu and Ke (2015) also suggest that the TAM is an adoption theory; thus, it emphasises that when an individual decides to perform an action, they will do it without hesitation.

Davis (1989) states that performance achievements are often disillusioned by users' reluctance to acceptance and use of an existing system. According to Davis (1989), people have a habit of using or not using a technology to the magnitude they trust it will be of assistance to them in

better performing their tasks. This variable is referred to as perceived usefulness. Even if prospective users have faith that a given technology is worthwhile, they may possibly also believe that the technology is too difficult to use. Performance reimbursement usages are thereby determined by the exertion of using a technology (Davis 1989).

According to Nath, Bhal and Kapoor (2013), the TAM recognises perceived usefulness and perceived ease of use as influential in attitude towards and intention to use a technology; it regards them as the most important determinants of actual use (Davis et al., 1989). Figure 2.4 represents the original TAM, where external variables do influence perceived usefulness and perceived ease of use (Legris, Ingham and Collette, 2003). Legris et al. (2003) define the external variables as the system's characteristics. Perceived usefulness and perceived ease of use determine an individual's attitude towards use and in turn influence their intention to use.

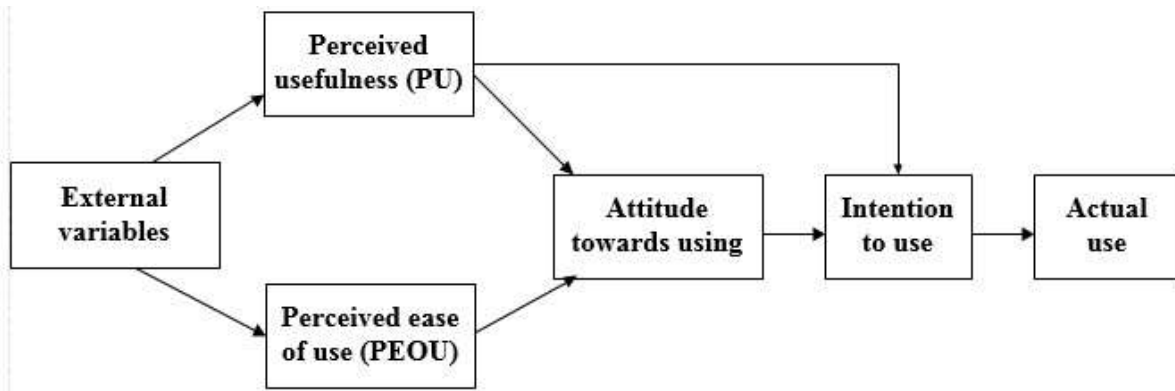


Figure 2.4: Technology Acceptance Model (Davis, 1989)

2.2.2.5 Task-Technology Fit

The Task-Technology Fit (TTF) theory was developed by Goodhue and Thompson in 1995 (Ariffin, Azman and Klobas, 2011). This theory is a linkage of models from two complementary streams of research (user attitudes as predictors of utilisation and task-technology fit as a predictor of performance). Goodhue and Thompson (1995) established this theory to examine the link between IT and individual performance. They wanted to confirm the notion that combining usage and task-technology fit can better clarify the performance of IT.

According to Sarker and Valacich (2010), the TTF theory upholds that individuals form an opinion on the appropriateness of technology built on perceptions of how the technology supports their requirements. The TTF can be defined as the extent to which the capabilities of the technology fit the task's demand (Goodhue and Thompson, 1995, Kuo and Lee, 2011). Goodhue and Thompson (1995) ascertain that a technology will be used when it conforms to or fits the task of the user. According to Waite, Harrison and Hunter (2011), the TTF theory maintains that a technology must be used to the best of its functionality and the technology must be a good fit with the task that it supports. In addition, for a technology to have an encouraging influence on performance, it is necessary for the technology to be used (Goodhue and Thompson, 1995). It should be a 'good fit' with the tasks it supports. Figure 2.5 presents the TTF model, where task characteristics and technology characteristics combine to lead to the fit of a technology to a task. Achievement of fit leads to performance.

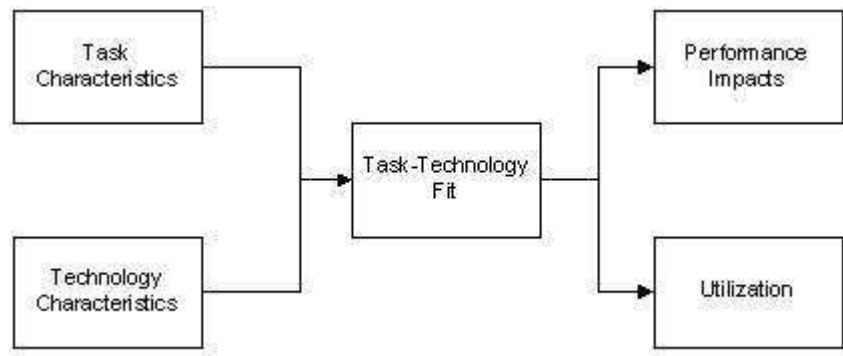


Figure 2.5: Task-Technology Fit Model (Goodhue and Thompson, 1995)

2.2.2.6 Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh, Morris, Davis and Davis (Venkatesh, Morris, Davis and Davis, 2003) (Figure 2.6). This theory is a more recent model and is a combination of eight present models of technology acceptance, including the TAM (Oshlyansky, Cairns and Thimbleby, 2007). Venkatesh et al. (2003) integrated these models to promote a unified view of user acceptance and to identify the most significant influences. Oshlyansky et al. (2007) reveal that the UTAUT model

incorporates elements from the TRA, Motivational Models, TPB, a combined TAM and TPB model, model of personal computer use, DOI theory, and social cognition theory.

Each of the models mentioned in this section covers a user’s intention to use a technology or the actual use of a technology as the dependent variable. User intention between the different models varies from 17% to 53% (Vanneste, Vermeulen and Decler, 2013). By integrating the conceptual and empirical similarities of these eight models, the UTAUT model explains up to 70% of the variance in intention to use a technology (Vanneste et al., 2013). Furthermore, according to Vanneste et al. (2013), the UTAUT model explains up to 50% of the variance in technology usage. The UTAUT model constructs are performance expectancy, effort expectancy, Social Influence, facilitating conditions, use behaviour, behavioural intention, gender, age, experience and voluntariness of use.

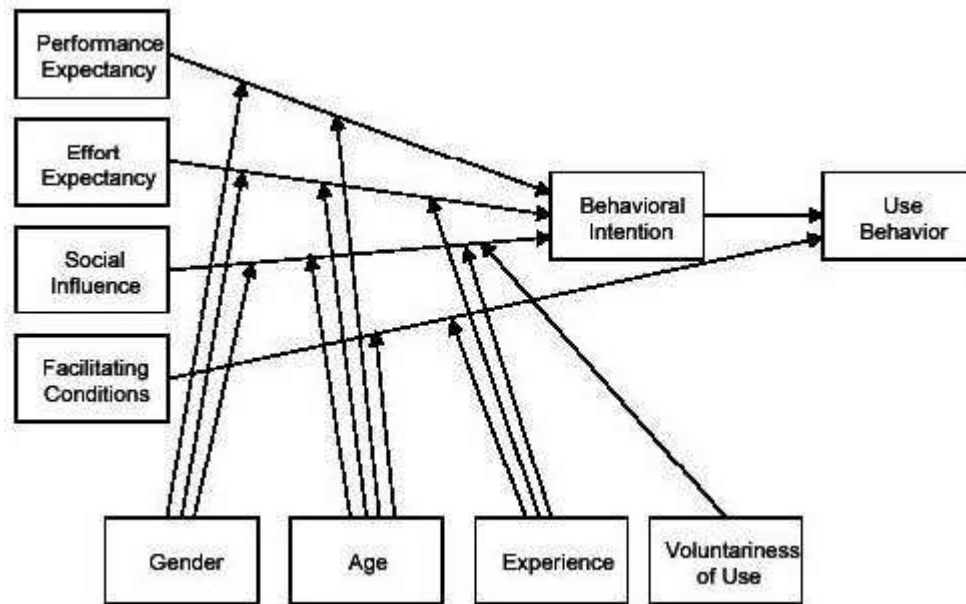


Figure 2.6: Unified Theory of Acceptance and Use of Technology Model (Venkatesh and Zhang, 2010)

Performance expectancy, effort expectancy and Social Influence are direct determinants of behavioural intention to use a technology. Use behaviour is determined by facilitating conditions and behavioural intention. Venkatesh et al. (2003) also included four constructs that determine the effects of constructs on behavioural intention and/or use behaviour: gender, age,

experience and voluntariness of use. In the current study, the TAM and TTF theory have been integrated in an effort to develop a proposed IFM for evaluating the adoption of e-books at CUT.

2.3 Applicable Models for this Study

Previous studies indicate that the TAM is the most influential model in technology usability and adoption (Çelik and Yilmaz 2011, Kashi and Zheng, 2013). Since this current study aims to investigate MLU evaluation of e-books, it is appropriate to consider the TAM constructs in line with e-books usability. According to Poon (2014), the success of e-books usability is dependent upon the application of a scholastic model that addresses scholar needs, relevant content and enhances student performance. Poon (2014) utilised the TAM in investigating the intention of college students in using e-books. The findings provide improved understanding of student intention to use e-books for academic purposes.

Lee, Hsieh and Chen (2013) proclaim that the TTF theory is among the most widely used models for measuring performance enhancement by using technology. The current study seeks to establish the effect of e-book usability on student performance. Therefore, applying the TTF theory in this current study is appropriate as it is widely utilised for measuring performance (Lee et al., 2013). D'Ambra et al. (2013) suggest that the acceptance of e-books may depend on how individuals perceive the fit of e-books toward the tasks they must complete. Additionally, acceptance is dependent upon the various levels of functionality provided by the technology that delivers the content. The results of a study where the TTF theory was utilised to evaluate the adoption of e-books in education suggest that the task and technology characteristics have a positive influence on the fit of the technology to the task, which in turn has a positive influence on performance and utilisation (D'Ambra et al., 2013). The next sections provide an overview of where the TAM and TTF theory have been used and why they are suitable for this current study.

2.3.1 Previous studies on the Technology Acceptance Model

Shroff et al. (2011) conducted a study in Hong Kong in which the TAM was evaluated in order to observe learners' behavioural intention to use an electronic portfolio system. The results reveal that learners' perceived ease of use has a major effect on attitude towards use and an even greater effect on perceived usefulness.

In an Arabian study, Hu, Al-Gahtani and Hu (2013) proposed a model based on the TPB and the TAM that concentrated on the properties of gender in long-standing Saudi Arabian ethos traditions. The study was based on social norms outlining distinct gender roles and the acceptance of computer technology by Arabian workers. The results of the study indicate that the TAM could explain a substantial portion of changes in workers' intentions to use a technology (Hu et al., 2013).

In a Southern African study, the TAM was utilised to establish if there is technology acceptance in supported monetary services (Wentzel, Diatha and Yadavalli, 2013). The study included the constructs of trust, social, hedonistic, task and self-efficacy. According to Wentzel et al. (2013), the findings of the research depict that the suggested improvement of the TAM is appropriate to the data when considering the acceptance of a technology-supported facility such as banking. Furthermore, the integration of perceived usefulness, perceived ease of use and attitude to their hypotheses improved their understanding of the adoption intention for technology-enabled banking facilities.

Korpelainen (2011) explains that the TAM has the advantage of being uncomplicated, a feature that has stimulated academics to apply it extensively. Moreover, the TAM may possibly be suitable in predicting users' acceptance of an IT system in an organisation (Lee et al., 2013).

The purpose of the current study is to develop an IFM for MLU evaluation of e-books. Usability is a term that has been associated with adoption, making the TAM a suitable model for evaluating the acceptance of e-books. Shroff et al. (2011) ascertain that the TAM strives to comprehend the association between perceptions (PU and PEOU of technologies) and usage

conduct. Students' perceptions of the overall use of e-books on their chosen platform will be considered through the constructs of the TAM.

2.3.2 Previous studies on Task-Technology Fit

In an Australian study, the TTF theory was applied to evaluate the adoption of e-books by academics (D'Ambra et al., 2013). The aim of the study was to assess how well e-books meet the requirements of academics. The findings of the study suggest that the overall TTF constructs have a substantial positive influence on users' behaviour and use. The TTF constructs also have a positive influence on performance in using e-books.

The TTF theory and the TPB were applied in a study at a university in Taiwan, with the aim of modelling the factors that affect individuals' utilisation of online learning systems (Yu and Yu, 2010). In other words, the study investigated the online learning utilisation of Taiwanese students.

A total of 870 students who were introduced to the system were surveyed after a period of exposure. The results of the research model were based on the causal relationship between task characteristics, individual characteristics, TTF, user perceptions and user acceptance. Yu and Yu (2010) report that the results of their study indicate that combining the TTF theory and the TPB provides a better explanation for variance in online learning system utilisation.

The findings of a study focusing on the use of the TTF theory for mobile learning of information systems indicate that the TTF theory clarifies the influence of an IT system on individual performance (Gebauer, Shaw and Gribbins, 2010). Gebauer et al. (2010) state that besides usage, user-perceived accomplishment of individual tasks was also prevalent among participants.

Yu and Yu (2010) explain that variations to technology and user needs for the task at hand should be used to improve the TTF theory. An advantage of the TTF theory is that when a technology is utilised optimally in support of a task, task performance increases considerably (Yang, Kang, Oh and Kim, 2013). Having pointed out this advantage, Yu and Yu (2010) argue

that among other advantages, the TTF theory provides an impressive understanding of the interrelationship among individual and task characteristic fitness. These then affect a user's choice concerning whether or not to use an information system. In the current study, this will help to clarify the relationship between the student as an individual and the use of e-books for educational purposes, which will then highlight the attitude that the individual has towards using e-books.

2.4 Proposed Model and Constructs

The proposed IFM for this current study includes the constructs of the TAM and the TTF theory. The model includes Social Influence from the UTAUT model as well as perceived enjoyment, the latter being from extensions of the TAM and other motivational models (Sun and Zhang, 2006). There are some researchers that have written on the topic of usability of e-books with an inclusion of TAM and TTF (D'Ambra, Wilson and Akter, 2013; Aharony, 2014). However, those studies only included the TTF and TAM constructs. In the current study, the proposed model includes the TAM and TTF theory with additional constructs from the UTAUT model (Social Influence) and from other motivational models (Perceived Enjoyment).

The Social Influence construct refers to the felt subjective norms or alteration in behaviour caused by one person on another, deliberately or unintentionally (Tsai and Bagozzi, 2014). Risselada, Verhoef and Bijmolt (2014) argue that Social Influence is likely to influence decisions to adopt a technology. Therefore, Social Influence is included as one of the constructs in the IFM because it is one of the constructs that may determine user adoption of technologies and will be useful in this current study in determining whether participants' decision to use e-books was influenced by others.

The Perceived Enjoyment construct is considered as the degree to which the use of technologies is perceived as pleasant (Sun and Zhang, 2006). It is also considered as one of the important constructs which determine attitude and behaviour (Pe-Than, Goh and Lee, 2014). Therefore,

Perceived Enjoyment is incorporated as one of the construct of the IFM in order to determine if the enjoyment of e-books has an effect on usability.

A perceived weakness of TAM for usability studies is its apparent lack of task focus (D'Ambra, Wilson and Akter, 2013). Although the TAM construct “perceived usefulness” (see figure 1.2) involves tasks, the inclusion of additional task characteristics could deliver an improved model for usability of e-books. The TTF model tries to resolve this apparent lack of task focus by including the task (Gebauer *et al.*, 2004).

In the current study, the proposed model includes the TTF theory in order to apply the tasks of students, which involve the use of e-books to complete their tasks, or assignments, at the university. On the other hand, the TAM provides the inclusion of the users attitude or characteristics towards e-books. E-books are categorized under mobile learning (Kissinger, 2013) which essentially provides the functionality of anywhere and anytime learning. Therefore, in the current study, the IFM is proposed to evaluate the usability of e-books as an information resource for students in higher education.

2.5 Summary

In this chapter, the literature review of the study was presented. Firstly, usability was discussed, which is measured using six elements in relation to software design and is regarded as ease of use in terms of user experience. Thereafter, the adoption of e-books was detailed entailing a look at previous studies on technology adoption and common theories of technology acceptance. These included the DOI, TRA, TPB, TAM, TTF and the UTAUT models. This was followed by a discussion on applicable models for this current study, which include the TAM and the TTF theory. The most widely used model for technology acceptance is also the TAM. Lastly, the proposed model and constructs pertaining to this current study were presented.

The next chapter presents the methodology of the study. This includes a description of the research paradigms, research approach and design, data collection instruments, the pilot study, and ethical considerations.

CHAPTER 3: RESEARCH METHODOLOGY

Chapter 2 was dedicated to presenting the literature review of the study. The literature review covered the adoption of e-books and the adoption theories in Information Systems (IS). This chapter consists of the research methodology, which includes the research paradigm, research approaches, research type design, data collection instruments and ethical considerations.

Research methodology is an orderly tactic suitable for establishing solutions for problems that may result from research questions (Meredith, Raturi, Amoako-Gyampah and Kaplan 1989, Ponterotto 2005, Cothran 2011, Houghton, Hunter and Meskill, 2012). Such an approach is necessary for establishing and determining problems relating to e-book usability resulting from the lack of consistent and dedicated e-book usability evaluations. A research method for establishing an IFM for e-book usability evaluations should provide sequential phases of the research progress in order to meet the objectives of the research. Following Creswell's (2002) insights, phases involved in this research include instrument design, data collection and data analysis.

3.1 Research Paradigms

The research paradigm used in this current study was the positivist research paradigm. This current study adopted the use of hypotheses, with data being collected using questionnaires that are analysed quantitatively. Following Johnson (1999) and Wright and Parchoma's (2011) criteria for classifying research in different paradigms, this current study fits the positivist criteria as it uses quantitative data collection and analysis methods. This paradigm was applied because it eliminates researcher bias and provides authentic action or reason for conducting research (Myers and Klein 2011, Compeau, Marcolin, Kelley and Higgins 2012, Urquhart and Fernández, 2013).

A positivist paradigm was chosen because, according to Susman and Evered (1978), positivism has conquered the biological, physical, and societal sciences for more than a hundred years.

Whereas interpretivism may lead to data generalisation causing challenges with reliability and representativeness of data, the data for this current study were analysed in an objective manner, making the positivist paradigm the most suitable for this current study (Kelliher 2005, Myers, 2008). A third research paradigm is critical realism, which is concerned with characteristics of the philosophy of science, ontology and epistemology. Critical realism can use the mixed-methods approach.

3.2 Research Approaches

The main research approaches in research are quantitative, qualitative and a mixed-methods approach (Venkatesh, Brown and Bala, 2013). According to Fisher Jr and Stenner (2011), these research approaches are a reflection of the different views of the world on how knowledge is developed. Each is discussed briefly below.

3.2.1 Quantitative research

According to Pishghadam and Navari (2010), quantitative research clarifies a phenomenon by collecting data that are analysed using mathematically based methods. The quantitative approach is a methodology that makes use of statistical methods to synchronise the outcomes of multiple studies (Cothran, 2011). Venkatesh et al. (2013) refer to quantitative research as a method of analysis which tries to explore, define, enlighten or predict incidences in the domain in which we reside. According to Na'slund (2002), quantitative research is inclined to fit with the positivist paradigm. Research has been conducted in the field of natural sciences and social sciences using quantitative methods. In social sciences, quantitative research has been widely applied in gender and political science, sociology, economics, health and human development and many more (Chor 2010, Geary 2011, Hussein, 2015).

The types of studies that include this approach are those where a researcher wishes to perform data comparisons systematically (Creswell and Creswell, 2017). It is included in situations where the researcher needs to make some generalisations of the whole population or else test

theoretical assumptions using some kind of hypothesis (Yilmaz, 2013). The quantitative approach was adopted for this current study, emphasis being placed on measurements that are objective and data being analysed in a statistical, mathematical or numerical manner. The next research approach is qualitative research.

3.2.2 Qualitative research

Qualitative enquiry is the employment of different techniques for collecting and examining data and takes on a world view about the nature of familiarity and inquiry (Ferguson, 1993). According to Xuehong (2002), qualitative research consists of occurrence methods, for instance, case studies (performed in a natural setting), site studies, field studies, local gazette research of ethnology, and research of interpretations. Xuehong (2002) adds that qualitative studies make use of data collection methods by the researcher going into the domain of the subjects and collecting rich, detailed data. Processes involve documentation of what researchers realise and hear while they examine what they have documented. Berger (2015) states that qualitative research is rather an approach than an ordinary method and allows the researcher to develop a deeper understanding of a topic. Qualitative research is a methodology for data collection and considering data through observation of participants in the data collection process.

Recent times have seen an increased interest in qualitative research as seen by numerous high-quality studies that are being done using qualitative methods, as well as the increasing number of special issues on qualitative research in highly ranked general management journals and strategic journals (Gupta and Mukhopadhyay, 2014). Green (2015) proclaims that the qualitative research approach can be positivist in that it tries to document events that often lead to customary results. A qualitative research approach can be interpretivist in that it can pursue to comprehend what overall notions like “poverty” or “race” mean in their definite operations (Goldkuhl 2012, Petty, Thomson and Stew, 2012, Stol, Ralph and Fitzgerald, 2016). Since critical realism can use the mixed-methods approach, this then means that it can also apply the qualitative approach.

The qualitative approach was not applied in this current study because it is said to lack rigour, has practical difficulties, and provides little basis for generalisation (Gupta and Mukhopadhyay, 2014). In addition, it is subjective in that the bias of the researcher can also affect the outcomes and the selection of a topic by the researcher is led by means of the subjectivity of the qualitative enquiry (Morgan, 1980).

3.2.3 Mixed methods

According to Gallivan and Petter (2004), the unpretentious characterisation of mixed-methods research, also known as multi-methods research, engages more than one enquiry method in a study. This methodology may thus adopt a combination of qualitative and quantitative methods.

Although the mixed-methods approach provides benefits of both the quantitative and qualitative research methods, it was not employed in the current study. The reason for this is that when qualitative data are quantified, the data lose depth and flexibility (Caruth, 2013). This happens because qualitative data codes are multi-dimensional while quantitative data codes are one-dimensional (Bazeley and Kemp, 2012). According to Caruth (2013), mixed-methods research can also be expensive and time consuming.

3.3 Research Type and Design

According to Srivastava and Teo (2006), the type of research to be conducted should inform the researcher about research methods to be followed. Straub, Gefen and Boudreau (2004) posit that the two principal forms of research are exploratory and confirmatory research. Exploratory research proposes and formulates hypotheses and is undertaken for a problem which has been unclearly stated (Goeman and Solari, 2011), whereas confirmatory research is structured, rigorous and outlines a group of aforementioned hypotheses on a phenomenon and explores whether the outlined hypotheses are valid. Since this current study proposes nine hypotheses on the academic usage of e-books, it is classified as confirmatory research.

A research design is the strategy of the research study. The main research design types are descriptive, correlational, experimental, semi-experimental, meta-analytic and review. The research design adopted in this current study was a correlational study, with the Structural Equation Model (SEM) as the statistical analysis technique.

3.3.1 Correlational study

A correlational study is a quantitative method of research where there are two or more variables from the same group of subjects, and where a relationship between the variables is to be determined (Tuckman and Harper, 2012). According to Murcia, Hildago, Navío, Araña and Doña-Rodriguez (2014), any two quantitative variables can be correlated, as long as the researcher has scores on these variables. A correlation refers to a relationship between two variables, whether strong or weak (Murcia et al., 2014).

In correlational research, the researcher is able to collect much more data compared to experiments (Abi and Jijo, 2012). Additionally, since correlational studies typically take place in a non-laboratory environment, the results are usually more relevant to everyday life (Abi and Jijo, 2012) and allow room for unlimited additional research (Banister, 2015). When researchers start considering an occurrence or relationship between certain variables, a correlational study is the right approach to take. It permits researchers to determine the strength and direction of a relationship so that later studies can narrow the research down (Lin and Huang, 2008). However, a correlation study only uncovers a relationship; it cannot provide a conclusive reason for why the relationship exists (Abrahamse, Schultz and Steg, 2016).

According to Nikolić, Mureşan, Feng and Singer (2012), the purpose of utilising correlations includes establishing an association between variables and determining the degree to which a relationship exists between the variables. This denotation is the basis of several statistical tests that result in a correlation coefficient, defined as a numeric representation of the strength and direction of a relationship.

Richardson (2011) posits that there are three possible results of a correlational study: a positive correlation, a negative correlation and no correlation. Chang, Yan and Tseng (2012) explain that the correlation coefficient is the measure of the correlation strength and can range from -1.00 to +1.00. A positive correlation means that both variables increase and decrease at the same time (Williams et al., 2010). According to Akinwale, Gregorio, Nwilene, Akinyele, Ogunbayo and Odiyi (2011), a correlation coefficient close to +1.00 indicates a strong positive correlation.

In statistics, three types of correlations are usually measured, namely, Pearson, Kendall and Spearman correlations. Eisinga, Grotenhuis and Pelzer (2013) denote that the Pearson correlation (Pearson r) is generally used for measuring the degree of the relationship concerning linear-related variables. According to Chau, Van der Ploeg, Dunn, Kurko and Bauman (2012), the Spearman correlation (Spearman rank) is a non-parametric investigation that is used for measuring the degree of the relationship between two variables. The Kendall correlation (Kendall rank) is a nonparametric investigation that usually measures the degree of dependency between two variables (Pozzi, Di Matteo and Aste, 2012).

While correlational studies can suggest that there is a relationship between two variables, it cannot prove that one variable causes a change in another variable; in other words, correlation does not equal causation. These types of studies do not reveal which variables influence each other and do not determine causality (Curtis, Comiskey and Dempsey, 2016). The current study follows the correlational-study design because it examines relationships between several e-book-adoption variables. Another reason for adopting this design is that, through correlations, the relationship between the students and the use of e-books will be determined. (Xenikou and Furnham, 1996). Additionally, to determine which variables are related to one another and to determine the strengths between the variables.

3.3.2 Structural Equation Model

Ko and Stewart (2002) denote that the SEM is a method for instantaneously estimating the relationships concerning observed and latent variables (measurement model), and for

estimating the relationships among latent variables (structural model). The SEM is a statistical method that combines factor analysis and path analysis. It provides theory construction and analyses relationships among variables. According to Weir (2005), the SEM suggests the accuracy of a score and allows one to construct confidence intervals for scores.

Ko and Stewart (2002) argue that the SEM is a model that has gained popularity because it combines confirmatory factor analysis and regression analysis to model a variety of relationships. Weir (2005) mentions that the SEM makes provision for a complete index of reliability. The main function of the SEM is to compare the research model hypotheses to empirical data, which leads to fit-statistics assessing the matching of the research model hypotheses and empirical data. If the fit is acceptable, the assumed relationships between latent and observed variables (measurement model) is regarded as being supported by data. In addition, if the fit is acceptable among assumed dependencies between the various latent variables (structural model), it is also regarded as being supported by data.

The SEM calculates the precision of individual scores on a test (Harvill 1991). The clarification of the SEM is centered on the calculation of reliability within individual subjects (Shrout 1998). The direct calculation of the SEM consists of the determining of the standard deviation (SD). The SD is a measure that is expressed to count the amount of variation or dispersion of a set of data values (scores) (Rosenfield 2011). When the SEM is applied, a large number of scores is not normally collected, so the SEM is estimated.

According to Nachtigall, Kroehne, Funke and Steyer (2008), the SEM inspires enthusiastic praise as well as persistent rejection. In addition, the SEM allows for conducting and combining a vast variety of statistical procedures such as multiple regression, factor analysis, analysis of variance and others. On the other hand, the SEM is often experienced as complicated and difficult to understand; the requirements in sample size appear vague and the interpretation of the results should be handled with care.

In the current study, the SEM was applied in order to evaluate and validate the IFM and the hypotheses. The measurement model and structural model analysis were utilised as method of analysis for the SEM. In this current study, the SEM was focused on the attitudes of students

at CUT Bloemfontein towards the use of e-books. It was applied to determine whether the IFM is valid and to analyse the relationships among variables. The SEM was also used to study the behavioural intentions of students. It included a combination of the factor and path analysis.

3.4 Data Collection

Data collection is a method used for gathering and evaluating data on specific variables in a recognised, methodical manner (Yu and Yu, 2010). According to Yu and Yu (2010), data collection supports the researcher in responding to appropriate questions and in evaluating data. Data collection is utilised by all fields of research study and helps in collecting the main facts as gathered data (Aitken, Marshall, Elliott and McKinley, 2011). Cohen, Manion and Morrison (2013) posit that the aim of all data collection is capturing quality evidence. This then converts to in-depth data analysis and creates the construction of a substantial and reliable response to questions that are posed (Vermeeren et al. 2010, Cohen et al., 2013).

Maintaining the reliability of the research and ensuring that data are accurate is of importance in data collection (Vermeeren et al., 2010). According to Creswell (2013), the necessity of formal data collection is that it guarantees that the collected data are both well-defined and correct. It also ensures that the succeeding results based on the arguments in the finding are valid (Creswell 2013). There are generally three types of data collection methods: survey questionnaires, focus groups and interviews (Zikmund, Babin, Carr and Griffin, 2013). The data collection method chosen for this current study was a survey questionnaire.

3.4.1 Data collection instrument: survey questionnaire

Questionnaires are forms completed individually by respondents. They can be handed out and later collected or sent by email and later returned. According to Harris and Brown (2010), questionnaires are used for collection of standardised data from a great number of people. The collection of data utilising questionnaires is a statistical procedure (Lietz, 2010). Lietz (2010)

states that questionnaires may possibly be used to gather regular or irregular repetitive data and data utilised for specialised studies.

In this current study, a questionnaire with quantitative analysis was employed to examine the variables in the IFM and to achieve evaluation of e-book usability by IT students at CUT. The respondents were informed that participation is voluntary and that they need not include their names on the questionnaire forms. Nowhere in the questionnaires are the participants asked to include their personal information. A Likert scale was used in the questionnaires (pilot [section 3.4.5] and main study). The Likert scale was designed to examine how strongly the participants agree or disagree with statements. A five-point scale was utilised, with the following anchors: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree and (5) Strongly agree (Chomeya, 2010).

The questionnaire contained sections on demographic details of participants, types of devices used for accessing e-books, questions that address individuals' characteristics and student perceptions based on the constructs in the IFM. All sections included a number of questions constructed to evaluate the usability and adoption of e-books as well as performance. The questionnaire is attached to this dissertation as Annexure A.

3.4.2 Target population

This current study took place at CUT in Bloemfontein in the Free State province of South Africa. The target population for the main study did not include participants from the pilot study. The population of the main study included students who were enrolled for CCNA and Oracle short courses in 2015 as they used e-books as one of the methods for content delivery. This group of participants consisted of 180 students. Students registered for a Computer Security module during the year 2015 participated in the pilot study. This group of students consisted of 60 participants. Another reason for selecting this population was that students registered for these modules had to access and download the prescribed e-book by using their preferred technology devices that included desktop device and mobile devices, namely, laptops, tablets, smartphones and iPads. The study took place in the first semester of 2015, over a

twelve-week period. The university provided e-book licenses and the necessary software for downloading the prescribed book, as well as free Wi-Fi on campus in order to promote ubiquitous access to all electronic content by academic staff members and students.

3.4.3 Sampling technique

Sampling is a method that involves using a small percentage of a specified population for making conclusions concerning the whole population (Abu-Dalbouh, 2013). The sample is considered as a subset of the population comprising of some members selected from it. The aim is to draw generalised conclusions on the population based on the data retrieved from the sample. Sampling was not utilised in this current study, since all students registered for the Computer Security module were given a questionnaire to complete for the pilot study and all students present participated. No sampling was used in the main study as all students that were enrolled for the short courses (who were present) participated. In this way, construct reliability and validity were maintained.

3.4.4 Reliability and validity

In quantitative research, the practise of ensuring reliability and validity is important (LoBiondoWood and Haber, 2014, Carbin, Misailovic and Rinard, 2013, Yilmaz, 2013). According to Beverland and Lindgreen (2010), reliability and validity stand embedded in the positivist perspective.

According to LoBiondo-Wood and Haber (2014), reliability is the degree to which the results of a study are consistent during a certain period. It is an accurate depiction of the entire population of the study. A research instrument is considered reliable when the results of a study can be reproduced using a similar methodology (Burton and Mazerolle, 2011). According to Yilmaz (2013), the types of reliability that exist are – but not limited to – test-retest reliability, parallel forms reliability, internal consistency reliability and inter-rate reliability.

Test-retest reliability refers to the extent to which the results of a test are constant over a certain time period (Plichta et al. 2012, Resch et al., 2013). In essence, when measuring test-retest reliability, the researcher must give the same test to the same participants twice and then compare the results (Plichta et al., 2012). According to Kim (2012), parallel forms reliability uses a single set of questions that are distributed in twofold sets, where the sets comprise questions that quantify the same construct. Internal consistency reliability measures how well items in the same test measure the same construct (Duffy, Allan and Bott, 2012, Adamson and Prion 2013, Green and Yang, 2015). According to Hodgson et al. (2014), inter-rater reliability, the fourth type of reliability test, is a method that measures the ratings given by judges based on how consistent they are. If some judges disagree, then this means that the scale is unreliable or needs to be re-evaluated (Mylius et al., 2013, Cools et al., 2014, Gulgin and Hoogenboom 2014). Internal consistency reliability was used in the current study to measure the constructs in the IFM. This was achieved by phrasing some questions/statements in both a negative and a positive way. For example, a positive statement would be: Using e-books is beneficial, whereas the negative for the same statement would be: Using e-books is foolish.

Validity is also used for instrument validation. Drost (2011) denotes that validity is the extent to which a research instrument reflects reality. According to Markon, Chmielewski and Miller (2011), validity determines if the research actually measures what it was anticipated to measure. It also measures the truthfulness of the results. There are four types of validity measurements in research (Drost, 2011), although predictive validity and concurrent validity are considered with criterion validity; therefore, three types of validity are discussed (Drost, 2011): criterion validity, content validity and construct validity.

According to Mokkink et al. (2010), with criterion validity, the researcher is mainly concerned with some principle which needs to be predicted. The process involves administering a test and then obtaining an independent principle measure on the same population and calculating a correlation (Mokkink et al., 2010, Rhew et al., 2010, Scheeringa and Haslett,, 2010). When determining content validity, the researcher needs to demonstrate that the test items are a sample of a universe in which the researcher is interested (Bottari, Dassa, Rainville and Dutil, 2010, Wright and Craig, 2011, Delgado-Rico, Carretero-Dios and Willibald, 2012). Lastly,

construct validity, according to Mandy, Charman and Skuse (2012), is the capacity of a measure in properly assessing a specific cause-and-effect relationship between the measure and another factor.

The questionnaire of this current study was validated for internal consistency reliability using the composite reliability (CR) and the average variance extracted (AVE) (discussed in detail in Chapter 4). This current study proposed an IFM that consists of constructs that make up the study hypotheses. The reason for the application of internal consistency in the current study is that it measures how well each question or item measures the same construct. The questionnaire originally comprised 40 items of which three were removed because they did not fulfil an item loading of at least 0.70 (Chin, Thatcher, Wright and Steel, 2013). The remaining items that were evaluated represent the fundamental constructs that contribute to the construct validity of the questionnaire. Construct validity was done to test whether the test measures the intended constructs of the IFM. The results of this validation are reflected in Chapter 4.

3.4.5 Pilot Study

Before the main questionnaire was distributed, a pilot study was done. The pilot study was significant in that it served as a guide to constructing the questions in the main study questionnaire. The purpose of the pilot study is to rectify any problems or ambiguous questions (Yu and Yu, 2010). The wording of some problematic questions in the pilot study questionnaire were reformulated for the main study questionnaire (Annexure B). The pilot study consisted of 60 students enrolled for a Computer Security module during 2015. Only 49 questionnaires were validated. The results were reported in a conference paper (Mafunda, Swart and Bere, 2015).

3.5 Ethical Considerations

Approval for conducting the current research study was obtained from the Faculty Research and Innovations Committee (FRIC) at CUT (Annexure C). In addition, participation in the study was voluntary. The questionnaire did not include any personal information from the

participants and this ensured anonymity and confidentiality. The participants were made aware that participation in the study is voluntary.

3.6 Summary

In this chapter, the research methodology employed was discussed. This included a description of the research paradigm, research approaches, research design and data collection instrument used for the study as well as ethical considerations. The applicable research paradigm is the positivist paradigm as it is objective in nature rather than subjective. A correlational study design was followed, and the data collection instrument was a survey questionnaire, which was evaluated in terms of construct validity and reliability. The type of reliability considered was internal consistency, which measures how well items in the same test measure the same construct. The next chapter presents an in-depth interpretation of the data analysis and results of this research.

CHAPTER 4: DATA ANALYSIS AND RESULTS

The previous chapter discussed the research methodology employed for this current study. The chapter covered the research paradigm, research approaches, research design, data collection instrument and ethical considerations. In this chapter, the results of this current study are discussed. The demographics of participants are deliberated, followed by the instrument validation, the measurement model analysis, path coefficients and descriptive statistics.

This chapter only reflects the results of the main study. Students had been using mobile devices to download e-books using the free Wi-Fi on campus. Self-administered paper-based questionnaires were used to collect the data. Participants were in a classroom setting when the questionnaire was administered. The data collection instrument was validated using the Composite Reliability (CR) and Average Variance Extracted (AVE). The CR and AVE approaches check internal consistency reliability and construct validity, respectively, which constitute the primary indicators for measuring convergent validity (Chen and Huang, 2012). Due to these reasons, CR and AVE were chosen for instrument validation. Descriptive statistics are used to provide a simple analysis of the results in the graphs. The Structural Equation Model (SEM) was used as measurement model for path analysis using the path coefficients. The purpose of the SEM was to estimate the factor loadings, path coefficients and AVE.

4.1 Participant Demographics

Participant demographics is important because it provides details about the population of the study (Mondal and Shitan, 2014) by clearly showing characteristics of the population, such as gender, age, race, ethnicity and level of education. The demographics give background information about the participants of the study. Table 4.1 illustrates the demographics of participants for this current study. The table consists of the participant category, frequency, percentage and cumulative percentage. The percentage refers to the total number of participants expressed in hundred. The cumulative percentage is the sum of all the percentages. The total

number of questionnaires distributed was 180 and 36 were disregarded as they were incomplete. Gender, race and age distribution are based on a total of 144 participants. The participants could indicate whether they used more than one device for accessing e-books, which added up to 208 devices being used to access e-books. Thus, the cumulative percentage for the devices used is based on a total of 208 devices.

Table 4.1: Participant Demographics

Category	Frequency	Percentage (%)	Cumulative percentage (%)
Number of participants	144	100	100
Gender			
Male	102	70.8	70.8
Female	42	29.2	100
Race			
Black African	131	90.9	90.9
Coloured	5	3.5	94.4
White	4	2.8	97.2
Other	4	2.8	100
Age Distribution			
20-24	122	84.7	84.7
25-29	18	12.5	97.2
30-34	4	2.8	100
Device Used			
Desktop computers	51	24.5	24.5

iPads	5	2.5	27
Smartphones	35	16.8	43.8
Tablets	21	10.1	53.9
Laptops	96	46.1	100
Total Devices Reported	208	100	100

The study was motivated by the introduction of implementing e-book usage at CUT. Among other initiatives to promote e-book utilisation, the research site provides Wi-Fi access to students and staff, which facilitates downloading of e-books and accessibility to the internet in general to promote anywhere and anytime learning. As can be seen from Table 4.1, 144 (180 originally and 36 disregarded) students registered at CUT participated in the study, their ages ranging between 20 and 34 years. Male participants outnumbered female participants 2.5:1. This gender disparity can be associated with the observation that IT and engineering studies and the job market in South Africa is dominated by males (Martin and Barnard, 2013).

Participants of the study were from different racial backgrounds, with the most dominant race present being black Africans, with 131 participants. Five participants were coloured, four white and four belonged to the ‘other’ category. The racial imbalance among participants could be explained due the fact that the research site is located in a province with a majority race of Black Africans. Additionally, it can be argued that the government’s post-apartheid higher education transformation initiatives that encouraged access for Black Africans to tertiary education are gaining momentum (Badat, 2010).

The age distribution of participants ranged between 20 and 34 years, with the majority of participants aged between 20 and 24 years of age. This could be because the average age of first year students is 18 and 22 for those who enroll for BTech (Thinyane, 2010). Only four participants belonged to the 30–34 years age category. The participants used any mobile device of their choice (desktop computers, iPads, smartphones, tablets and laptops). The majority of

the participants used laptops (46.1%). This could be because students registered for IT require a computer for the course, which is in most cases a laptop (Dahlstrom, Walker and Dziuban, 2013). Following laptops and desktop computers, smartphones were used by 16.8% of participants. The device used least was the iPad (2.5%), which is generally more expensive than the other devices.

4.2 Instrument Validation

The statistical model used for data analysis in the current study was the SEM. The SEM is a statistical modelling procedure that may be utilised in studies of different disciplines (educational studies, behavioural sciences, social science and more). The SEM is generally an amalgamation of factor analysis as well as path analysis (Chen and Huang, 2012). The purpose of the SEM is to observe and decide whether a particular model is valid. Additionally, it analyses relationships among variables (Chin, 1998). It is used in the current study to observe and analyse the IFM and hypotheses. The SEM is available through linear structural relations (LISREL) and the Alpha Micro Operating System (AMOS), software analysis tools used for the purpose of analysing covariance (Urbach and Ahlemann, 2010). Lee and Tsai (2010) ascertain that LISREL is used in the SEM for noticeable and latent variables. The structure of LISREL is primarily syntax-based, even though newer kinds have a graphic user interface.

According to Urbach and Ahlemann (2010), AMOS makes it possible for one to stipulate, approximate, evaluate and present models in order to indicate hypothesised associations among variables. With this software, one can build models with accuracy as compared to typical multivariate statistical methods. Furthermore, AMOS enables one to build attitudinal and behavioural models that reflect complex relationships (Chin, 1998). Other component-analysing software that also provide SEM analysis are the SmartPLS and partial least squares (PLS) PLSGraph (Vinzi, Chin, Henseler and Wang, 2010). The PLS is a variable-grounded technique. Chin et al. (2013) assert that PLS capitalises on the explained variance of the endogenous latent variables by approximating partial model relationships in the form of a series

of ordinal least regressions. A substantial characteristic of PLS is that it estimates latent variable scores as detailed linear combinations of their related apparent variables and treats them as impeccable substitutions of apparent variables (Chin et al., 2013). Vinzi et al. (2010) posit that PLS has two sets of equations, the measurement model and the structural model.

The measurement model is comprised of equations representing the relationships between indicators and the variable measure. It is used for examining all the measured variables. It also includes estimating the internal consistency for each block of indicators. Table 4.2 illustrates the results of the item loading, CR and AVE.

Table 4.2: Construct, Item, Item Loading, CR and AVE

Construct	Item	Item Loading	CR	AVE
Task Characteristics (TsC)	TsC1	0.8210	0.836	0.634
	TsC2	0.7903		
	TsC3	0.7817		
	TsC4	0.5807		
Technology Characteristics (TecC)	TecC1	0.8380	0.869	0.563
	TecC2	0.8866		
	TecC3	0.7743		
	TecC4	0.8348		
Perceived Usefulness (PU)	PU1	0.8091	0.957	0.763
	PU2	0.8736		
	PU3	0.7956		
	PU4	0.7687		

Perceived Ease of Use (PEoU)	PEoU1	0.7925	0.821	0.665
	PEoU2	0.6210		
	PEoU3	0.8168		
	PEoU4	0.8133		
Perceived Enjoyment (PE)	PE1	0.9215	0.943	0.774
	PE2	0.8331		
	PE3	0.8827		
	PE4	0.5209		
Social Influence (SI)	SI1	0.7306	0.811	0.584
	SI2	0.7727		
	SI3	0.7947		
	SI4	0.7226		
Attitude Towards Use (ATU)	ATU1	0.8248	0.799	0.656
	ATU2	0.7429		
	ATU3	0.7772		
	ATU4	0.7111		
Usability (U)	U1	0.8296	0.892	0.647
	U2	0.9123		
	U3	0.7948		
	U4	0.7535		

Adoption (A)	A1	0.8281	0.835	0.689
	A2	0.8600		
	A3	0.9125		
	A4	0.7601		
Performance (P)	P1	0.7236	0.861	0.734
	P2	0.7602		
	P3	0.7157		
	P4	0.8711		

Note: Values in red are rejected

According to MacKenzie, Podsakoff and Podsakoff (2011), the primary indicators for measuring construct validity are CR and AVE. The measure of general reliability of a group of various but similar items is known as CR (Chin et al., 2013). Kim (2012) argues that CR is a less prejudiced estimate of reliability and its accepted value is 0.70 and above. The results illustrated in Table 4.2 show an agreeable CR for each of the variables as they are all over 0.70. Therefore, the constructs also had a reliability of greater than 0.70. According to Hair, Ringle and Sarstedt (2011), the higher the CR, the higher the internal consistency of a latent variable.

The CR values for this current study range from 0.799 to 0.957. The perceived usefulness and perceived enjoyment constructs have significantly high internal consistency, with CR values being significantly high (exceeding 0.90). Attitude towards use has the lowest CR value (0.799). The CR values indicate strong reliability for all the constructs in the study (Lee, 2013). This means that the different questions (for each construct) were able to reliably measure each of the constructs. The results are consistent in that participants gave the same answers for most of the questions. For example, for some of the questions more than half of the participants either agreed or disagreed to the item in the questionnaire. The results maintain consistency in that for each question (based on a certain construct) the results were similar.

AVE measures the level of variance captured by a construct versus the level due to measurement error. The purpose of AVE is to calculate the shared variance of the constructs to examine the validity of the constructs (Wang and Wang, 2013). Acceptable values for AVE are 0.50, while values above 0.70 are considered very good and acceptable values for item loading are 0.70 and above (Liu, Li and Carlsson, 2010). AVE values presented in this current study are all greater than 0.50, which also adheres to the suggested criteria (Raman and Don, 2013). This means that the answers to the questionnaire items associated with each variable are sufficiently correlated, which suggests that the participants understood the questionnaire items in the context of mobile learning in higher education.

AVE scores for perceived usefulness, perceived enjoyment, and performance are significantly higher than 0.70. Technology characteristics and Social Influence have the lowest AVE scores, but are still in the acceptable range. Table 4.2 also indicates some crossed-out results (in red). As mentioned, acceptable values for AVE is above 0.50. These crossed-out values are those that had an item loading value below 0.70, which means that those values and items were rejected.

The construct validity of the measurement model was examined by comparing the correlation coefficient between the constructs and square root of the AVE for each construct (Henseler, Hubona and Ray, 2014). The AVE score is the measure of the error-free variance of items or measure of convergent validity (Lee et al., 2013). The higher the AVE, the higher the convergent validity (Chang, Yan and Tseng, 2012). Bookstein (1986) propose that the AVE value should be greater than 0.50. Table 4.3 portrays the square root of AVE for each variable. The table also indicates that each latent variable ranges between 0.50 and 0.90. Based on this analysis, latent variables in the current study possess a good convergent validity.

Table 4.3: Square root of AVE and correlation coefficient values

	TsC	TecC	PU	PEoU	PE	SI	ATU	U	A	P
TsC	0.792									
TecC	0.542	0.823								
PU	0.663	0.652	0.776							
PEoU	0.557	0.596	0.452	0.753						
PE	0.554	0.665	0.511	0.462	0.789					
SI	0.578	0.452	0.512	0.624	0.536	0.763				
ATU	0.654	0.615	0.596	0.562	0.542	0.558	0.729			
U	0.785	0.693	0.523	0.504	0.458	0.567	0.662	0.894		
A	0.594	0.452	0.632	0.426	0.624	0.598	0.623	0.661	0.759	
P	0.556	0.521	0.547	0.511	0.488	0.577	0.598	0.520	0.531	0.743

Note: *Square root of AVE is in bold; the other values are correlation coefficient values

Fornell and Bookstein (1986) suggest that discriminant validity can be calculated by the square root of the AVE of each latent variable and the correlation coefficient between latent variables. Discriminant validity exists when the square root of the AVE of a latent variable is greater than the correlation coefficients between the latent variable and other latent variables. The values that are not in bold represent the correlation coefficients. All AVE scores are higher than the correlation coefficients, as shown below them or to their left. As indicated in Table 4.3, technology characteristics has a correlation coefficient of 0.542 to task characteristics, which is lower than the AVE, thereby indicating good validity. Similarly, perceived ease of use, with

a correlation coefficient of 0.596 to technology characteristics, is lower than the AVE. All the variables have a correlation coefficient that is lower than the AVE. Therefore, this means that discriminant validity was established.

The values in Table 4.3 were calculated using the SEM. In this current study, the SEM was applied as the method of computing statistical data. The SEM consists of various sets of carefully worked-out models, computer procedures as well as statistical methods which fit linkages of hypotheses to data (Iacobucci, 2010). As mentioned in the previous section, the SEM is a collaboration between the factor analysis and regression or path analysis (Attanasio, Meghir and Santiago, 2012). According to Gill and Prowse (2012), the SEM is a very broad statistical modelling technique that is commonly used in studies of behavioural science modelling. The concern in SEM is often on theoretic hypotheses which are characterised by regression or path coefficients amongst the factors (Götz, Liehr-Gobbers and Krafft, 2010). The SEM is performed primarily for examining path coefficient and R-squared values within latent variables of the research (Cyprien and Kumar, 2011). In the next section, the path coefficient scores are presented.

4.3 Path Coefficients

The path coefficient measures the relative strength and indication of spontaneous relationships among latent variables (Wong, 2013). The unpremeditated paths can be assessed using statistical significance as well as strength using homogenous path coefficients which range between -1 and $+1$. According to Chin (1998), standardised paths should be at least 0.20 and ideally above 0.30 in order to be considered meaningful for discussion.

Table 4.4 is a representation of the path, path coefficients, t-value scores and status (which indicates whether the hypotheses have been supported or rejected). The path coefficients of each IFM path per given hypothesis are illustrated, where all nine hypotheses were supported. Path coefficients for the nine hypotheses are all above the ideal standardised path of 0.30.

Table 4.4: Hypotheses, path, path coefficient, t-value and status

Hypothesis	Path	(β)Path coefficient	t-value	Status
H1	Task characteristics – Usability	0.447	6.411***	Supported
H2	Technology characteristics – Usability	0.301	4.366***	Supported
H3	Perceived usefulness – Attitude towards use	0.432	6.291***	Supported
H4	Perceived ease of use – Attitude towards use	0.324	4.687***	Supported
H5	Perceived enjoyment – Attitude towards use	0.320	4.641***	Supported
H6	Social Influence – Attitude towards use	0.356	4.878***	Supported

H7	Attitude towards use – Usability	0.337	4.701***	Supported
H8	Usability – Adoption	0.526***	6.897***	Supported
H9	Adoption – Performance	0.422	6.212***	Supported

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (Strong relationship)

A single asterisk (*) indicates whether a correlation is significant at the 0.05 level and a double asterisk (**) indicates whether the correlation is significant at the 0.01 level. The only path coefficient with a triple asterisk (***) is between usability and adoption, with a correlation of $\beta = 0.526$. This means that there is a strong relationship between usability and adoption. As mentioned above, all the hypotheses were supported. Most importantly: H1: task characteristics (TsC) has a positive influence on usability ($\beta = 0.447$ and $t = 6.411$) and H2: Technology characteristics (TecC) has a positive influence on usability ($\beta = 0.301$ and $t = 4.366$).

4.4 Descriptive Statistics

This section encompasses descriptive statistics of the main study, which are quantitative results that provide a simple synopsis concerning the population and are often presented in the form of tables, graphs, histograms, and so forth (Shroff et al., 2011). The structure of descriptive statistics is the foundation of fundamentally all quantitative analysis of data with straightforward graphic analysis (Redick et al., 2012). Redick et al. (2012) argue that the purpose of descriptive statistics is that it presents quantitative descriptions of the data in an easily understandable manner. It is utilised in the current study to present the actual results of the questionnaire. In this way, one will be able to understand the feedback received from the participants as the results are presented in a text-based and understandable format.

In this section, all the constructs used in the previous section will be presented graphically. No reasons for the responses are provided as only quantitative data was collected. The title of each graph (given at the bottom) represents each variable within the IFM. The horizontal axis of each graph represents the respective questions for each variable, whereas the vertical axis represents the frequency in percentage of each item according to the option of the Likert scale of 1 to 5, as mentioned in Chapter 3. The questionnaire had a middle value of 3 (Neutral) which made provision for those participants who may neither have agreed nor disagreed.

4.4.1 Perceived usefulness

Figure 4.1 represents the results related to perceived usefulness. The perceived usefulness construct had four questions, as depicted in Figure 4.1.

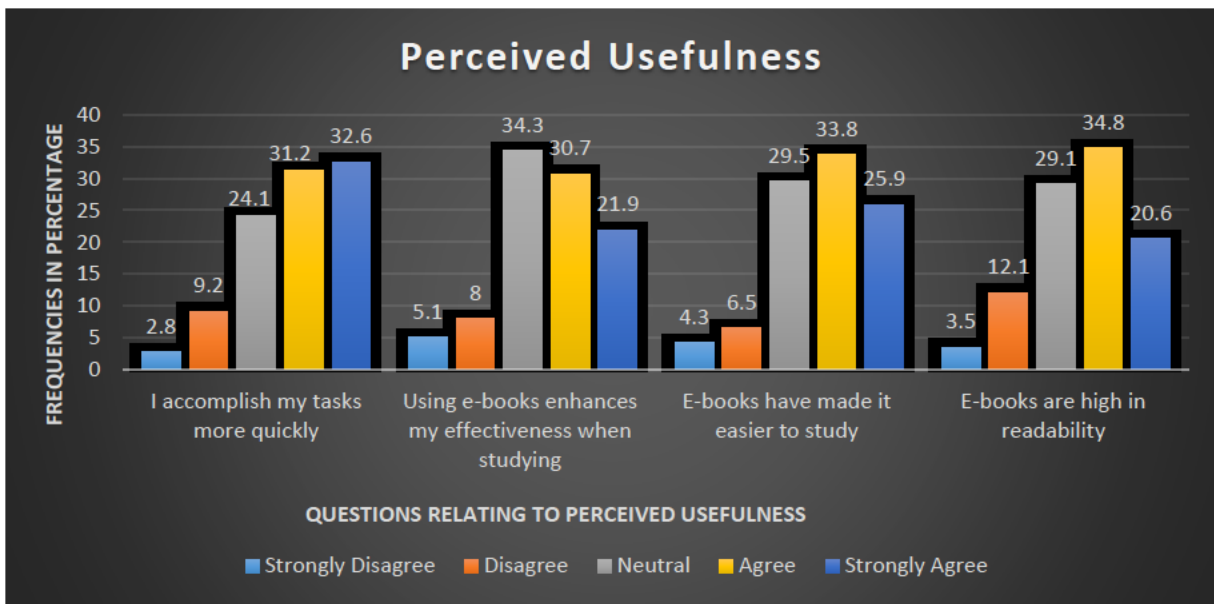


Figure 4.1: Questions relating to Perceived Usefulness

The majority of participants (32.6% + 31.2% = 63.8%) agreed that they accomplish tasks more quickly when using e-books. Just over half of the participants (29.8% + 21.3% = 51.1%) agreed that e-books enhance their effectiveness when studying. The majority of participants (33.3% +

25.5% = 58.8%) agreed that e-books have made it easy to study while nearly 60% (34.8% + 20.6% = 55.4%) agreed that e-books are high in readability.

4.4.2 Perceived ease of use

Results relating to perceived ease of use are depicted in Figure 4.2. Four questions were developed for this construct; however, one was rejected as its item loading score was below the required 0.70 score for validity. This is reflected in Table 4.2. According to figure 4.2, almost two thirds of participants (41.8% + 22.7% = 64.5%) agreed that using e-books are clear and understandable. 72.7% of participants (37.4% + 35.3%) agreed that they find e-books easy to use while a significant percentage of participants (42.6% + 39% = 81.6%) agreed that they can easily navigate through e-books.

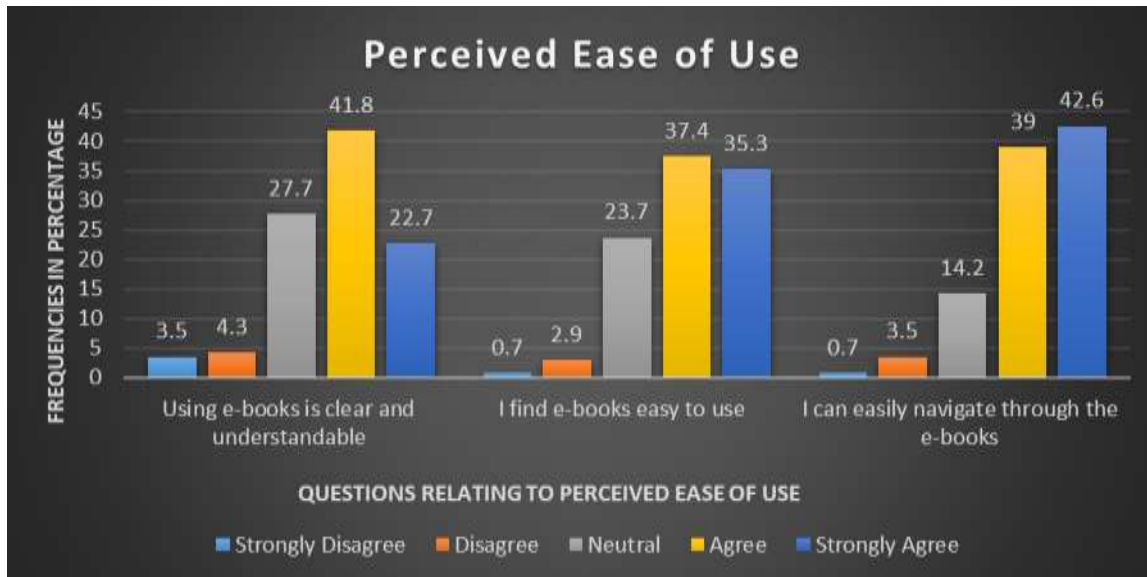


Figure 4.2: Questions relating to Perceived Ease of Use

4.4.3 Perceived enjoyment

Figure 4.3 represents the statistics related to perceived enjoyment. According to Table 4.3, four questions were formulated for this construct, of which one was rejected; therefore, only three are reflected in the figure.

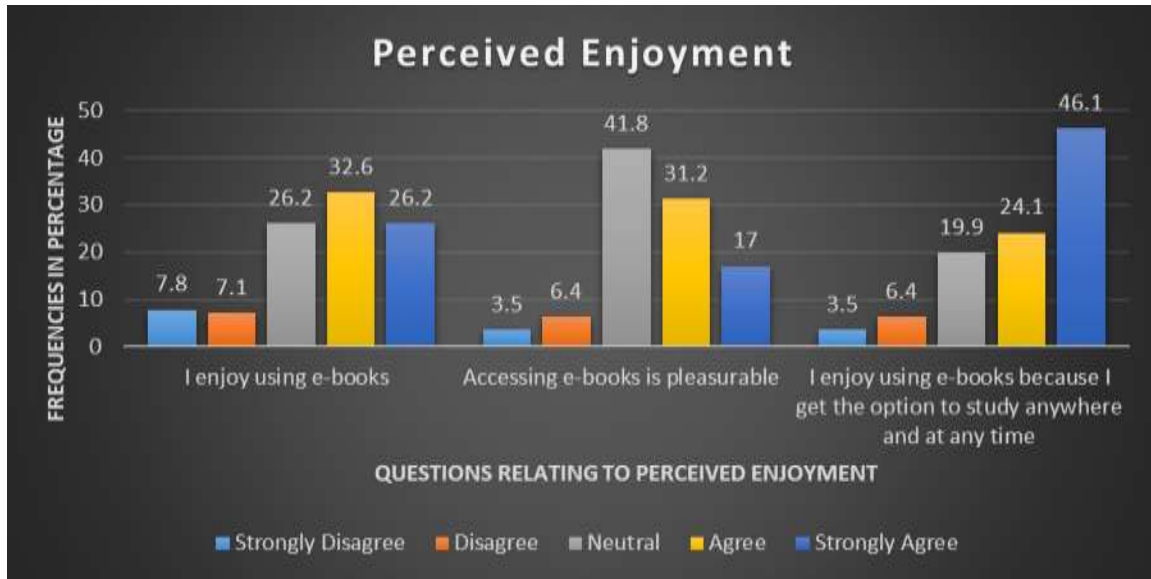


Figure 4.3: Questions relating to Perceived Enjoyment

Almost two thirds of the participants ($36.2\% + 26.2\% = 62.4\%$) agreed that they enjoy using e-books. Nearly half of the participants ($17\% + 31.2\% = 48.2\%$) agreed that accessing e-books is pleasurable. More than two thirds ($46.1\% + 24.1\% = 70.2\%$) agreed that they enjoy using e-books because of the option to study anywhere and anytime.

4.4.4 Social Influence

Social Influence is another of the constructs within the IFM. The results regarding this construct are represented in Figure 4.4. According to Figure 4.4, 36.2% ($22.7\% + 13.5\%$) of participants agreed that their behaviour towards e-books was influenced by their peers, while 42.5% ($17\% + 25.5\%$) indicated that people who are important to them think they should use e-books. Figure 4.4 also represents the results for the statement, “My lecturers positively influenced my

behaviour to use e-books”, with 48.2% (31.6% +17%) in agreement. For the last statement regarding Social Influence, just over a third of participants agreed (24.8% + 12.1% = 36.9%) that influential people in their lives contributed to their decision to use e-books.

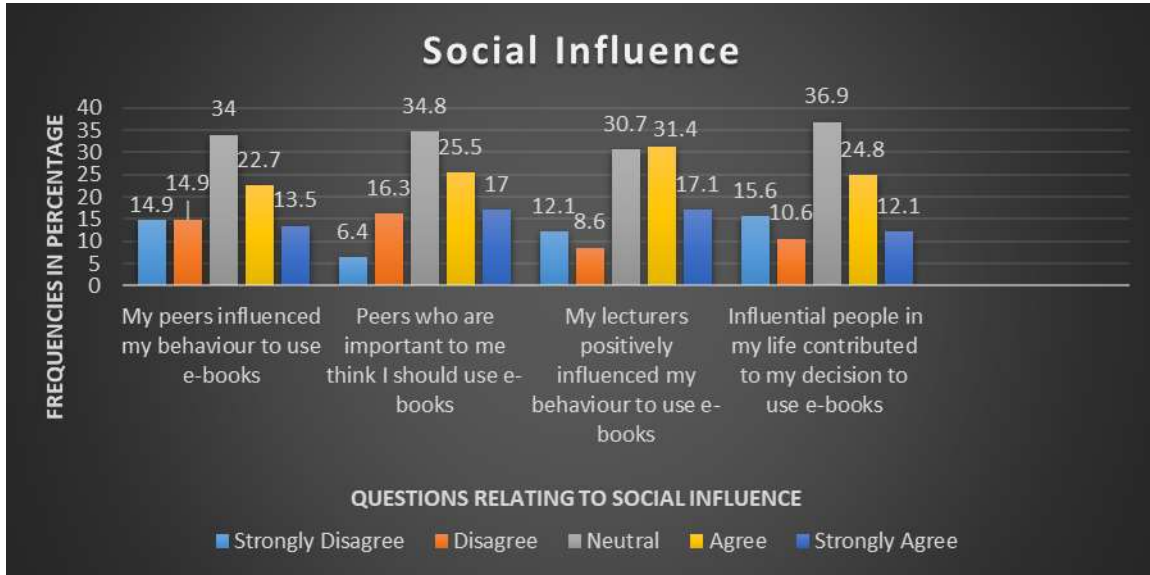


Figure 4.4: Questions relating to Social Influence

4.4.5 Attitude towards use

The next construct to be discussed is attitude towards use, which also had four questions, as reflected in Figure 4.5. According to Figure 4.5, a significant percentage of participants (63.8% + 16.3% = 80.1%) disagreed with the statement that using e-books is foolish.

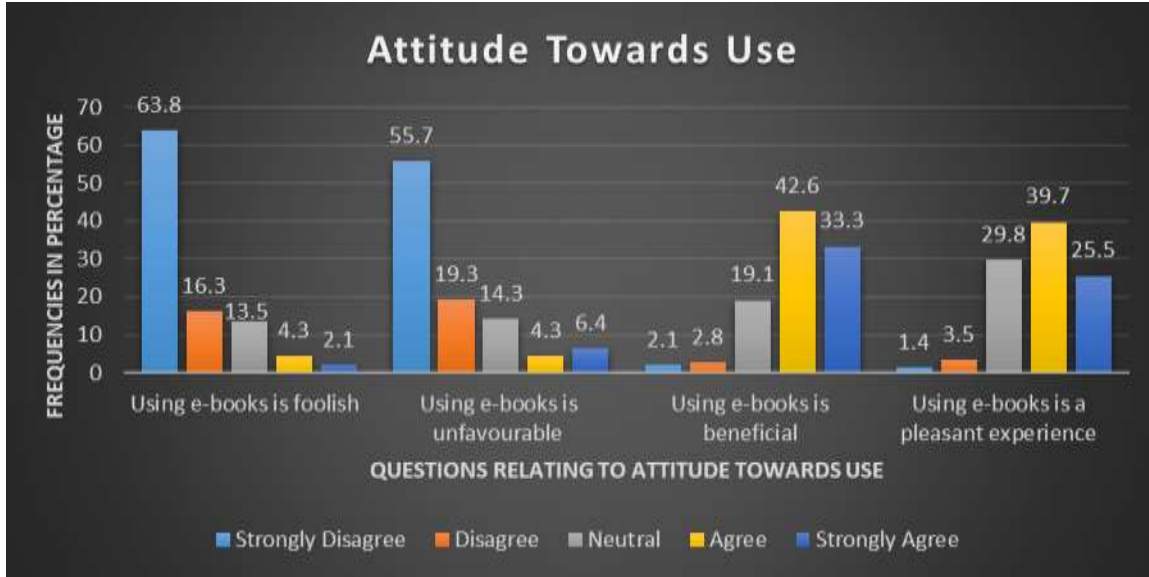


Figure 4.5: Questions relating to Attitude Towards Use

One of the questionnaire statements for attitude towards use was that using e-books is unfavourable. The majority of participants (55.7% + 19.3% = 75%) disagreed with this statement. Figure 4.5 also depicts the results of the statement that using e-books is beneficial, to which 75.9% of participants agreed (33.3% + 42.6%). Finally, almost two thirds of participants (39.7%+25.5% = 65.2%) agreed that using e-books is a pleasant experience.

4.4.6 Task characteristics

Figure 4.6 reflects the results for task characteristics. Only three of the four questions were accepted and thus appear in the figure.

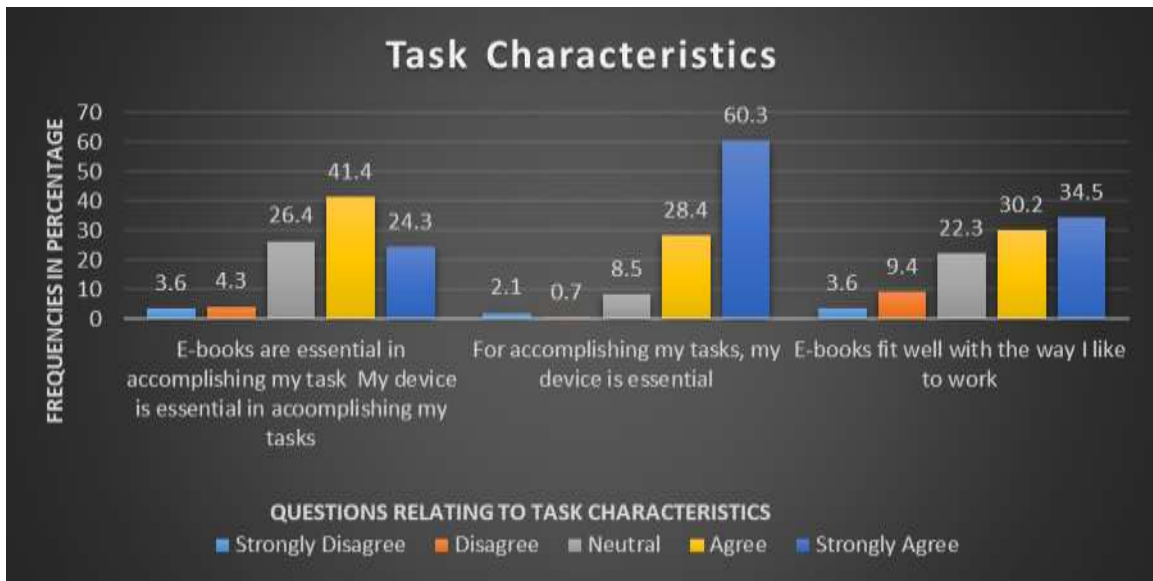


Figure 4.6: Questions relating to Task Characteristics

According to Figure 4.6, the majority of participants (41.1% + 24.1% = 65.2%) agreed that e-books are essential for accomplishing specific tasks. The majority of participants (29.8% + 34% = 63.8%) agreed that e-books fit well with the way they work. Additionally, the greater majority of participants (28.4% + 60.3% = 88.7%) agreed that their devices are important for accomplishing their tasks.

4.4.7 Technology characteristics

The results for the technology characteristics construct are depicted in Figure 4.7. This construct had four questions, as reflected in the figure.

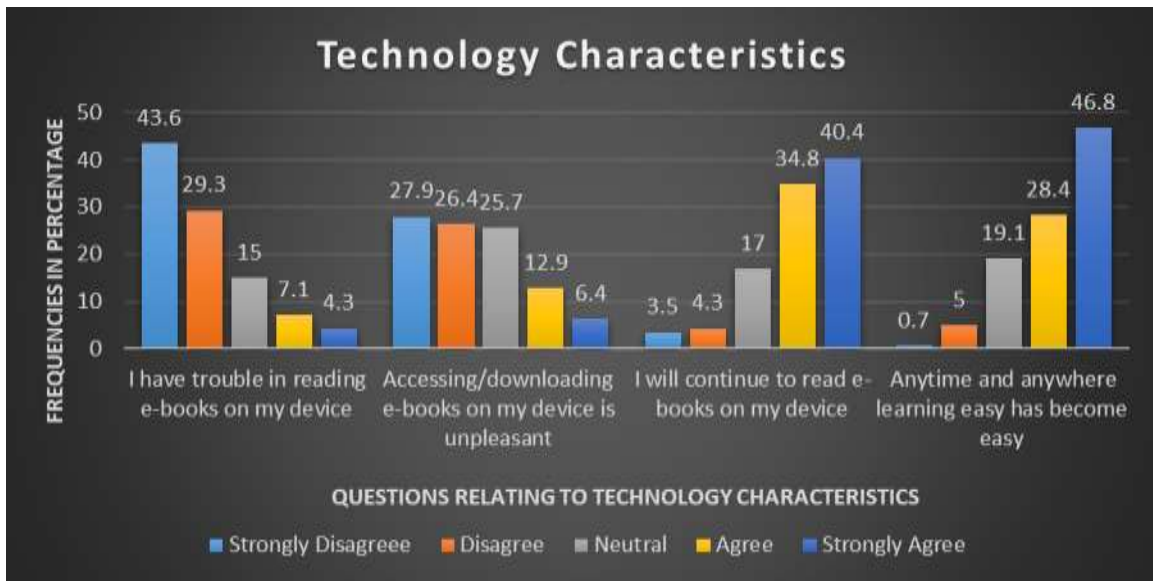


Figure 4.7: Questions relating to Technology Characteristics

The majority of participants ($29.1\% + 43.3\% = 72.4\%$) disagreed with the statement that they have trouble reading e-books on their devices. More than half of the participants ($27.7\% + 26.2\% = 53.9\%$) disagreed that downloading e-books on their devices is unpleasant. A significant number of participants ($40.4\% + 34.8\% = 75.2\%$) agreed that they will continue to read e-books on their devices, with another significant number ($46.8\% + 28.4\% = 75.2\%$) agreeing that anytime and anywhere learning has become easy.

4.4.8 Usability

Figure 4.8 depicts the results for the questions relating to usability. Almost two thirds of participants ($29.8\% + 29.1\% = 58.9\%$) indicated that they use their e-books frequently, while half of the participants ($31.9\% + 15.6\% = 47.5\%$) agreed that they learn better with e-books.

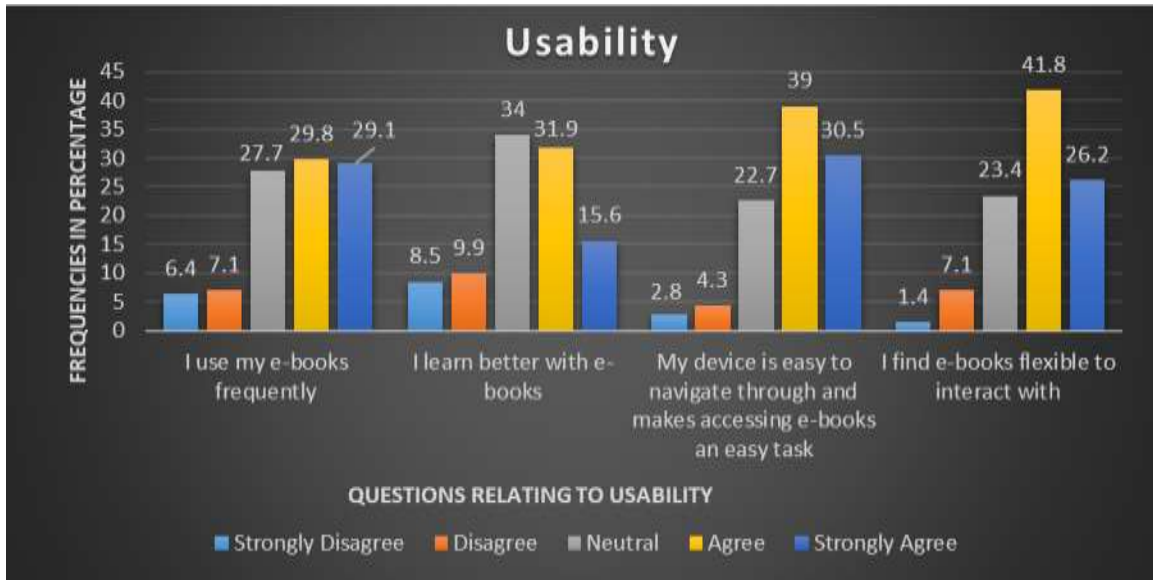


Figure 4.8: Questions relating to Usability

According to Figure 4.8, a significant percentage of participants ($30\% + 39\% = 69\%$) agreed that their devices are easy to navigate, making access to e-books an easy task. The majority of participants ($41.8\% + 26.2\% = 68\%$) agreed that e-books are flexible to interact with.

4.4.9 Adoption

The adoption construct also had four questions, for which the results are depicted in Figure 4.9. 46.1% ($24.8\% + 21.3\%$) of the participants agreed that they spend more time reading e-books than traditional textbooks, while the majority of the participants ($36.2\% + 34\% = 70.2\%$) agreed that they will continue using e-books for academic gain.

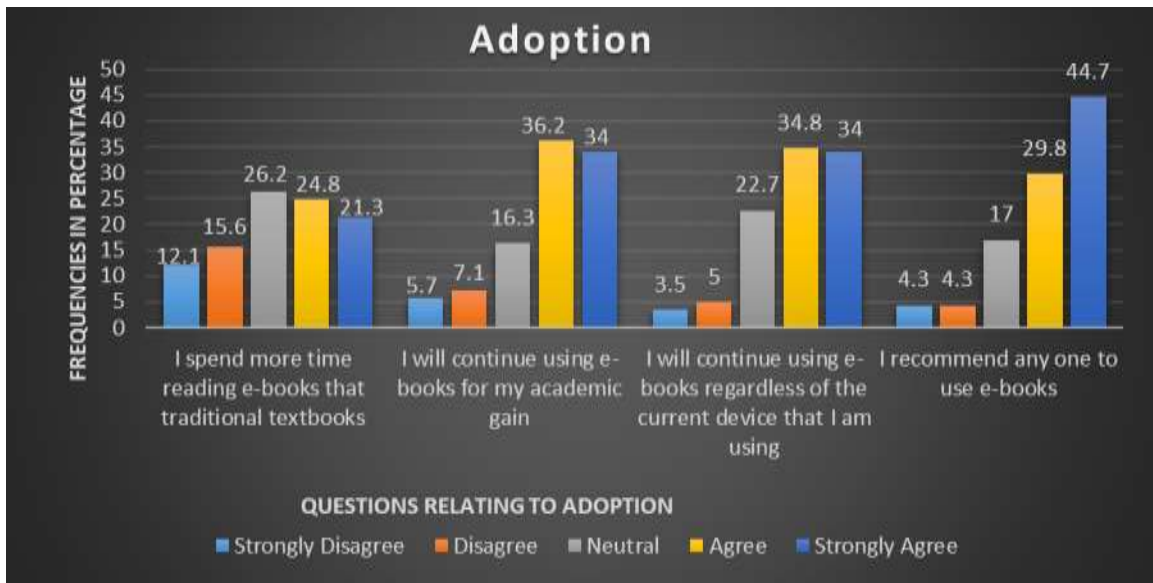


Figure 4.9: Questions relating to Adoption

The majority of participants (34.8% + 34% = 68.8%) agreed that they will continue using e-books regardless of the device and that they will recommend the use of e-books to anyone (44.7% + 29.8% = 74.5%). However, 8.6% of participants (4.3% + 4.3%) disagreed with this statement.

4.4.10 Performance

The performance construct is the last of the constructs to be addressed. This construct had four questions, of which the results are reflected in Figure 4.10. As can be seen in Figure 4.10, 42.5% of participants (31.2% + 11.3%) agreed that using e-books have improved their grades. The results in Figure 4.10 indicate that majority of participants (36.2% + 34% = 70.2%) agreed that using e-books has enhanced their learning effectiveness.

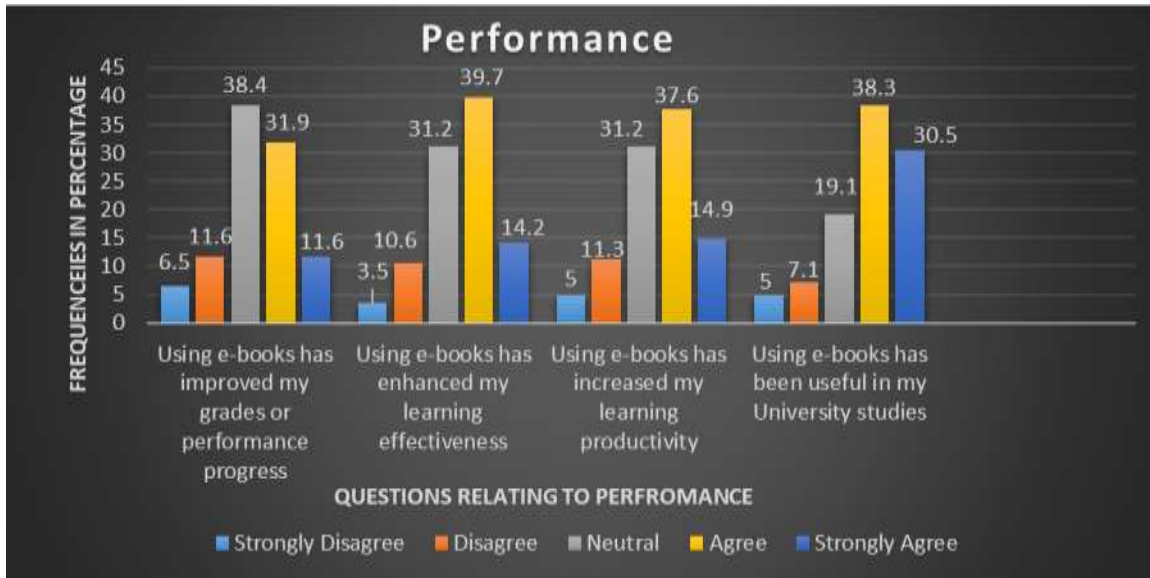


Figure 4.10: Questions relating to Performance

Figure 4.10 also reflects that more than half of the participants ($37.6\% + 14.9\% = 52.5\%$) agreed that e-books have increased their learning productivity, while the majority of participants agreed ($30.5\% + 38.3\% = 68.8\%$) that using e-books has been useful in their university studies.

4.5 Summary

In this chapter, a detailed description of the data analysis and results was given, as retrieved and interpreted from the questionnaire. Firstly, the demographics of the 144 participants were given. This was followed by a discussion on the validity of the instruments that were used to measure the data, the SEM being the model utilised for this current study. Furthermore, path coefficients which measured the strength of the relationships among latent variables were also discussed.

The next chapter entails a discussion of the results as produced by the SEM. The findings, contributions, implications, limitations, and conclusions of the study are also presented in this chapter.

CHAPTER 5: DISCUSSIONS, IMPLICATIONS AND CONCLUSION

The previous chapter covered the results of the study. The results of this current study are quantitative and were analysed using descriptive statistics. The chapter also presented participant demographics, instrument validation, the measurement model analysis and descriptive statistics for each construct in the IFM. In this chapter, the findings depicted in the previous chapter, are discussed. This chapter also includes sections on research questions answered, contributions, implications, limitations and conclusions.

5.1 Findings

An IFM was proposed for this current study that incorporated the TTF theory and the TAM, with the inclusion of Social Influence and Perceived Enjoyment constructs. The Social Influence construct was taken from the UTAUT model, while the Perceived Enjoyment construct was taken from motivational models.

According to the IFM, individual characteristics (attitude towards use), task characteristics and technology characteristics have a positive influence on usability. Usability has a positive influence on adoption, which in turn has a positive influence on performance. The results of this current study support all of the hypotheses in the IFM. Three individual questions (one each from task characteristics, perceived ease of use and Perceived Enjoyment) were, however, rejected as their item loading score was less than 0.70. Figure 5.1 represents the structural model and hypotheses of the study.

In Figure 5.1, the R-square and path coefficient (β) values of each of the hypotheses are indicated. As can be observed in the figure, all the paths were supported. The findings indicate that perceived usefulness ($\beta = 0.432$) and perceived ease of use ($\beta = 0.324$) have a positive influence on students' attitude towards using e-books. Therefore, a person's individual characteristics do determine their motivation to use a technology (Venkatesh, Thong and Xu,

2012). This finding is in agreement with those of other studies (Davis 1986, Wu and Chen 2011, Liaw and Huan,g 2013). As mentioned in Chapter 2, factors such as individual learning characteristics, positive learning attitudes, effective learning activities and useful learning environments can enhance effective e-learning.

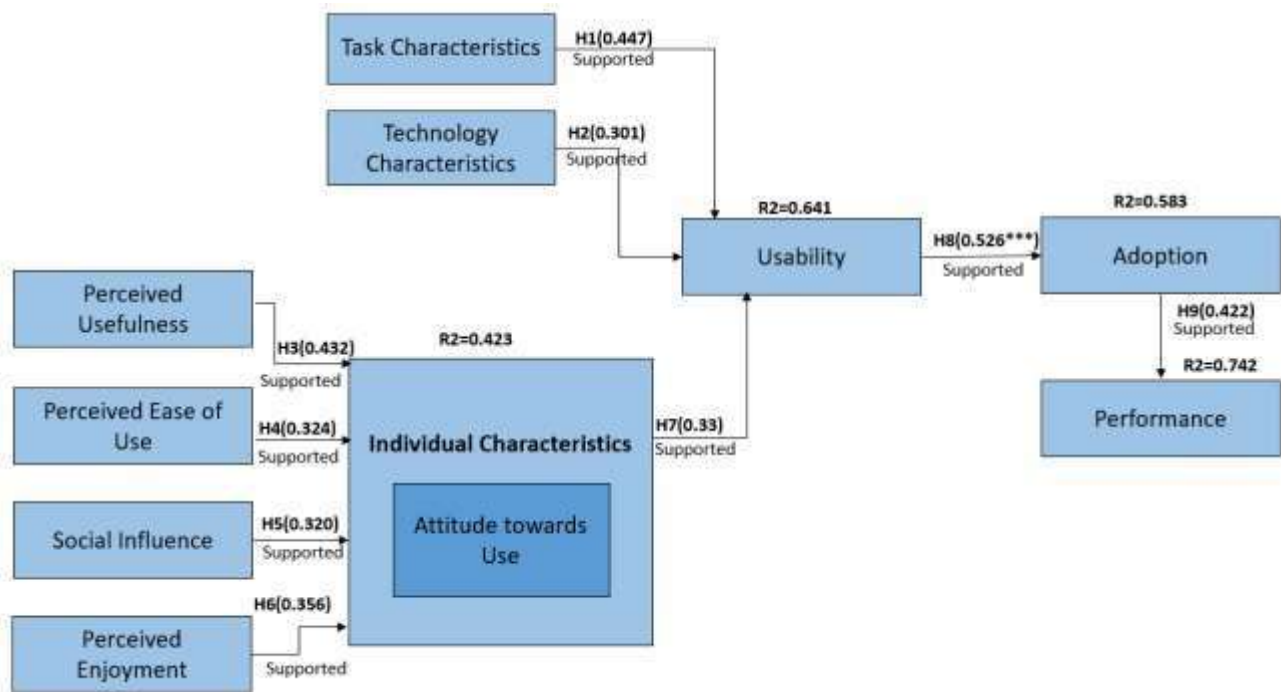


Figure 5.1: Structural Model and Hypotheses (R2 represents R-squared)

According to the statistics indicated in Chapter 4 (see Figure 4.6), 42.5% of the participants indicated that their behaviour to use e-books was influenced by people who are important to them. In addition, 48.2% of participants indicated that they were influenced by their lecturers to use e-books. This indicates that Social Influence could play a positive role in attitude towards use ($\beta = 0.320$). Results from another study that incorporated Social Influence as one of the variables in the hypotheses also indicate that it may affect an individual's attitude towards a technology positively (Venkatesh and Zhang, 2010). Social Influence had the greatest effect on adult women in their initial stages of experience (Venkatesh and Zhang, 2010), as the construct depends much on gender, experience, age and voluntariness.

For Perceived Enjoyment ($\beta = 0.356$), the majority of participants indicated that they enjoy using e-books because it gives them the option to study anywhere and anytime. According to Embong, Noor, Hashim, Ali and Shaari (2012) and D'Ambra et al. (2013), the benefits of using e-books include portability; thus, the burden of carrying heavy textbooks is eliminated. Furthermore, as mentioned in Chapter 4, simple features such as being able to perform word searches could also be a significant benefit of using e-books (Kissinger, 2013). Besides these benefits, users may also benefit academically, physically and psychologically (Embong et al. 2012, D'Ambra et al., 2013, Liaw and Huang, 2013). Therefore, the results of the current study and those from the relevant literature confirm that Perceived Enjoyment has a positive influence on attitude towards use. Since all the path coefficient (β) values for H3, H4, H5 and H6 were supported, this may provide proof that individual characteristics do have a positive influence on attitude of a person towards using e-books.

According to the research findings, task characteristics ($\beta = 0.447$) has a positive influence on usability. The majority of participants (65.2%) agreed that e-books are essential in accomplishing their tasks. Moreover, the majority of participants (88.7%) indicated that their devices are essential for accomplishing their tasks. The tasks that are being referred to here are those of downloading, doing assignments or homework, reading e-books on their electronic devices, etc. A possible reason for these responses may be that this group of participants were IT students who are quite familiar with using electronic devices. Participants also indicated that e-books fit well with the way they work. A study conducted by Yu and Yu (2010) support these findings. In their study (as reflected in Chapter 2), Yu and Yu (2010) argue that the TTF theory provides a grander understanding of the interrelationship among individual and task characteristic fitness, which then affects users' choice concerning whether or not to use an information system.

Technology characteristics ($\beta=0.301$), the second TTF construct, also has a positive influence on usability. The findings of a study in which only the TTF constructs were utilised to evaluate the adoption of e-books in education, supports the complete TTF theory in replicating substantial positive influence of 'task, technology, and individual characteristics' on the use of e-books in academic settings (D'Ambra et al., 2013). As reflected in Chapter 4 (see Figure 4.7),

72.4% of the participants disagreed that they have trouble reading e-books on their devices. This may be due to improved screen resolutions of newer electronic devices. Furthermore, 69% of participants disagreed that accessing/downloading e-books on their devices was unpleasant. The reason for this could be the availability of free Wi-Fi on the university's campus. According to Gebauer, Shaw and Gribbins (2010), as users move between locations, the quality of the network connection becomes an issue. Thus, the responses by participants may indicate that they access e-books on campus where the Wi-Fi connection is quite strong. More than two thirds of participants (68.8%; see Figure 4.7) indicated that they will continue to read e-books on their devices. This may be because of the usability of e-books, which in turn may lead to adoption of e-books. The ubiquity of e-books has allowed students to study anywhere and anytime.

The path between individual characteristics and usability ($\beta = 0.33$) indicates a positive influence (Figure 5.1). According to the descriptive statistics in Chapter 4 (see Figures 4.1–4.5), the results of the constructs that address individual characteristics were all positive. Thus, individual characteristics, task characteristics and technology characteristics have a positive influence on usability.

Furthermore, the path between usability and adoption is quite strong ($\beta = 0.526$). This indicates that usability has a positive influence on adoption. As discussed in Chapter 2, for a technology to be adopted, it has to be usable (Wiredu, 2014). According to Wiredu (2014), optimum usability is accomplished when there is coordination between the harmony of technology application and tasks involved. Moreover, user adaptation and adoption are essential contributors to technology usability. The findings of the current study indicate that students prefer to use e-books due to their portability, affordability and ease of navigation on different electronic devices (see Figures 4.7 and 4.8). Participants in the current study furthermore indicated that these e-books have to be effective for their learning needs. According to literature, e-books should meet student individual needs, since student needs vary from student to student (Cassidy, Martinez and Shen, 2012, D'Ambra et al., 2013, Aharony, 2014).

Furthermore, as can be seen in Figure 5.1, adoption has a positive influence on performance ($\beta = 0.442$). The great majority of participants indicated that they will continue to use e-books for academic gain (70.2%) and regardless of the device (68.8%) (see Figure 4.9). In addition, a significant percentage of participants (74.5%) indicated that they would recommend e-books to anyone. These findings indicate that there could be an increase in adoption of e-books amongst students. For performance (see Figure 4.10 in Chapter 4), 17.7% of the participants disagreed with the statement that e-books have improved their grades. Nevertheless, Embong et al.'s (2012) study indicates that students benefit academically from using e-books, which is confirmed by the findings of the current study. Moreover, more than two thirds of participants (70.2%; Figure 4.10) revealed that using e-books has enhanced their learning effectiveness. These findings are supported by Liaw and Huang (2013). Additionally, with e-books, time and place are not prohibiting factors due to portability (D'Ambra et al., 2013). Even though using e-books has not caused an improvement in some of the participants' grades, the majority (68.8%) agreed that using e-books has been useful in their university studies.

The R-square values (the aggregate variance described by independent variables on dependent variables) are also illustrated in Figure 5.1. The R-squared values of 0.423, 0.641, 0.583 and 0.742 are for attitude towards use, usability, adoption and performance, respectively. The IFM revealed more than 50% (0.50) of the total variance for usability, adoption and performance. This supports the IFM as a good predictor of MLU evaluation of e-books.

5.2 Research Questions Answered

In this section, the research questions are repeated (as reflected in Chapter 1), followed by a discussion on how each was answered:

- What is the relevance of the Technology Acceptance Model and Task-Technology Fit theory in developing an appropriate model for evaluating MLU of e-books?

The findings indicate that perceived usefulness ($\beta = 0.432$) and perceived ease of use ($\beta = 0.324$) have a positive influence on students' attitude towards using e-books. Therefore, a person's individual characteristics do determine their motivation to use a technology (Venkatesh, Thong and Xu, 2012). This finding is in agreement with those of other studies (Davis 1986, Wu and Chen, 2011, Liaw and Huang, 2013).

The R-squared values of 0.423, 0.641, 0.583 and 0.742 are for attitude towards use, usability, adoption and performance, respectively. The IFM revealed more than 50% (0.50) of the total variance for usability, adoption and performance. This supports the IFM as a good predictor MLU evaluation of e-books.

- What other constructs should be included in the IFM for evaluating MLU of e-books?

According to the statistics indicated in Chapter 4 (see Figure 4.6), 42.5% of the participants indicated that their behaviour to use e-books was influenced by people who are important to them. In addition, 48.2% of participants indicated that they were influenced by their lecturers to use e-books. This indicates that Social Influence could play a positive role in attitude towards use ($\beta = 0.320$).

For Perceived Enjoyment ($\beta = 0.356$), the majority of participants indicated that they enjoy using e-books because it gives them the option to study anywhere and anytime. Since all the path coefficient (β) values for H3, H4, H5 and H6 were supported, this means that this research question was answered.

5.3 Contributions of the Study

The current study has successfully applied the TAM and TTF theory on the usability of e-books. Through incorporating the TAM and TTF theory, both models can fill gaps where the other may be lacking. This current study has contributed to the body of knowledge (see Figure 5.1) by including Social Influence and Perceived Enjoyment in the IFM. The results of the study reveal that individual characteristics, task characteristics and technology characteristics

positively influence usability. Usability positively influences adoption, which in turn influences performance. The current study reveals a substantial use of e-books among senior IT students at CUT, which does suggest technology adoption.

5.4 Implications of the Study

The implications of the study are twofold, that for practice and that for theory. One of the implications to practice is that lecturers and students should undergo e-book training. Both students and lecturers should be trained on software used to access e-books in order to improve ease of access. This will also be determined by the type of device used for accessing e-books as some devices have rather small screens. In addition, universities should not assume that all students have mobile devices. They should rather include e-book readers as part of students' stationery or any other alternative device suitable for reading and accessing e-books. Lastly, usability guidelines should also be followed in determining which devices are more effective.

The implication to theory is that there should be an integration of two theories and two extended constructs to evaluate MLU of e-books; that is, the TAM and TTF theory should be integrated, along with an inclusion of Social Influence and Perceived Enjoyment (see Figure 5.1 with regard to individual characteristics). This will then contribute to the body of knowledge.

5.5 Limitations of the Study

The current study was done at the IT Department of CUT, Bloemfontein campus. The following are limitations pertaining to the study:

- Given that the study (main study questionnaire) only focused on students enrolled for an Oracle and CCNA short course, the results may not necessarily be true for the entire university. It could be different for the rest of the university because some faculties and

departments are not as exposed to information technologies as the IT department. The results could thus be a reflection of IT students' familiarity with technologies.

- Since the study was conducted for IT students, a measure of bias towards the use of e-books could exist, as it is an educational technology. Results from other faculties may be used to enhance this current study's findings.
- Participants who did not have smartphones had to use their laptops. Laptops can be rather limiting as the battery life is not as efficient as that of a smartphone. Participants who used their laptops did not necessarily benefit from learning anywhere and anytime as power and place could have been delimiters. Laptops of students who depend on public transport could also be at risk of theft. All these factors could have influenced the way students perceive e-book usability, influencing the outcome of certain results.

5.6 Conclusions

This section provides conclusions specifically related to the TAM, TTF theory, the IFM as well as the objectives of the study.

5.6.1 Technology Acceptance Model

According to the review of literature of the current study, the TAM is the most prominent extension of Ajzen and Fishbein's TRA, which was developed by Fred Davis in 1986. Surendran (2012) ascertains that the TAM is one of the theories based on the TRA and has been used to explain individuals' acceptance behaviour. According to Al- Adwan et al. (2013), the TAM is acknowledged as a well-known model related to technology acceptance and use. It has presented great potential in unfolding and predicting the actions of users of a technology (Al-Adwan et al., 2013). The TAM incorporates two fundamental constructs, namely, perceived usefulness and perceived ease of use (Park, 2009) (see Figure 2.4 in Chapter 2). In the current study, the original TAM constructs were integrated with Social Influence from the UTAUT model and Perceived Enjoyment from extensions of the TAM and other motivational models.

In a study by Shroff et al. (2011), the TAM was evaluated in order to observe learners' behavioural intention to use an electronic portfolio system. The results reveal that learners' perceived ease of use has a major effect on attitude towards use and that perceived ease of use has a major effect on perceived usefulness. In another study, Gerlach and Buxmann (2013) applied the TAM to examine how well e-books "fit" an individual reader. Perceived usefulness was correlated to usage objectives of using e-books. The results could not validate that perceived ease of use has a positive influence on students' intentions to use e-books (Gerlach and Buxmann, 2013). In conclusion, perceived ease of use presented a limited influence on the perceived usefulness of e-books in their study.

In the current study, however, the results indicate that perceived ease of use has a positive influence on the perceived usefulness of e-books. Findings indicate that perceived usefulness ($\beta = 0.432$) and perceived ease of use ($\beta = 0.324$) both have a positive influence on students' attitude towards using e-books. This means therefore that a person's individual characteristics do determine their motivation to use a technology (Venkatesh et al., 2012). The findings also indicate that perceived usefulness and perceived ease of use have a positive influence on attitude towards use. This is coherent with results mentioned in the previous chapter. Altogether, the TAM was sufficient in explaining or determining an individual's acceptance behaviour towards e-books. The next section represents the conclusions of the TTF theory in the current study.

5.6.2 Task-Technology Fit Theory

The TTF theory was developed by Goodhue and Thompson in 1995 (Ariffin et al., 2011). This theory is a linkage of models from two complementary streams of research (user attitudes as a predictor of utilisation and task-technology fit as a predictor of performance). The TTF theory ascertains that for a technology to have an encouraging influence on performance, it is necessary for the technology to be used. It should be a 'good fit' with the tasks it supports. The TTF constructs are task characteristics and technology characteristics. These characteristics all

combine to lead to the fit of a technology to a task. When this fit is achieved, it then leads to performance impact and utilisation.

The TTF theory was applied in a study (discussed in Chapter 2) to evaluate the adoption of e-books in education (D'Ambra et al., 2013). The findings of that study supported the complete TTF model in replicating substantial positive influence of 'task, technology, and individual characteristics' on the use of e-books in academic settings (D'Ambra et al., 2013). In another study (discussed in Chapter 2), the TTF theory was applied in order to determine the factors that affect individuals' utilisation of online learning systems (Yu and Yu, 2010). Yu and Yu (2010) report that the results of their study indicate that employing the TTF theory provided an explanation for variance in online learning system utilisation.

In the current study, the β value for task characteristics is 0.447, as indicated in Figure 5.1. This indicates that task characteristics has a positive influence on usability. Technology characteristics also has a positive influence on usability, with a β value of 0.301. Therefore, the TTF constructs led to the fit of a technology to a task, which has a positive influence on usability.

5.6.3 Integrated Framework Model

The IFM successfully evaluated MLU of e-books of the participants in the current study. According to the findings, potential exists for the adoption of e-books in education, as 68.8% of participants agreed that they will continue to use e-books for academic gain. The results indicate that even though using e-books did not improve students' grades, they will continue to use them. Awareness of student perceptions of e-books should be raised to the developers of technology devices in order to improve the adoption of these devices. Usability experts should work hand in hand with end users in order to create applications that can be used with ease, thereby improving adoption of those technologies. Higher education institution managers and stakeholders also need to be made aware of this as it may enable universities to decide whether or not to adopt e-books throughout the institution.

5.6.4 Research Objectives

The objectives of this study are as follows, as also listed in Chapter 1:

- To construct an IFM based on the Technology Acceptance Model and Task-Technology Fit theory, dedicated to evaluating MLU of e-books.
- To evaluate the Technology Acceptance Model in order to explore the acceptance of e-books for by students.
- To evaluate the Task-Technology Fit theory in order to explore how individual task and technology profiles improve user performance and technology utilisation.
- To assess the IFM in order to deduce its effect on MLU evaluation of e-books.
- To perform a pilot study and analyse its results in order to determine any concerns or deficiencies in the data collection instrument.

All the above objectives have been met. The IFM, which incorporated the TAM and TTF theory, was constructed with the inclusion of Social Influence and Perceived Enjoyment. The study questionnaire included questions from each of the TAM constructs in the IFM in order to explore the acceptance of e-books for mobile learning by students. The TTF constructs were evaluated to explore how individual task and technology profiles improve user performance and technology utilisation. Evaluation of the IFM indicates that all the constructs contributed positively to MLU of e-books. Therefore, the IFM was sufficient in evaluating MLU of e-books. The pilot study revealed which questions needed to be modified for the main study.

5.7 Summary

This chapter included, among other things, a discussion on the findings, in addition to the implications and conclusions of the study. Firstly, the findings were discussed, which are based on the constructs of the IFM. The main findings are that the IFM served as a good predictor for evaluating MLU of e-books. Furthermore, the research questions were answered, followed by a discussion on the contributions of the study, implications of the study and some study

limitations. Lastly, this chapter covered the conclusions of the study as specifically related to the TAM, TTF theory, IFM and the research objectives.

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Annexure A: Main Study Questionnaire



SURVEY ON USABILITY OF E-BOOKS AT THE CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE

Dear Respondent,

This questionnaire is designed to undertake a survey on the use of e-books among the Information Technology students at the Central University of Technology, Free State Bloemfontein campus. The data collected will be analysed in an effort to create a better understanding of the E-books usage. The information that you provide will help in giving a better understanding about the students' usability and adoption regarding the access of E-Book in order to determine its effectiveness. Participation is voluntary. It would be greatly appreciated if you would respond to the questions sincerely and honestly. Your responses and information will be kept strictly confidential. Thank you very much for your cooperation.

DEMOGRAPHIC DATA

Please tick (/) the appropriate box

1. Gender

Male

Female

Race

Black African

Colored

White

Other

2. Age

20 -24

30-34

25-29

< 34

What technology device did you use for accessing E-books?

Desktop computer

Smart-phone

Laptop

IPad

Tablet

Other

Please put an X on your answer based on the given scale

STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
1	2	3	4	5

Task Characteristics

Question 1: For accomplishing my tasks, E-books are essential.

1	2	3	4	5
---	---	---	---	---

Question 2: For accomplishing my tasks, my technology device is essential.

1	2	3	4	5
---	---	---	---	---

Question 3: E-books fit well with the way I like to work.

1	2	3	4	5
---	---	---	---	---

Question 4: E-books are compatible with my technology device.

1	2	3	4	5
---	---	---	---	---

Technology Characteristics

Question 1: I have trouble in reading the E-books on my technology device.

1	2	3	4	5
---	---	---	---	---

Question 2: Accessing/downloading E-books on my technology device is unpleasant.

1	2	3	4	5
---	---	---	---	---

Question 3: I will continue to read e-books on my technology device.

1	2	3	4	5
---	---	---	---	---

Question 4: My technology device has made anywhere and anytime learning easy for me as I can download and open my E-books anywhere.

1	2	3	4	5
---	---	---	---	---

Perceived Usefulness

Question 1: Using E-books for my school work enables me to accomplish tasks more quickly.

1	2	3	4	5
---	---	---	---	---

Question 2: Using E-books enhances my effectiveness when studying.

1	2	3	4	5
---	---	---	---	---

Question 3: Using E-books has made it easier to do study.

1	2	3	4	5
---	---	---	---	---

Question 4: E-books are high in readability.

1	2	3	4	5
---	---	---	---	---

Perceived Ease of Use

Question 1: Using E-books is clear and understandable.

1	2	3	4	5
---	---	---	---	---

Question 2: I find E-books easy to access/download.

1	2	3	4	5
---	---	---	---	---

Question 3: I find E-books easy to use.

1	2	3	4	5
---	---	---	---	---

Question 4: I can easily navigate through the E-books.

1	2	3	4	5
---	---	---	---	---

Perceived Enjoyment

Question 1: I enjoy using E-books.

1	2	3	4	5
---	---	---	---	---

Question 2: Accessing E-books is pleasurable.

1	2	3	4	5
---	---	---	---	---

Question 3: I enjoy using E-books because I get the option to study anywhere and at any time.

1	2	3	4	5
---	---	---	---	---

Question 4: The layout of the E-books is easy to work with.

1	2	3	4	5
---	---	---	---	---

Social Influence

Question 1: My peers have influenced my behavior to use E-books

1	2	3	4	5
---	---	---	---	---

Question 2: Peers who are important to me think I should use E-books.

1	2	3	4	5
---	---	---	---	---

Question 3: My lecturers positively influenced my behavior to use E-books

1	2	3	4	5
---	---	---	---	---

Question 4: Influential people in my life contributed to my decision to use E-books

1	2	3	4	5
---	---	---	---	---

Attitude toward use

Question 1: Using E-books is foolish.

1	2	3	4	5
---	---	---	---	---

Question 2: Using E-books is unfavourable.

1	2	3	4	5
---	---	---	---	---

Question 3: Using E-books is beneficial.

1	2	3	4	5
---	---	---	---	---

Question 4: Using E-books is a pleasant experience.

1	2	3	4	5
---	---	---	---	---

Usability

Question 1: I use my E-books frequently.

1	2	3	4	5
---	---	---	---	---

Question 2: I learn better with E-books.

1	2	3	4	5
---	---	---	---	---

Question 3: My technology device is easy to navigate through and makes accessing E-books an easy task.

1	2	3	4	5
---	---	---	---	---

Question 4: I find E-books flexible to interact with.

1	2	3	4	5
---	---	---	---	---

Adoption

Question 1: I spend more time reading E-books than traditional textbooks.

1	2	3	4	5
---	---	---	---	---

Question 2: I will continue to using E-books for my academic gains.

1	2	3	4	5
---	---	---	---	---

Question 3: I will continue using E-books regardless of the current technology device that I am using.

1	2	3	4	5
---	---	---	---	---

Question 4: I recommend any one to use E-books.

1	2	3	4	5
---	---	---	---	---

Performance

Question 1: Using E-books has improved my grades or performance progress.

1	2	3	4	5
---	---	---	---	---

Question 2: Using E-books has enhanced my learning effectiveness.

1	2	3	4	5
---	---	---	---	---

Question 3: Using E-books had increased my learning productivity.

1	2	3	4	5
---	---	---	---	---

Question 4: Using E-books has been useful in my University studies

1	2	3	4	5
---	---	---	---	---

Annexure B: Pilot Study Questionnaire



QUESTIONNAIRE FORM

(PILOT STUDY)

Researcher: Boniswa Mafunda

Tel: 0730534448

Email: bmafunda@cut.ac.za

Faculty of Engineering and Information Technology

Title of the study:

DEVELOPING AN INTEGRATED MODEL FOR USABILITY EVALUATION OF E-BOOKS

Dear Respondent,

This questionnaire is designed to obtain student perceptions regarding the use of cellphones for accessing e-books prescribed for the IT course offered at the Central University of Technology. The information that you provide will help in obtaining a better understanding about student usability and adoption attitudes towards accessing and using e-books instead of hardcover books. I would greatly appreciate it if you would respond to the questions sincerely and honestly. Your responses and information will be kept strictly confidential, as the questionnaire is totally anonymous. Thank you very much for your cooperation.

DEMOGRAPHIC DATA

Please put a cross (X) in the appropriate box

1. Gender

Male	<input type="checkbox"/>
Female	<input type="checkbox"/>

2. Age

20-24 yrs.	<input type="checkbox"/>
25-29 yrs.	<input type="checkbox"/>

30-34 yrs.	<input type="checkbox"/>
35-39 yrs.	<input type="checkbox"/>

3. Home Language

Afrikaans	<input type="checkbox"/>
English	<input type="checkbox"/>
Male	<input type="checkbox"/>

Sepedi	<input type="checkbox"/>
Sesotho	<input type="checkbox"/>
Female	<input type="checkbox"/>

IsiXhosa	
IsiZulu	

Setswana	
Other	

STUDENT PERCEPTIONS

Please put a cross (X) over the number which is most appropriate to each question

Question/ Statement	STRONGY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
I used another technology other than a cellphone device to download the e-book	1	2	3	4	5
I can easily browse the Internet using my cellphone	1	2	3	4	5
I can download academic content onto my cellphone	1	2	3	4	5
I only use my cellphone for social interaction	1	2	3	4	5
I can open PDF documents on my cellphone	1	2	3	4	5
I can access e-books on my cellphone	1	2	3	4	5
I enjoy using my cellphone for educational purposes	1	2	3	4	5
My friends influenced me into using my cellphone for education	1	2	3	4	5
It was a waste of time to download e-books onto my cell phone	1	2	3	4	5
I do not enjoy reading e-books on my cellphone	1	2	3	4	5
My cellphone has a large screen resolution to easily display e-book contents	1	2	3	4	5
Reading e-book contents on my cellphone tends to hurt my eyes	1	2	3	4	5

I will continue to read e-books on my cellphone	1	2	3	4	5
E-books have made learning easier for me as I can download and open them anywhere	1	2	3	4	5
E-books are cheaper than hardcover textbooks	1	2	3	4	5
I prefer to use my cellphone for accessing ebooks than using a personal computer	1	2	3	4	5
I cannot afford to access e-books via my cellphone due to the high data costs	1	2	3	4	5

Any other comments, advantages or challenges in using cellphones to access e-books will be appreciated.

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Annexure C: Ethical Clearance

A letter was submitted to the Faculty Research and Innovation Committee (FRIC) for ethical clearance. The letter was approved in the meeting which was held (see snapshot).

8.23 Request for FRC approval for the use of questionnaire – B Mafunda

Letter & Questionnaire Form: **FRC2015/03/8.23**

Resolution: FRC2015/03/8.23

This has been recommended and referred to ECF.

Annexure D: List of Publications from this work

Mafunda, B., Bere, A. and Swart, J. 2015. Establishing determinants of electronic books utilisation: An integration of two human computer interaction adoption frameworks. Paper presented at the International Conference on Human-Computer Interaction, (HCI) Toronto, Canada, 20-22 July.

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