Mobile Learning Usability Evaluation Using Two Adoption Models

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Abstract

The Central University of Technology, Free State has introduced the use of e-books as opposed to printed hard-cover textbooks for students. This is in line with international campaigns seeking the adoption of e- books for educational purposes, while reducing the costs of printing material. This study is aimed at developing an Integrated Framework Model for evaluating the usability of e-books in higher education, thereby enhancing mobile learning adoption at a university. Despite the advantages of usability, continuous emphasis is still placed on the gap which exists between software development and usability evaluation. It is for this reason that the results of usability evaluations frequently have little or no significant influence on the software development of mobile learning applications. This paper reports on the results of a pilot study where a questionnaire was developed to evaluate the use of e-books on mobile devices by students in higher education. The sample size consisted of 49 IT students who registered for a Computer Security module during 2015, where the majority were Sesotho speaking. The outcomes of the study may create provision of a framework useful for evaluating mobile learning usability which may subsequently lead to enhanced adoption.

Keywords: Mobile learning; task technology fit; technology acceptance model; usability; adoption

1. Introduction

According to [1], the infiltration of mobile devices in sub-Sahara Africa has transpired with remarkable haste, with the youth viewing it as a very important component of their daily lives. Moreover, mobile devices are increasingly becoming a predominant part of contemporary computing in organizations and society [2]. Country-level adoption and usage rates suggest that mobile devices, even in poor households, are rapidly becoming part and parcel of life [1, 3].

Despite ML speculations and high mobile technology appropriation, previous research suggests that there is inadequate ML adoption in South Africa [4]. Researchers argue that adoption of mobile

technologies is influenced by usability [2]. According to [5], there are usability guidelines that are used for designing technology interfaces in order to enhance usability. However, current usability evaluation techniques are based on traditional methodologies which were designed for traditional computer systems, and not for emerging mobile computing technologies. They are therefore either difficult to apply or dependent upon evaluators expertise.

The objective of this study is to develop an Integrated Framework Model (IFM) for ML usability evaluation. This study is motivated by the following research problem: "A lack of ML usability evaluation techniques have resulted in poor adoption of these emerging technologies among students at Universities of Technology (UoT) in South Africa". The proposed IFM is aimed at addressing the research problem and answering a number of subsidiary research questions relating to ML adoption.

In this paper, two specific adoption models are discussed with relevance to this study. The proposed model is then introduced along with the research methodology. Thereafter, the results, discussion and conclusion follow. The Task Technology Fit adoption model is initially presented.

2. Adoption Models

A. Task Technology Fit

The Task Technology Fit (TTF) model was developed by Goodhue and Thompson in 1995 [9]. This model combines different models from two complementary streams of research (user attitudes as predictors of utilisation and task-technology fit as a predictor of performance). According to previous research, this theory was established to examine the link between information

technology (IT) and individual performance [6].

The TTF model has three main constructs (task- technology fit, task characteristics and technology characteristic). This model stresses that a technology should have features that support the "fit", or are aligned, to a required task [7]. After thorough analysis of the TTF model, the authors realized that incorporating the constructs of TTF into the IFM may have an impact on the adoption and usability of a technology. The easier it is to use a technology in accomplishing a given task may result in a higher performance on that task. These constructs may be applied to ML adoption relating to when students access and use e-books on their mobile device, the device may be evaluated for compatibility.

B. Technology Acceptance Model

The Technology Acceptance Model (TAM) is the most prominent extension of Azjen and Fishbein's Theory of Reasoned Action (TRA). It was developed by Fred Davis in 1986. This model suggests that apparent usefulness and apparent comfort of use include a person's intention to make use of a system with "intention to use" serving as an intermediary of real system use [8]. According to [9], the TAM contains two fundamental constructs - perceived ease of use (PEOU) and perceived usefulness (PU). 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 [10].

The TAM has three further constructs, namely attitude toward use, intention to use and actual use. Previous research suggests that the TAM lacks sufficient thoroughness and relevance that would make it a well-established theory for the IT community [11]. In this study, individuals will interact with the technology

(mobile devices for learning) and TAM will only address the individuals' usage of the technology. The TAM does not consider the technology being used, but rather the perceptions of the user in terms of the degree to which the technology will be easy to use. The user's attitude, PU and PEOU are all related to usability and enhanced performance of the students and adoption of e-books. The proposed model for this study therefore aims to append the TTF model with the TAM.

3. The Proposed Model

The proposed IFM incorporates the TAM as it has been used in previous e-book adoption research where the results indicated better understanding of students' behavioural intention to adopt e-books [12]. The TTF was used in a study that evaluated the use of e-books and the findings reported that all the constructs have a substantial positive influence on user individualities of e-books for educational purposes [13]. The TAM and TTF model cover different aspects of technology usability (i.e. TAM is involved with user perceptions while TTF mainly looks at performance measurements). The authors found it appropriate to merge the two frameworks in an effort to develop a model that capitalizes on the strengths of both frameworks and also addressing the weaknesses of both. The following subsidiary research questions are proposed and will be answered using the IFM:

• What is the relevance of the TTF model in developing an appropriate model for evaluating mobile learning usability (MLU) at a University of Technology (UoT)?

• What is the relevance of TAM in developing an appropriate model for evaluating MLU at a UoT?

• How will the TTF model and TAM contribute to the effective learning evaluation in the proposed IFM?

The hypotheses of the proposed IFM are stated next. The hypotheses entail the individual characteristics (attitude towards use) which are linked to the TAM and the TTF constructs. The hypotheses also indicate how the constructs in the IFM influence one another.

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 individual characteristics.

H4: Perceived ease of use has a positive influence on individual characteristics.

H5: Perceived enjoyment has a positive influence on individual characteristics.

H6: Social influence has a positive influence on individual characteristics.

H7: Individual characteristics have a positive influence on usability.

H8: Usability has a positive influence on adoption.

H9: Adoption has a positive influence on performance enhancement

Figure 1 presents the proposed IFM which incorporates the TTF model and the TAM. Each of the nine hypotheses is linked to the individual constructs of the two models.
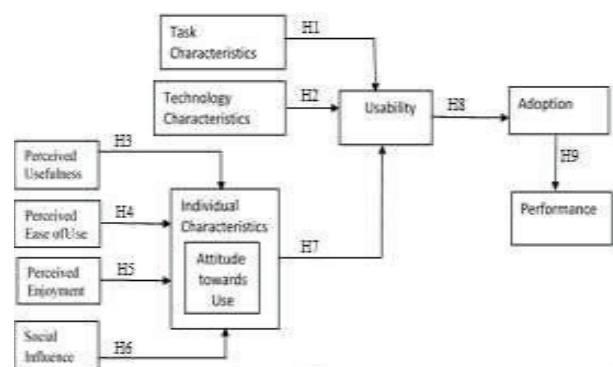
Figure 1. Proposed Integrated Framework Model.

4. Methodology and Research Design

The study adopted an exploratory design approach. Exploratory designs are used to explore research questions and are performed in order to gain a better understanding of a situation, phenomena, community or person [14]. In this study, the use of e-books by students at a UoT is explored and the research questions are answered. This is done in order to gain a better understanding of why students are adopting or not adopting e- books for educational purposes. Descriptive statistics and thematic analysis are used as techniques for data analysis [13]. The target population of the study is restricted to IT students who use e-books for academic purposes as an alternative to the traditional textbooks. The study employed a qualitative approach. Its purpose is to observe the behavior of students towards e-books and then analyse it. The sample size consisted of 56 Computer Security students who registered during 2015. However, only 49 completed questionnaires were received. The questionnaire was selected as the main data collection instrument and piloted before being used in the main study. The questionnaire featured Likert scale questions ranging from "1" (strongly disagree) to "5" (strongly agree). A pilot study is a small-scale study for helping to design a further confirmatory study [14]. Its purpose is to help detect flaws in the instrument which must be corrected before being used in the main study.

5. Research and Discussion

Devices that were used for accessing and reading e-books were tablets, cell phones and laptops. Sotho speaking students dominated the profile of the participants (being 45%). Males outnumbered females by 4 to 1, while the dominate age group was 20-24 years (86% of the participants).

Figures 2 to 6 present the results of the survey questionnaire addressing each of the hypotheses. Figure 2 represents the Task Characteristics and Adoption results which indicate that most of the participants strongly agreed that they could download and open academic content on their cellphone (H1 supported). However, for Adoption, less than 50% of the participants indicated that they will continue to use e-books (H9 rejected).

Figure 3 depicts PEOU and Social Influence (SI). The responses for PEOU tend to suggest that students find it easy to use their cellphone for studying purposes (H4 supported). However, students were influenced by other factors other than their peers into using cellphones for learning when considering the right hand column in Figure 3 (H6 rejected).
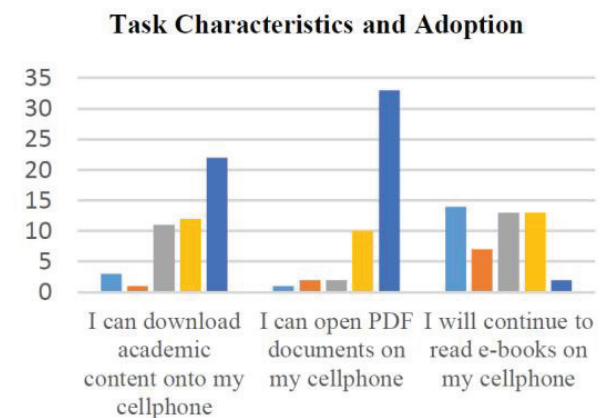

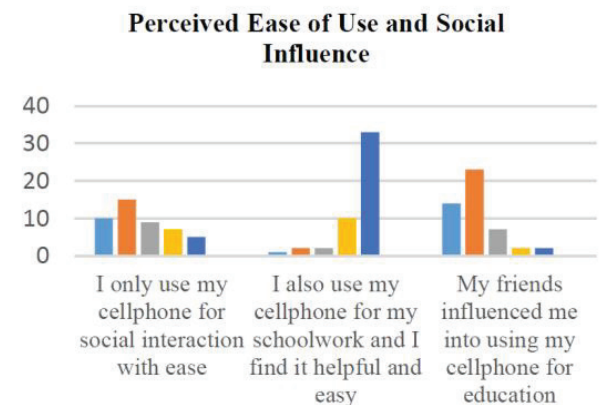**Figure 2.** Task Characteristics and Adoption.

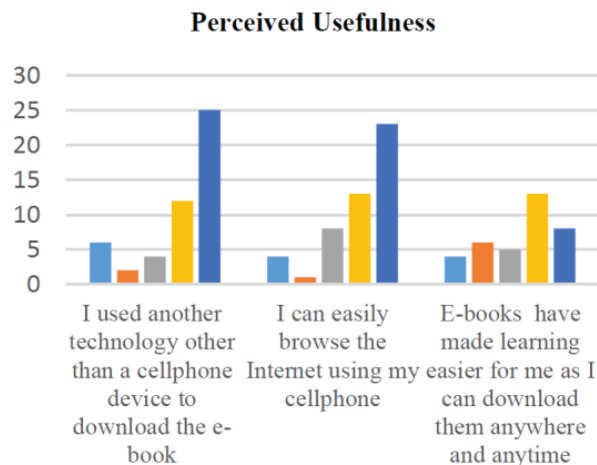**Figure 3.** Perceived Ease of Use and Social Influence.

Figure 4. Perceived Usefulness.

Figure 5 represents Usability and Perceived Enjoyment (PE). More than 50% of the students indicated that they can access e-books on their cellphones (H8 supported). However, less than 50% of the students indicated that they enjoy reading e- books on their cellphone (H5 rejected). Figure 6 represents Usability and Individual Characteristics (IC).

Students are divided on the use of e-books on a cellphone or on a PC (H2 rejected). However, the majority of students felt that it was not a waste of time to download the e-book onto their cellphone (H7 supported).
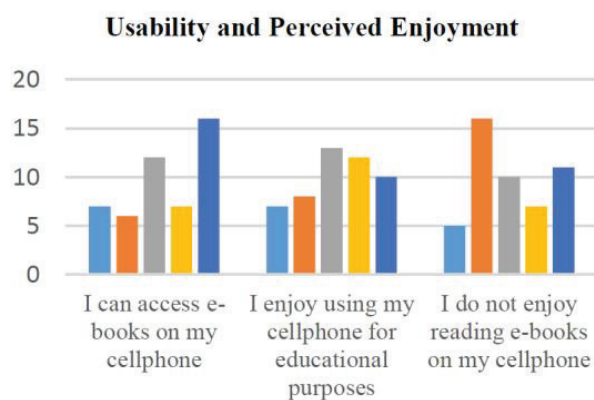

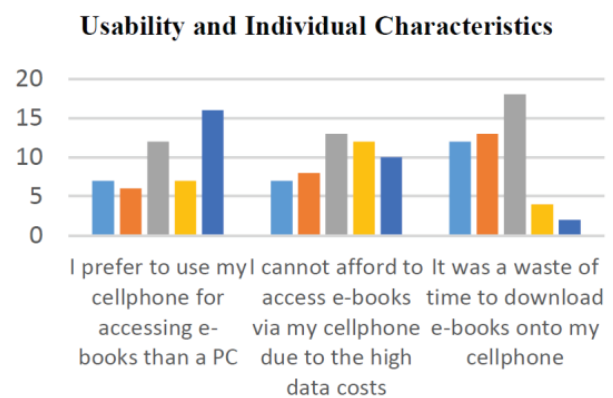**Figure 5.** Usability and Perceived Enjoyment.

Figure 6. Usability and Individual Characteristics.

4. Conclusion

The purpose of this study is to develop an IFM for evaluating the usability of e-books in higher education, thereby enhancing mobile learning adoption at a university. However, it must be re- iterated that the results presented in this paper are from a pilot study, serving to correct any question deficiencies or concerns. No statistical analysis was done as this is reserved for the main study.

The pilot study results tend to suggest that 4 hypothesis are supported (H1, H4, H8 and H7). One of the major TAM constructs is supported, being PEOU having a positive influence on e-book adoption. However, the other major construct, PU, seems to have a negative influence on e-book adoption. The initial results of this pilot study seem to suggest that using mobile devices for e-book adoption for academic purposes is not supported.

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