

AN EVALUATION OF IPAD AS A LEARNING TOOL IN HIGHER EDUCATION WITHIN A RURAL CATCHMENT: A CASE STUDY AT A SOUTH AFRICAN UNIVERSITY

Ruth Diko Wario, Bonface Ngari Ileri and Lizette De Wet
Department of Computer Science and Informatics, University of the Free State, South Africa

ABSTRACT

Since Apple released the iPad in 2010, it has been widely adopted for teaching and learning. Its graphical user interface combined with touch screen features engages users by attracting their attention. However, the level of engagement that would influence learning is not well understood. This case study investigated the use of iPads when engaging students during teaching and learning. A course unit was purposefully selected and 43 students in an extended undergraduate program were given iPads to read, refer, annotate, and access the internet. A structured questionnaire was used to elicit responses from these students. The findings indicated that perceived ease of use ($p < .05$), perceived learning ($p < .01$) and perceived student engagement ($p < .05$) were positively related to learning outcomes. The findings show that the ease of use of iPad, confidence and attention were significant predictors of students' perception that iPad mediated learning.

KEYWORDS

iPad, student, perceived ease of use, instruction, student engagement

1. INTRODUCTION

The world has witnessed a rapid mobile penetration and growth of mobile data including marginalized areas such as Sub-Saharan Africa. According to GSMA Mobile Economy sub-Saharan Africa report, projected 2016 mobile penetration in sub-Saharan Africa would have been 48.7%. An increase in device ownership and data usage was reported due to decreasing cost of mobile devices and an increase in broadband coverage (GSMA the Mobile Economy Report, 2015).

The ability of mobile devices, especially iPad, to share digital content in formats of video, images, voice and text has made it an attractive and appropriate educational delivery tool (Geist, 2011; Henderson & Yellow, 2012; Hutchison, Beschoner & SchmiCrowford, 2012). Students and educators access multimedia content, some in form of eBooks, slides and pdfs from remote servers via wireless network, thus lightning the burden of carrying books to class. Lecturers are able to share soft copies of class notes and other learning material with students (Babnik et al., 2014; Fri-Tic, 2012; Hahn & Bussell, 2012). According to Hughes, (2011), 25 million iPads were sold in the first fourteen months after release of iPad in 2010. This was a remarkable market penetration and the "wow" factor generated by the unprecedented consumer interest and its affordance coupled with its computing power made iPad a preferred mobile device. According to Dahlstrom and Bichsel, (2014), 86% of the students that took part in a survey conducted in 213 institutions with 75,306 responses across 15 countries, indicated that they owned a smartphone while nearly all owned a mobile device.

Research has shown that students used iPad more in class (more than 50% of class time) than laptops (25 % of class time), making iPad a preferred mobile device (Karsenti, 2013). Some researchers have claimed that iPad would revolutionize education (Ferenstein, 2011). Amidst such claims, there are those researchers that have indicated that despite high penetration of mobile devices, the use in learning is not as widespread as the devices themselves (Dahlstrom & Bichsel, 2014). A few students do classwork daily from mobile devices (Wright, 2013), which is relatively small compared to percentage ownership. This is an indication that device ownership and usage in learning is not proportionately related (Chen, Seilhamer, Bennett & Bauer, 2015).

The usage of mobile devices by students is motivated by connectivity to internet, which makes it easy to communicate on social media and access to multimedia content that interests them (Sana, Weston & Cepeda, 2013; Junco, 2011; Smith & Caruso, 2010). While competence in handling a technology has been proven to be a significant predictor of information and communications technology integration in the classroom (Wario & Viljoen, 2015) and students being competent in using mobile devices (Dahlstrom & Bichsel, 2014), does not necessarily mean they are used for learning (Junco, 2012). However, in controlled classroom activities, researchers have reported positive correlations between mobile learning and improved performance (Ostler & Topp, 2013; Rossing, Miller, Coed & Striper, 2012). Others hold the view that they are disruptive in class (Junco, 2012) and should be discouraged. Due to the contradictory views held by researchers, there need to investigate how the students perceive mobile devices as enablers to engage in learning activities; and also how they perceive the device as a learning tool. Research has shown that student acceptance to a technology motivates them to use it more, which is as a result of the way students perceive it and adopt it (Louho, Kallioja & Oittinen, 2006; Yusoff, Zaman & Ahmal, 2011).

Perception is the basic source of knowledge and knowledge is acquired through senses. Philosophers argue that it is often varied, subjective and dependent on the preceptor's powers of reason and emotion, however, researchers use perceptions as basic source of empirical data (Dunn, 2013). This study used student's perceptions as primary source of data to evaluate iPad as a learning tool while the technology acceptance model (TAM) was used to guide the investigation on how the students perceive iPad as a learning tool, and how it enables the student engage actively and collaboratively while undertaking an assigned task. The logit multinomial model was also used for identification of the significant characteristic of the students' that best predicts student's perception to choose iPad as a learning tool.

2. LITERATURE REVIEW

2.1 Mobile Learning

There is no singular definition for mobile learning, however, researchers agree that it encompasses learning mediated by mobile devices used as learning tools (Pegrum, Howitt & Striepe, 2013). While definitions use the terms mobile and learning, researchers argue that the term learning means transformation or changes in a person's perceptions, attitudes, cognitive or physical skills after performing a learning activity and that it cannot be 'mobile'. Therefore, the term mobile learning is linguistically misleading (Dichantz, 2001). However, the term is popular and is commonly used and accepted to emphasize the delivery of information that leads to learning. Students are deemed to actively acquire knowledge when they use a mobile computing device to interact with learning objects anytime, anywhere (Ileri & Omwenga, 2014). Mobile learning has a dual aspect in this context, one is the use of mobile learning devices, and the other is the mobility of the student (Sharples, Taylor & Vavoula, 2005). In both cases the learning can take place while a student is mobile or stationary as long as the student is using a hand held computing device. This study considers iPad as a personal learning tool and not an instructional tool, thereby adopting the definition.

The use of iPad and other mobile devices in education has been over praised, however questions continue to be asked, whether they can be used in a Higher Education (HE) environment in a pedagogically sound manner (Oppenheimer, 2003); and if any technology that works outside educational environment, can succeed inside it (Melhuish & Falloon, 2010)? Some researchers argue that, it is due to many challenges facing University level education such as a higher volume of work, large class sizes and demand on student's time and bandwidth that makes universities adopted programs that use technology (Schnackenberg, 2013; Gasparini & Culen, 2012), while others argue that mobile technology is obstructive and is lowering the learning standards since students waste a lot of their time on social media and less time studying (Junco, 2012).

2.1.1 Learning with a Mobile Device (iPad)

Teachers play a significant role in the successful pedagogical integration of teaching technologies in class (Kanseti, 2013), however, learning only occurs when the students engage actively with learning activities (Morf & Weber, 2000; Prince, 2004; Ileri & Omwenga, 2014). Learning is enhanced by the use of technology, which mediates learning (Sharple's et al., 2005). According to researchers, iPad has been tried in

class with unprecedented adoption especially in developed countries such as Canada and USA (Etherington, 2013). About 4.5 million students in the USA (Etherington, 2013) and about 10,000 students in Quebec (Kanseti, 2013) use iPad in class.

Mathematics is one of many subjects, which is taught using the iPad (Staats & Robertson, 2014). Staats and Robertson (2014) indicated that students made interesting choices while making videos on iPads of the algebra of inaccessible objects. They were required to take photographs of artwork and do an analysis. As a conclusion of their findings, the way students worked using the iPad could not otherwise have been done to make students understand. In another project, Lewis (2014), taught history using iPad by creating an open theatre called “Place Based Cinema”. These were interactive films, animations, and pictures of historical events, which were mapped and made accessible through iPad and Smartphones. In his findings, the digital reading device (iPad), enabled students to customize their reading experience by changing font size using Kindle. The Kindle allowed them to deepen their comprehension by making notes in the text and utilizing the audio-enhanced dictionary. The few research trials of iPad have made some universities like Abilene Christian University provide mobile devices to students and faculty members in order to empower them to use mobile learning as a mode of teaching and learning. At the University of San Francisco, researchers provided faculty members and librarians with iPads and the results indicated that the iPad was valued as a tool for teaching and learning (ACU Connected, 2012).

In all these studies, the success of iPad was mainly due to the ease access of learning content, interactivity between student and content as well as the teachers (Lewis, 2014; Babnik et al., 2013; Hahn & Bussell, 2012). Despite this “wow” factor leading to the adoption of iPad, challenges that are inherent in all mobile devices like transportation of multimedia content alongside scalar data and predictor characteristics of students in using the device are still not fully understood (Alvi et al., 2015). Little is reported on the challenge of introducing iPad in the classroom since its effective pedagogical use and the perceptions of students to use it has not been fully explored. This paper aims to assess students’ perception after being introduced to iPad’s multi-purpose tablet technology within their learning time. The iPad was chosen because it is a commonly used device in institutions around the world, has advanced technology features and supports many users (King & Bass, 2013).

2.1.2 Technology Acceptance Model

Most studies on introduction of technology revolves around the intention to adopt a particular technology or assessing the usage of it. Literature on user attitude or perception to adopt technology is explained in the Technology Acceptance Model (TAM) (Ramayah & Ignatius, 2005). The TAM has evolved through time, originally developed by Davis, Bagozzi and Warshaw (1992) and subsequently modified by Venkatesh and Davis (1996). They removed an attitude variable from the original model, because attitude did not fully mediate the relationship between perception constructs and behavioral intent. The modified TAM model has been widely applied (Ndubisi et al., 2001; Venkatesh & Morris, 2000; Ramayah, Jantan & Aafacqi, 2003). The model has been used to predict behavioral intent towards the use of information technology. Behavioral intention is a strong predictor of actual behavior according to the theory of Reasoned Action (Fishbein & Ajzen, 1975).

Although some researchers argue that behavioral intention is a subjective norm, which does not directly influence behavioral intent, Davis et al. (1989) states that there is a strong school of thought that supports the opposite. Venkatesh and Davis (1996), found that the subjective norm does significantly influence behavioral intention. This study used the modified TAM model to evaluate the perceived use of iPad in learning and engagement. The external variables were derived from class activities, and were measured on the ability to participate, gain confidence, gain attention and learning.

The modified TAM model by Venkatesh and Davis, (1996) explains the relationships that exist between external variables, perceived usefulness, perceived ease of use, behavioral intention to use and actual usage. External variables are directly related to perceived usefulness and perceived ease of use, perceived ease of use is related to perceived usefulness and behavioral intention to use while behavioral intentional to use is related to actual usage.

2.1.3 The Multinomial Logit Model

The multinomial logit model is a mathematical model used to perform a logistic regression analysis to determine how well the variables predict a student’s choices (McFadden, 1973; Agresti, 2002) and to

determine which characteristic factors are significant enough to explain the choice. The students were faced with the choice of agreeing or disagreeing with the fact that iPad enabled them to learn or not. The logit model is a probability model used popularly in evaluations of perceptions of participants (Park & Choi, 2009), represented mathematically by the formula:- $P(i|z, C, \beta) = \frac{e^{z_i\beta}}{\sum_{j \in C} e^{z_j\beta}}$ where, $C = \{1, 2, 3, \dots, j\}$ is a finite choice set; i, j are alternatives in C ; z_i is a k -vector of the explanatory variables describing the attributes of alternatives j and or characteristics of the decision maker, which affect the desirability of alternative j ; $z = (z_1, z_2, \dots, z_j)$ representing the attributes of C ; and β is a k -vector of taste parameters. $P(i|z, C, \beta)$ is the probability that a randomly selected decision maker faced with choice set C with attributes z , will choose i . Therefore, the taking the natural logs of both side of the equation, the final equation becomes linear and can be represented as:- $\text{logit } P(z_i) = \sum_{i=1}^k \beta z_i$.

The learner characteristics considered in this study were, gender, age, race, confidence, perceived ease of use, perceived engagement (participation), attention, and perceived learning. The choices that the student faced were categorized as agree or disagree that iPad contributed to learning. The β values generated were the coefficients that linearly define the relationships between the choices and student characteristics.

3. METHODOLOGY

The study used a descriptive and interpretive case study method where a survey was conducted to evaluate the Students' Perceptions on use of iPad for Learning after they used iPad to do class work for 14 weeks. The class was sampled randomly amongst first years/extended courses. The students were encouraged to enroll for the class where each student was promised an iPad for the entire semester.

3.1 Procedure

The participants were drawn from an extended program in a faculty of Natural and Agricultural sciences. Students were made aware of the study before they enrolled in the course. Participation was voluntary and students were able to leave the study at any time. All the participants (students =60) who enrolled in the course participated in the study, seven of which took part in the pilot study. Students were issued with iPads and a demonstration on basic iPad procedures was conducted. Students were free to seek help and support from the lecturer who taught the course. After 14 weeks of learning, a questionnaire was given to students. The questionnaire was adapted from works of Streepey, Choe, Miller, Rossing and Stamper (2011) and Diemer, Fernandez, and Streepey (2012). Students rated their learning and engagement while using iPads. Survey responses were classified as Agree or Disagree before data was entered into an SPSS application. Three categories were created perceived ease of use, perceived engagement and perceived learning. Data was analyzed using descriptive statistics, cross tabulations and linear regression binomial logit model to cross examine relationships and perception predictors.

4. RESULTS

Most participants were female (60%) while Blacks (96%) were the majority and the rest Colored (4%). Most participants' (86%) were aged between 19 to 21 years old. Approximately a third (67.3%) of the participants owned a smartphone and 21.2% intended to purchase one.

The level of competence in using a mobile device before exposure to iPad was 51.9%. When participants were asked to describe how likely it was that they would use a handheld mobile computing device for e-learning after the iPad exposure, 44.2% said they were likely while 38.5% said they were extremely likely to use it. Most participants were happy with their experiences, however, 17.3% were not decided whether they would use iPad for learning after the exposure.

A correlation analysis between learning, participation in course activities and connecting to new idea using iPad revealed that iPad as a tool of learning was highly perceived by the participants to be an effective tool that could enhance learning. All Pearson's correlation factors were above .800 at 99% degree of confidence as shown in table 1. The participants indicated that using iPad, was likely to increase

collaborative student participation in class activities. They also perceived learning took place while they used iPad. An increase in participation of participants while using iPad in class had a positive correlation (Pearson's correlational value .878) with perceptions of the participants connecting to new ideas and also with the perceptions that learning was taking place (Pearson's correlational value .917). A summary of other analyses on cross tabulations is shown in table 2.

Table 1. Correlation between learning, participation in course activities and connecting to new ideas using iPad

Participant perception	Helped in learning	iPad activities increased Participation in class	Helped connect new ideas
Helped in learning	1		
iPad activities increased participation in class	.917**	1	
Helped connect new ideas	.891**	.878**	1

** P value less than .001

Table 2. Cross tabulation between participants' ease of use, attention, confidence and participation while using an iPad

Cross Tabulation	P-Value	Crammer-V Value
After using iPad versus participation	.000*	.865
After using iPad versus confidence	.001*	.605
Attention versus participation	.010*	.466
Attention versus confidence	.000*	.783

*degree of confidence 95%

From results (Table 2), there existed strong relationships between use of iPad in class and participating in class activities, also between use of iPad in class and participants' confidence, in both cases ($P < .05$), with Crammer's V values .865 and .605 respectively. Crammer's V values are above .5 with its scale of 0 to 1. The results indicate participants gained confidence after using iPad. When participants were asked why they thought they gained confidence when using iPad, they pointed out that it was easy to use. However, there was no significant relationship between attention and participation. Attention in this case was drawn to individual, not group activity. There existed a relationship between gaining attention and confidence irrespective of gender or age ($p < .05$; Crammer's $V > .5$).

The participants' responses on how iPad helped them to solve problems in class were: -

- "I simply google answers or ask my friends by chatting with them";
- "I SMS my teachers"
- "I quickly refer to my notes"
- "I listen to YouTube video clips from other professors".

When asked if they would consider purchasing iPad after the end of the semester, 78.4% were willing, 12% were not decided and 9.6% would not due to high cost of iPad.

A further analysis on the predictors of choices made by the participants on iPad was done using a multinomial logit linear regression analysis and are summarized in table 3. The results revealed that participants' confidence, attention and perceived ease of use of iPad were the characteristics that would best predict the choice of iPad as a learning tool.

Table 3. Summary of the multinomial logit model regression analysis

Helped me to learn the course		B	Wald	Sig.	Exp(B)
Disagree	Gender	4.557	.008	.929	95.265
	Age	.000	.000	1.000	1.000
	Race	.000	.000	.894	1.000
	Confidence	2.023	.000	.949	7.558
	Attention	.000	.000	.893	1.000
	Ease of use	.000	.000	1.000	1.000
	Engagement	.000	.000	.736	1.000
Strongly Agree	Gender	.000	.000	1.000	1.000
	Age	.000	.000	1.000	1.000
	Race	.000	.000	1.000	1.000
	Confidence	12.067	.000	.049*	11.000
	Attention	24.569	.013	.003*	34.010
	Ease of use	45.000	.000	.006*	61.000
	Engagement	.000	.000	.736	1.000

*. The degree of confidence at 95%

The decision to disagree was not predicted by any participant characteristic, which meant there was no distinctive characteristic that featured significantly for them to disagree. However, for them to strongly agree, confidence, attention and ease of use played a significant role in determining the choice to agree that iPad mediated learning.

5. DISCUSSION

The participants perceived iPad as a learning tool, which enabled them to engage in learning activities. These findings are not unique but confirms what other researchers have found out about iPad as learning tool. Fischman and Keller (2011), found out that iPads promoted active learning, collaboration, and student engagement. Perceptions of participants provided the primary data. Fiser, et al. (2010), indicates that human perception is statistically inferred in learning and therefore both perception and learning should not be separated, but be treated together. They argue that perceptions are sensory inputs, which are used by the brain to process what the student experiences as outputs and thus should viewed in a unified manner. In this case, participants' perceptions contributed to and was related to their view that iPad enabled them to build confidence, gain attention and participate in learning activities. The participants became motivated and payed attention in pursuit of a learning goal, a concept that Fischman and Keller (2011) also observed. The study was located in a rural setting with the student population drawn from the rural habitant. Due to high mobile device penetration in rural areas, the participants had previously interacted with a mobile device therefore making it easy to learn how to navigate the iPad features. The responses by the participants on ease of use of iPad for learning confirms that iPad can be introduced successfully in institutions of higher learning including those in rural environments.

The participants' responses on how iPad helped them solve problems gave iPad positive results and made it a potential learning tool for promoting student engagement and collaborative learning. Their responses praised the iPad's collaborative features of communication (Chat), connectivity to internet and access to stored content through shared content.

While the results of this study confirmed that iPad was a suitable device for learning, the excitement of the participants could not be ruled out. Therefore the perceptions expressed by participants should be applied by educators with a pedagogical decision-making and instructional design considerations. When this is done, critics of mobile learning may be pacified. Their argument that mobile devices are disruptive and hinder

learning, perhaps is true when students are left to use the devices in class without control. As Kinash, Brand and Mathew (2012) argue, educators should not waste their energy so much with students using their mobile devices in class, the fact that they will go to social media and surf the net, because in their view this is not categorically different from traditional class where students' minds wander while professors are teaching and use their pen and paper to doodle and write letters during class. Therefore, a lecturer must maintain class control and management in a mobile learning class, just like in a traditional class (Ileri & Omwenga, 2015).

The results from the logit model regression analysis provided indicators why participants preferred iPad as a learning tool. The results are useful to educators that may intend to use mobile technology. The indicators identified as predictors could influence the participants' perceptions to learning. It is therefore, informative to lecturers that building students' confidence, attention and providing user guides on use of instructional technology can aid in achieving learning outcomes.

6. CONCLUSIONS

The students who were the participants' perceived iPad as a good learning tool, which enabled them to engage in learning activities, connect with their classmates, and connect with new ideas. They also perceived that it was easy to use iPad, gained confidence and attention while learning. Most students indicated that they would purchase an iPad after the end of the semester. The results also showed that ease of use, confidence and attention were critical predictors of student's perception to use iPad as a learning tool. This research recommends the use of iPad as an instructional mobile device for higher learning institutions be included in rural catchments areas. Also lecturers intending to use mobile learning need to build students' confidence, attention and provide user guides on use of instructional technology. This will help in achieving learning outcome as designed by the lecturer. Finally, the lecturer must be in control of the class by providing learning activities that engage students with their mobile devices.

7. DIRECTION FOR FURTHER RESEARCH

For effective and useful integration of mobile devices in our classrooms, research needs to continue to examine: institutional and lecturer's readiness to integrate mobile learning in classes, positive and negative pedagogical effects of mobile learning, and the effects of multitasking and knowledge retention.

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