

Analysis of the Effect of Effort Expectancy on School Learners' Adoption and Use of Cloud Computing

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ABSTRACT The paper aimed to analyse the determinants of Cloud computing adoption and use among high school learners in East London School district. A closed ended questionnaire was administered and analysed through variance, kurtosis, correlation, and significance to studying Cloud computing adoption and use based on effort expectancy. There was a large positive correlation observed between 'Mobility which enables respondents to access real-time data' and 'less mental effort required to learn because of their skill at mobile devices' ($n = 116$, $r = 0.929$, $p = 0.000$). Because of this correlation, these sub-variables fell within the accepted Kurtosis range and were normal ($k = -0.022$, and $k = -0.393$). Considering the Kurtosis range of -1 to +1, all the variables were significantly normal. In view of the p values in this paper, the alternative hypothesis which stated that, effort expectancy will affect learners' intention to use Cloud was not rejected.

INTRODUCTION

Advances in the field of network based computing and applications on demand have led to an explosive growth of application models such as Cloud computing, software as a service, community network, web store, and so on. As a major application model in the era of the internet, cloud computing has become a significant research topic of the scientific and industrial communities since 2007 (Qi and Gani 2012). Furthermore, Cloud computing has generated a lot of interest and competition in the industry and it is recognized as one of the top 10 technologies of 2010 (Sharma 2012). Therefore in education, Cloud computing is considered to be the application of digital equipment to all aspects of teaching and learning. The use of ICT has brought about rapid transformation which involves the use of computers, internet and other information technologies.

The study of Virtual Software as a Service (VSaaS) Architecture for Cloud Computing Environment has provided a solution and the solution is that platforms are built with virtual personal desktop environment and remote display technology. Users use the client device to access the cloud operation system just like using the local computer (Patel and Chaube 2014). There are interactive whiteboard, personal computer, projector and wireless network access point for the Information Technology (IT) equip-

ment for classrooms that can provide teachers to incorporate information technology into Teaching.

Cloud computing is a tool to make IT related services available in a simplified manner hiding the complexities of those services, without really knowing and getting involved in the technicalities of how and what to do in providing the needed services (Patel and Chaube 2014).

The cloud computing appears to be truly obliging in rural educational contexts. There is a marvelous potential for cloud computing groundwork in rural schools. Cloud computing can assist rural education centers to accomplish effective use of their hardware and software supplies and to increase expertise in rural sector by cultivating the full exploitation of resources. Not only will it lead to improved education in rural areas but also in huge business opportunities and better educational facilities (Patel et al. 2014).

In the information age where ICT is transforming the educational landscape around the world, secondary schools in South Africa should rise up to the challenges ahead. Public expectation for ICT and educational systems has increased with the omnipresence of digital technologies in daily life. To date, the debate has been predominantly instrumental, focusing on the skills and the use of ICT in the service of curriculum and instruction. Although computers have been widely available in educational setting for well over two decades, a concern re-

mains that learners and teachers are neither confident nor competent users of ICT. The failure to use technology by many learners and teachers in the teaching and learning process is of particular concern. The implication for leaders in the delivery of IT service in school environment is to meet the reform agenda. Not only must they provide administration efficiencies, but also create an environment that appropriately supports technological innovation in school's teaching and learning. Most of the studies on innovation in higher education have centred on ICT software and hardware designs that are driven from information science (IS) or information technology (IT) perspective of behavioural intention to use the system on an individual level (Venkatesh and Zang 2010). Therefore, there is at various levels within any educational system, different expectations and drivers about technology's value and adoption on both personal and school level.

Research Objective

This paper was designed to investigate the determinants of Cloud computing adoption and application by learners in one selected high school in East London.

Having stated the purpose of the paper, the following is the objective of the paper: To determine the degree of variation that exists for effort expectancy on learners' intention to adopt and use Cloud computing.

Research Hypotheses

Based on the background, statement of the problem and research questions, the following alternative hypothesis (H_a) and null hypothesis (H_o) were stated:

H_a : Effort expectancy will affect the learners' intention to use Cloud computing.

H_o : Effort expectancy will not affect the learners' intention to use Cloud computing.

Literature Review and Theoretical Framework

Effort expectancy is the degree of ease associated with learners' use of technology (Venkatesh et al. 2003). Lenhart et al. (2010) found that 93 percent of teenagers, between the ages of 12 and 17 are going online. This number has remained consistent since 2006. Older teens ap-

pear to go on the Internet more frequently than younger teens. This could be in line with effort expectancy that gender, age and experience are posited as mediating factors for effort expectancy. Lenhart et al. (2010:9) stated: "Understanding an individual's technological environment is now a vital clue in understanding how that person uses the Internet, connects with others and accesses information. As of September 2009, 75 percent of adolescents own a cell phone. The amount of cell phone use among different adolescent groups (race, ethnicity, gender) is uniform. However, the ways in which females and males use cell phones varied.

The computer is also the most frequently used media for adolescents to connect online (Lenhart et al. 2010). Lenhart et al. (2008) suggests that location influences the quality of an adolescent's time spent online. This may include speed of the Internet, time of day online, parental monitoring, and the sites they visit. Landline use is more prevalent for conversations with friends while cell phones are used frequently for text messaging. Face-to-face communication and out-of-school interactions actually increase with age. Cell phone conversations are clearly prevalent in adolescents' daily lives. Not only do they talk on a cell phone but they also send frequent text messages. Adolescents are communicating in multiple ways to connect with their peers and this is the degree of ease that this paper wanted to ascertain. Today's learners were born during the period of computers, the Internet, and other new media technologies. The age gap that has been identified among technology users in literature needs to be bridged by ensuring that learners are allowed to use the Internet gadgets accessible to them in order to enhance their learning. Lenhart et al. (2008: 6) notes, "Teens appreciate the ability to revise and edit easily on a computer, but do not understand that computer usage helps to better their writing skill and improves the quality of their ideas". The research question on effort expectancy for this paper sought to demystify this claim so that proper conclusions are made based on the findings. The Internet is a tool that most adolescents rely on for research. It is reported that more than 90 percent of adolescents use the Internet. Lenhart et al. (2008) finds that Internet access is greater with teens from white or high-income families compared to low-income households or groups such as Hispanics. From the above information,

it can be noted that moderators such as age, gender and internet experience are regarded as having an effect on the learners' intention to adopt and use Cloud computing. However, the degree of ease associated with the use of Internet technology (effort expectancy) was tested in this paper.

Effort Expectancy Adapted from the Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) by Ajzen (1991) assists to understand how the behaviour of people changes. Briefly, according to TPB, there are three kinds of considerations, namely attitude towards behaviour (adapted from TRA), subjective norm (adapted from TRA) and perceived behavioural control. What perceived behaviour control means is the perceived ease or difficulty of performing the behaviour (Ajzen 1991). Ajzen (1991) believes that, the more favourable the attitude and subject norm and the greater control, the stronger should be the person's intention to perform the behaviour in question. Based on the TPB, this paper has identified effort expectancy as one of its main constructs that could affect learners' intention to adopt and use Cloud computing.

Based on the Unified Theory of Acceptance and use of Technology, gender, age and experience are posited as mediating factors for effort expectancy, which further affect computer self-efficacy and computer anxiety. From the perspective of effort expectancy in school settings, learners assess time and effort in forming views about the overall effort associated with the acceptance and use of technologies. In an educational context, price is also an important factor, unlike workplace technologies, learners have to bear the costs associated with the purchase of devices and services. Consistent with this argument, much consumer behaviour research has included constructs related to cost to explain users' actions (Dodds et al. 1991).

METHODOLOGY

The paper used a survey as a method to collect, analyse and process data from a quantitative approach. The nature of predictor variables did not allow manipulation; hence the variables in the paper were investigated in a survey (Panneerselvam 2008). A descriptive study was used

to outline and present circumstances and relationships concerning the research problem. This involved collecting data in order to answer research questions. Data collected through questionnaires were analysed using statistical analysis to answer the research question and verify the null hypothesis. The reported ICT literacy levels were analysed and correlated with each other. The socio-demographic characteristics of the learners included gender, age, grade, residential area, the kind of Internet devices they have, and major subjects studied.

Population

The researchers targeted a population of one thousand and twenty high school learners in the Eastern Cape Province of South Africa, because learners are at the forefront of Cloud computing technology. For the purpose of this paper, random sampling was used (Saunders et al. 2007) to examine the determinants of Cloud computing adoption and use by high school learners. A total of 286 questionnaires were distributed to high school learners and a total of $n = 116$ useful responses were received, yielding 40.6 percent response rate. The purpose of selecting such a sample was aimed at answering the research questions and meet the objectives of the paper.

Reliability and Validity

The Cronbach's Alpha test was used to test the reliability of the research instruments in order to confirm that they concurred with the objectives of the paper (Bell 2005). Responses from the pilot study were analysed for accuracy of meaning and objectivity. An instrument which measures accurately what the researcher expects to measure is valid. A pilot survey was used to test instruments against criterion and content validity benchmarks. There was a need to test the content validity of the research instruments as this ascertained that the items produced the relevant responses from the sample (Mugenda and Mugenda 2003). The Pearson correlation was used to analyse the learners' responses to determine the effect of effort expectancy on the learners' intention to use Cloud computing. In deciding whether to accept or reject the alternative hypothesis, one way analysis of variance was used.

RESULTS

Pearson Correlation

The following results represent the Pearson correlation results in relation to effort expectancy. Effort expectancy was measured using the following eight sub variables and responses given on a 4-point Likert scale ranging from strongly disagree to strongly agree.

- (a) Internet use for learning would be everywhere and useful.
- (b) Mobility enables me to access real-time data.
- (c) I would like to be able to launch a discussion on a learning forum through Internet devices.
- (d) I would like to be able to interact with teachers and classmates both inside and outside class via internet devices.
- (e) I would like to be able to engage in class discussion if I could share my thoughts in real-time through mobile devices.
- (f) It would not require me a lot of mental effort to learn because I am skilled at mobile devices functions.
- (g) It would be easy and clear to interact via mobile devices for learning.
- (h) It would be easier for me to ask help from others through mobile devices.

There was a large positive relationship found [$r(116) = +0.988, p < 0.05$] between the usefulness of Internet for learning when used anywhere, and the respondents' willingness to interact with teachers and classmates both inside and outside class via internet devices.

There was a large positive correlation found [$r(116) = +0.929, p < 0.05$] between the mobility which enables the respondents to access real-time data, and less mental effort it would require the respondents to learn because of respondents' skill at mobile devices' functions.

The results portrayed a large positive correlation [$r(116) = +0.953, p < 0.05$] between the respondents' willingness to be able to launch a discussion in a learning forum through Internet devices, and the use of Internet for learning which would be everywhere and useful.

The paper shows large positive correlation, [$r(116) = +0.973, p < 0.05$] between the respondents' willingness to be able to engage in class discussions if they could share their thoughts in real-time through mobile devices, and willing-

ness to interact with teachers and classmates both inside and outside class via internet devices.

A moderate positive correlation was found [$r(116) = +0.468, p < 0.05$] between the learners' encouragement to learn if they could access materials anytime and anywhere via mobile devices, and the use of Internet for learning purposes in enhancing the effectiveness of their learning.

A large positive correlation was found [$r(116) = +0.930, p < 0.05$] between the ease for respondents to ask for help from others through mobile devices, and the respondents' willingness to be able to launch a discussion on a learning forum through Internet devices.

Analysis of Variance

A one-way analysis of variance (ANOVA) between groups was conducted to compare the effect that Internet use for learning would be everywhere and useful has on the intention to use Cloud computing.

There was a remarkable influence of Internet use for learning everywhere, on the intention to use Cloud computing [$F(4, 111) = 136.325, p < 0.05$].

There was a noteworthy influence of mobility which enables learners to access real-time data, on the intention to use Cloud computing [$F(4, 111) = 85.475, p < 0.05$].

There was a significant influence of learners' interest in launching a discussion on a learning forum through Internet devices, on the intention to use Cloud computing [$F(4, 111) = 209.246, p < 0.05$].

There was a substantial influence of learners' interest to be able to interact with teachers and classmates both inside and outside class via internet devices, on the intention to use Cloud computing [$F(4, 111) = 122.281, p < 0.05$].

There was a significant impact of learners' interest to be able to engage in class discussion if they could share their thoughts in real-time through mobile devices, on the intention to use Cloud computing [$F(4, 111) = 130.589, p < 0.05$].

There was a significant effect of the belief that it would not require them a lot of mental effort to learn if they are skilled at mobile device functions, on the intention to use Cloud computing [$F(4, 111) = 40.405, p < 0.05$].

There was a momentous influence of ease and clarity to interact through mobile devices

for learning, on the intention to use Cloud computing [$F(4, 111) = 4.059, p < 0.05$].

As indicated in the results in Table 1, all the p values for effort expectancy were significant at the level of $p < 0.05$. This paper failed to reject the alternative hypothesis which states that “Effort expectancy will affect the learners’ intention to use Cloud computing”.

The alternative hypothesis was positively stated, and its acceptance means there is no way that the alternative hypothesis could be rejected as the ANOVA results show in Table 1.

DISCUSSION

Pardamean and Susanto (2012), while assessing user acceptance of blog technology using, the Unified Theory of Acceptance and Use of Technology established that both social influence and performance expectancy have a significant relationship with behavioural intention, whereas effort expectancy did not. The study further showed that behavioural intention did not have a significant relationship with actual usage level of blogs as a learning tool. Yahya et al. (2011) using UTAUT model researched on measuring user acceptance of E-Syariah portal in Syariah courts in Malaysia and found that

effort expectancy appeared to be significant and direct determinants of user acceptance and usage behaviour.

The current paper also found results that concur with the latter findings. From model 5 in Table 2, effort expectancy (EE) 1-8 contributed 0.106 of the total variation observed on behavioural intention to accept and use ICT. The correlation was (0.326) and R^2 (0.106). The regression equation is not significant with p value (0.229). The coefficient shows that EE1 is significant with p value (0.048), and it has positive influence on the behavioural intention to adopt and use Cloud computing.

Similarly to the significance of effort expectancy reported by Davis (1989), from model 6 (*cf.* Table 2) effort expectancy 1-8 contributed 0.193 of the total variation observed on behavioural intention to adopt and use Cloud computing. The correlation and the R^2 are (0.439 and 0.193) respectively. The regression equation is significant with p value (0.002) and the coefficient shows that EE6 is also significant with p value (0.000). Therefore EE has positive influence on the behavioural intention of the learners to adopt and use Cloud computing.

Moreover, the moderating effects of gender towards effort expectancy with respect to be-

Table 1: One way ANOVA for effort expectancy

		<i>Sum of squares</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig.</i>
Internet use for learning would be everywhere and useful.	Between groups	178.057	4	44.514	136.325	.000
	Within groups	36.245	111	.327		
	Total	214.302	115			
Mobility enables me to access real-time data.	Between groups	99.980	4	24.995	85.475	.000
	Within groups	32.459	111	.292		
	Total	132.440	115			
I would like to be able to launch a discussion on a learning forum through Internet devices.	Between groups	187.664	4	46.916	209.246	.000
	Within groups	24.888	111	.224		
	Total	212.552	115			
I would like to be able to interact with teachers and classmates both inside and outside class via internet devices.	Between groups	167.448	4	41.862	122.281	.000
	Within groups	38.000	111	.342		
	Total	205.448	115			
I would like to be able to engage in class discussion if I could share my thoughts in real-time through mobile devices.	Between groups	170.374	4	42.593	130.589	.000
	Within groups	36.204	111	.326		
	Total	206.578	115			
It would not require me a lot of mental effort to learn because I am skilled at mobile device functions.	Between groups	113.595	4	28.399	40.405	.000
	Within groups	78.017	111	.703		
	Total	191.612	115			
It would be easy and clear to interact through mobile devices for learning.	Between groups	249.254	4	62.314	4.059	.004
	Within groups	1703.918	111	15.351		
	Total	1953.172	115			

Table 2: Regression analysis summary

<i>Model</i>	<i>Independent variables</i>	<i>Dependent variables</i>	<i>R</i>	<i>R²</i>	<i>Significance</i>
1	PE 1-10	BI(1)	.425	.181	.047
2	PE 1-10	BI(2)	.346	.120	.153
3	PE 1-10	BI(3)	.519	.270	.000
4	EE 1-8	BI(1)	.352	.125	.262
5	EE 1-8	BI(2)	.326	.106	.048
6	EE 1-8	BI(5)	.439	.193	.002
7	SI 1	BI(1)	.290	.084	.214
8	SI 1	BI(2)	.234	.055	.500
9	SI 1	BI(3)	.304	.092	.533
10	FC 1	BI(1)	.280	.078	.168
11	FC 1	BI(2)	.259	.067	.251
12	FC 1	BI(3)	.220	.048	.448

havioural intention of technology usage conform to the results reported by Venkatesh et al. (2003).

It was also noted from the results of the current paper that male respondents are 41.7 per cent more likely to use Cloud computing devices in future than female respondents are (38.2%). These results suggest the need to provide more user-friendly interfaces for Cloud computing outlets such as school repositories to facilitate both access and easy dissemination of educational content for school learners.

Despite effort expectancy being found influential towards the use of technology in the original model (Venkatesh and Zhang 2010), other studies found to be insignificant predictor of the intention to adopt mobile banking (Yu 2012). Venkatesh et al. (2003) says that three constructs (perceived ease of use, complexity, and ease of use) from other models have similar meanings with effort expectancy construct. As such, perceived ease of use was found to have significant effect on intention to use 3G technology among Malaysians (Suki 2012).

The results of another study demonstrated support for the previous studies, which found that effort expectancy and its derivatives such as perceived ease of use, to be key determinants of behavioural intention to use cloud computing technology among Malaysian consumers and students respectively (Suki 2012). In another words, if the users feel that operating the technology does not require a lot of mental effort; they are more likely to adopt and recommend it to others. Therefore, the alternative hypothesis that H_a : effort expectancy will affect the learners' intention to use Cloud computing, was fully supported.

Perceived ease of use (as a construct for effort expectancy) is about the degree to which a person believes that using a particular system would be free of effort (Davis 1989). The ease of use scale developed by Davis (1989) considers ease of learning. This "ease of learning" evident in the Davis' (1989) ease of use scale, for example, system is clear and understandable; system requires low mental effort; easy to get the system to do what one wants. Davis (1989) finds perceived ease of use significantly correlated with current usage and future usage of computer. Naturally, inclination and approval would be based on the level of ease.

CONCLUSION

Effort expectancy is related to how easy an individual believes the system is easy to use. Based on the p values, effort expectancy had a positive influence on the behavioural intention of the learners to adopt and use Cloud computing in their school activities and is highly significant with p values < 0.05 . The paper therefore concludes that effort expectancy has a positive influence on the behavioural intention of the learners to adopt and use Cloud computing in their school activities.

Drawing upon other research, effort expectancy is more salient for females than males. Prior research supports the notion that constructs related to effort expectancy will be stronger determinants of individuals' intention for females and for older users of technology. Drawing from the arguments made in the context of performance expectancy, the researcher expects gender, age, and experience to affect the use of Cloud computing. Thus, this paper did not find effort

expectancy to be significant for females, particularly those who are older and with relatively little experience with Internet devices since the learners were mostly within the same Grade and age group. In this paper, gender has been demonstrated to play a significant role in the learners' intention to use Cloud computing.

RECOMMENDATIONS

For learners to be able to adopt and use Cloud computing, the schools should introduce Internet technologies that are easy to use. The model postulates that individuals are likely to show interest in technology usage if that technology is easy to use.

Since age, gender and experience are considered to play significant moderating roles for effort expectancy, schoolteachers should apply differentiated teaching to enhance differentiated learning. This calls for teachers to study each learner's background and preferences when it comes to technology use before they dictate information to them.

In order to ease the process of learning as this paper aims, it should be a priority for all involved, to ensure a trouble-free introduction of e-learning to the South African schools' curriculum.

The teaching of Computer Applications Technology should not only be reserved for certain schools, but compulsory for all schools and be left to the learners to choose for themselves. This is the only way that could fast-track learners to effectively participate in meaningful learning and counteract the low levels of Internet self-efficacy noted in this research.

For the new processes to be successfully introduced, it is important that courses on the new methodology be developed for the learners, the teachers in training and for practicing teachers. Technological methodology training cannot be left to schools to provide, and in future years, e-learning methodology must become an essential part of teacher training.

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