

A Framework for E-Learning Implementation in Developing Countries: A Students' Perspective

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Abstract. Institutions of higher learning in developing countries have lagged behind those in the developed world in e-learning (eL) adoption, mainly due to cost and poor Internet infrastructure. Introduction of eL in such institutions is often complex involving introduction of new technology, resistance by users and alignment issues. Most eL research in developed countries is on continuity, which is not the case in developing countries. The aim of this chapter is to address this gap by investigating whether Mombasa Polytechnic University College (MPUC) students, who had never had any eL experience, would accept it. The model used in this case is a Modified Unified Theory of Acceptance and Use of Technology (UTAUT). In this chapter, we adopt a survey approach supplemented by case studies. The findings are that majority of the students believe that their results will improve with eL and that a blended learning system or 'Click-n-Mortar institution with many courses online' is the best model for MPUC and similar institutions. The research proposes a framework for eL implementation. The findings are beneficial to institutions of higher learning in developing countries.

Keywords: E-learning adoption frameworks, Technology Acceptance, face to face learning, Moodle, Developing Countries.

1 INTRODUCTION

A notable problem in Kenya over the years has been lack of absorption capacity of the ever increasing large number of high school leavers who qualify to join university. According to [39], in the year 2008, only 16,629 out of 72,000 students who qualified for university admission were offered places in public universities. In Kenya, selection is usually pegged on bed space and the overall capacity of each of the current seven public universities.

The Government of Kenya has been upgrading middle level colleges into campuses and constituent colleges of the 7 public universities so as to meet the high demand; a move that has resulted in acute shortage of qualified lecturers. To address

the shortage, higher learning institutions have embarked on the use of ICT in education, thus embracing e-learning. On its part, the Kenya Government has set up a national platform on the adoption and use of eL (<http://kelc.org>) to support educational institutions.

A number of definitions of e-Learning have been proposed in literature [28; 24]. However, [34] provides one of the most comprehensive of these definitions, arguing that eL is the instructional content or learning experiences delivered or enabled by electronic technology which consists of the Internet, intranets or extranets, audio and videotapes, satellite broadcast, interactive TV, CD-ROM among others.

E-learning technologies revolve around ICT, with the internet as the backbone technology. The rapid development and growth of ICT over the years has led to the emergence of many eL technologies as listed by [49]. Most academic institutions combine the different eL technologies with traditional learning. This is described as 'blended learning', which is a combination of eL and face-to-face (f2f) learning [23]. The most current technology used for eL is mobile technology [30], which apart from communication; is increasingly used to deliver learning experiences.

The chapter presents the results of an investigation of an eL implementation framework for MPUC, Kenya, which could be extended to similar institutions in the country and in other developing countries with comparable infrastructural and social economic development. The aims and objectives of the investigation were:

- 1) To research and evaluate the current and emerging e-learning implementation frameworks in higher institutions of learning.
- 2) To survey e-learning platforms in Kenyan universities and tertiary colleges
- 3) To carry out a requirements analysis for the hardware and software infrastructure in MPUC for E-learning implementation.
- 4) To establish the views of students in MPUC regarding the implementation of E-learning

The feasibility study of eL implementation at MPUC aimed at pointing out the gaps in both hardware and software needs which have to be met. The study also identifies the general attitudes and views of MPUC students towards eL.

The rest of this chapter is structured as follows. Section 2 presents the background of the research, Section 3 presents the methodology, Section 4 presents the results and discussion, Section 5 presents solutions and recommendations, and Section 6 presents the conclusion and future research directions.

1.1 BACKGROUND INFORMATION ON MPUC

MPUC is an institution of higher learning that has passed through distinct phases from a technical training institute to a University college in a span of sixty years. MPUC has a total of 7,342 students spread in sixteen departments, 4,737 being male and 2,605 female. Admissions, typical of the other institutions, are pegged on the capacity of facilities such as accommodation, class rooms, staff and equipment.

MPUC, a technology training institution needs to improve the quality of its knowledge assets in the form of subject and industry knowledge. Some subject notes comprise of old handouts or books that are now worn out. Others have been photocopied many times to the extent of losing clarity.

2 RELATED WORK ON E-LEARNING ADOPTION

According to a survey carried by the Sloan Consortium in over 2500 colleges and universities in the United States, nearly 3.94 million students were taking at least one online course during the fall 2007 term, which was a 12% increase compared to the previous year [4]. This explosion is best explained by [38] who postulates that customers (learners) are drawn to the WWW because of everything there is to offer. He further argues that more businesses go online in search of the customers, which brings more customers to the web resulting in a positive loop. Unlike in the United States, colleges and universities in developing nations have lagged behind in eL adoption mainly due to cost and poor internet infrastructure [19].

The introduction of eL in teaching institutions is often complex and meet with resistance by educators [31]. Faculties run by techno-savvy educators will embrace any technology in their work, while others prefer the traditional approach [6]. IT solutions are meant to help the organization achieve some objective(s) and care should be taken to ensure alignment with the organizational strategy, so as to remain relevant and contribute towards the achievement of the strategic objective(s) [52; 53]. Introduction of “leading edge” technology such as an eL system is a major risk. The new system is un-tested and there is no guarantee on its performance and limitations [54]. It is therefore imperative that before adopting eL, MPUC addresses: stakeholder’s views; a strategy of implementation to be adopted and lastly, the choice and selection of a Learning Management System (LMS). A framework that addresses three concerns can be achieved by answering the questions:

- i) How does MPUC ensure that its students would accept eL if adopted?
- ii) Which is the best eL implementation strategy for MPUC?
- iii) Should MPUC adopt a Commercial-off-The-Shelf (COTS) or an Open Source Software (OSS) LMS?

2.1 E-learning Adoption Models

Varied theoretical frameworks are used to analyze the individual’s acceptance of technologies. Research in Information System acceptance has been influenced by intention-based models rooted in cognitive psychology, such as Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB) and their extensions; Technology Acceptance Model (TAM), TAM2 and Unified Theory of Acceptance and Use of Technology (UTAUT) [29].

Technology Acceptance Model (TAM). TAM is one of the most used research models in the study of technology acceptance [44] associated with many studies, validations

and reviews over the last 15 years [50; 15; 1; 45]. According to [27], TAM was adapted from the fundamental constructs of the Theory of Reasoned Action (TRA) developed by [18]. TAM theorizes that an individual's behavioral intention to accept a technology depends on two beliefs: perceived usefulness and perceived ease of use, which influence computer user's intentions and actual computer usage behaviour [50; 44]. Based on these two facets, users of any technology will always accept it, if it is deemed useful and is easy to use.

Several attempts have been made to enhance the predictive power of TAM by integrating it with other models, adding other variables and constructs [26]. The many enhancements point to TAM simplicity or lack of comprehensiveness. The model does not take into consideration social influence, demographic factors, experience and gender as factors affecting behavioral intention in acceptance of eL [13]. The model is thus limited as it stands.

Perceived Attributes Theory (PAT - Rogers' Diffusion of Innovation). Rogers (cited in [27], defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". According to [25], the diffusion process occurs within the society as opposed to the adoption process that pertains to an individual. In line with [25], the focus of this research is adoption process pertaining to a student and not the diffusion in the society. The model focuses more on technology attributes than individual characteristics. Just like TAM, it also assumes that social influence does not affect eL adoption and is more applicable to lecturers, who are beyond the scope of this research.

Unified Theory of Acceptance and Use of Technology (UTAUT). A review of literature by [42] involving eight technology user acceptance models (TRA; TAM; motivational model; theory of planned behaviour; model combining TAM and theory of planned behaviour; model of PC utilization; innovation diffusion theory; and social cognitive theory) resulted in an integrated model Unified Theory of Acceptance and Use of Technology (UTAUT). According to [3], integration has decreased the need for researchers to choose from among a multitude of models. It ensures that all important factors affecting behaviour intention from the eight models are taken into account thus minimizing assumptions and greatly easing the work of a researcher.

A model, which unlike the original TAM does not include attitude towards behaviour, was developed by [46]. Although [48] stresses the importance of attitude stating that it affects how well one responds to something, it was found not to be a statistically significant determinant of behaviour intention [8]. There is a thin line between attitude and behaviour intentions because generally our behaviours are affected by the attitude we hold to anything.

UTAUT which was validated by [46] has been applied in a number of studies. It has been extended to study learners' continuance intentions in web-based learning, though contrary to their hypotheses, social influence and facilitating conditions were not significant predictors of continuance intention [14]. Though the [14] model is relevant in as far as our study is concerned, it assumes that the learners

have already adopted web-based learning and only investigates their continuity intentions. UTAUT was applied in exploring the adoption of ICT in a Government organization in India, a developing country, in which findings were that performance and effort expectancy, social influence and facilitating conditions all positively impact the use of ICT [21].

2.2 Adoption of UTAUT to MPUC

UTAUT model integrates eight models, takes into account the social influence factor which was overlooked by TAM and PAT and factors in the effects of student characteristics such as age, gender and experience on the behaviour intention. It is therefore chosen as the best model for this study.

In line with the definitions by [42], performance expectancy is defined as the extent to which an MPUC student believes that using eL will help him or her to achieve the learning goals. Effort expectancy is defined as the extent of ease associated with the use of eL. Social influence is defined as the degree of importance a student attaches to others believes that he or she should adopt eL. Facilitating conditions is defined as the degree to which a student believes that an Organizational and technical infrastructure exists to support use of eL.

Research by [19] found that poor internet access, among other factors; have an effect on the rate of technology diffusion in the Nigerian Universities. The [13] model took into account internet access as an external variable. Internet access is the main facilitating condition for eL adoption for MPUC students; hence, in figure 1, internet access replaces facilitating conditions. Voluntariness of use would have no significant effect since undertaking eL will be assumed to be optional.

Based on the MPUC students UTAUT model, the following hypotheses are proposed:

- H1** Performance expectancy has a positive effect on behavioral intention to use eL.
- H1a** Performance expectancy influences behavioral intention to use eL more strongly for men than for women.
- H1b** Performance expectancy influences behavioral intention to eL more strongly for younger students than their older counterparts.
- H2** Effort expectancy has a positive effect on behavioral intention to eL.
- H2a** Effort expectancy influences behavioral intention to use eL more strongly for female students than for their male counterparts.
- H2b** Effort expectancy influences behavioral intention to use eL more strongly for older students than for younger students.
- H2c** Effort expectancy influences behavioral intention to use eL more strongly for experienced students in ICT than for the inexperienced students.
- H3** Social influence has a positive effect on behavioral intention to use eL.
- H3a** Social influence has a positive effect on behavioral intention to use eL more strongly for female students than for their male counterparts.
- H3b** Social influence has a positive effect on behavioral intention to use eL more strongly for older students than for younger students.

- H3c** Social influence has a positive effect on behavioral intention to use eL more strongly for experienced students in ICT than for the inexperienced students.
- H4** Internet access influences student’s acceptance of eL use.
- H4b** Internet access influences student’s acceptance of eL use more strongly for younger students than for older students.
- H4c** Internet access influences student’s acceptance of eL use more strongly for inexperienced students than for experienced students.
- H5** Behavioral intention toward eL has a positive influence on eL acceptance.

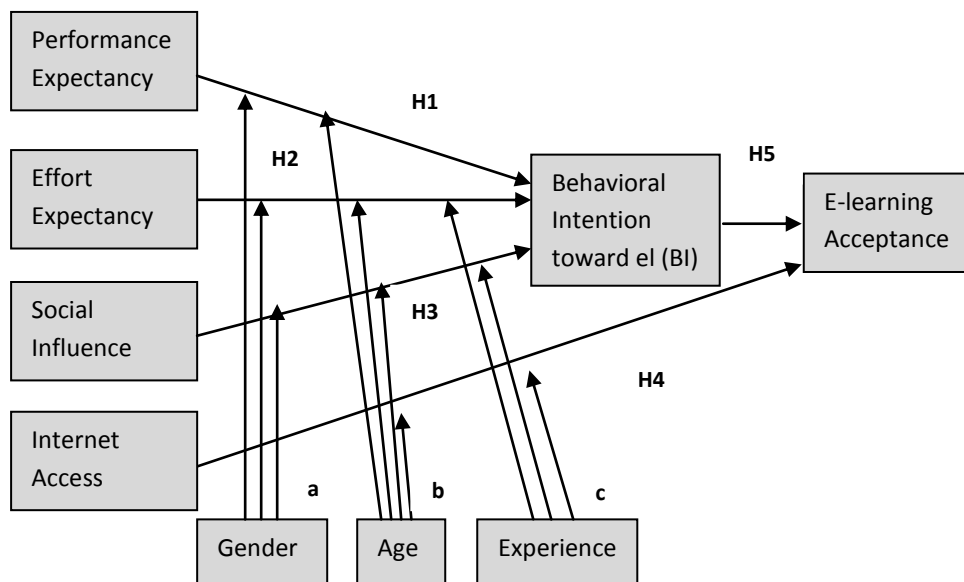


Figure 1: MPUC student acceptance model based on UTAUT

2.3 E-learning Implementation Strategy

For any institution to survive in a competitive environment and attain its goal, it must have in place an effective strategy. Strategy is defined as the future direction and actions or approaches of a company/organization for achieving specific objectives [11]. It is about how an institution chooses where to compete, how to structure and organize and the means by which resources may be allocated in order to compete effectively. Some of these can be determined using CommonKADS [2].

Although eL opens a door of opportunities in tapping the world market, it also opens a door for threats [35]. Porter’s model can be used to explain the threats brought about by embracing eL as:

- i) Threats of new entrants. Any institution that adopts eL enters into the global market.
- ii) Threats from substitute online courses or programs
- iii) Threats from traditional rivals
- iv) Increased bargaining power of e-learners (those that undertake programs via eL).

The shortcoming in Porter's model is that it assumes that the education curriculum is standard worldwide, which is not the case. A Kenyan student with a B+ grade in the Kenya Certificate of Secondary Education (KCSE) will be eligible to enroll in any online course in Kenyan Universities but not necessarily be eligible for the same course elsewhere. There are other barriers in the global market e.g. language. An online course designed in English would not tap into the French, Spanish and solely Arab speaking society.

The presence of organizations in the internet is categorized into six phases [37]. The phases are general and would help any learning institution to identify and assess their current status in terms of internet presence and in determining their ultimate goal. MPUC needs a strategy that would specifically guide to restructure and organize itself. According to [16], four e-business strategies that are used by different types of organizations include:

- i) Click- and-mortar organizations that use many e-business applications
- ii) Click- and-mortar organizations that use only one or two applications
- iii) Click-and-mortar organizations that use one e-business application that fundamentally changes their business
- iv) Pure-play e-business organizations that conduct their businesses purely online.

Two broad categories specific to eL implementation can be formulated out of these strategies as;

- Click-and-mortar organizations that offer blended learning, a combination of eL and traditional face-to-face learning [23].
- Pure-play organizations that have all their courses and programs online.

Organizations that adopt these two strategies would ultimately be in phase 4 of the [37] categories of internet presence. Click-and-mortar organizations that offer blended learning can further be divided into:

- click- and-mortar organizations that have many courses and programs online.
- Click- and-mortar organizations that have only one or two courses online.

A Pure-play organization is not a viable strategy for institutions that offer practical engineering and technical courses that entail workshops and laboratories like MPUC. The option of Click-and-mortar institution that offers blended learning is most viable for MPUC. The question of whether to have many courses or just a handful online can only be answered from the overall institutional strategy. From

the MPUC website www.mombasapoly.ac.ke, its vision is to be a centre of excellence in both vocational and technical training. Its mission is to provide high quality training in specialized disciplines and produce graduates with desirable attitudes, skill and knowledge for the Kenyan labor market and beyond. Having many courses online is more towards excellence than having only two courses online. This could include all those that do not require workshops and laboratories.

2.4 COTS versus OSS LMS Adoption

Debate on Commercial-Off-The-Shelf (COTS) versus Open Source Software (OSS) has been on for some time, although research on the same is limited [41]. The term LMS refers to software designed to provide a range of administrative and pedagogic services. Other terms used include Virtual Learning Environments (VLE) and Course Management Systems (CMS). So far, LMS have become synonymous to e-learning worldwide [12].

COTS LMS. By marrying definitions by [32] and [40], COTS can be defined as software that must be paid for and used without change by the purchaser. Buyers only receive binary code which they cannot modify and are only licensed to use the software for a given period [47], as the source code remains the property of the software vendor. Various COTS LMS products are available, such as Blackboard, Cose, Learnwise and webCT [7]. Advantages of COTS include: use of elaborate and standard development methodologies, thorough tests, wide range of functionalities, and constant reviews and updates. Some of the disadvantages associated with COTS include: price increases and license changes, functionality duplication across different products, and redundant functionalities which slow down performance [17; 36; 40]. COTS do not support some institutional objective and strategies such as collaboration and innovation due to interoperability limitations between products used by different institutions.

Open Source Software (OSS) for E-learning. The term open source was coined in 1998 having previously been known as free software [51]. Open Source Initiative (OSI) (<http://www.opensource.org/>), defines open source as a development method for software that harnesses the power of distributed peer review and transparency of process. The software source code is publicly available and free of charge [22], though the word ‘free’ is not necessarily zero price, but means freedom. According to [47] open source features include:

- Source code that is distributed with the software or otherwise made available for no more than the cost of its distribution
- Free redistribution without royalties or licensing fees from the author
- The software can be modified by anyone or derive other software from it, and then distribute it under the same terms.

Freedom includes: right to run the program for any purpose, study on how it works, adaption, copy redistribution, and improvement and sharing of the program with the community. Dissatisfaction in COTS LMS has contributed to increased interest in OSS LMSs. Moodle in Europe and Sakai in America, are the leading and

most viable OSS [36] in those regions. OSI argues that software evolves when programmers can read, redistribute and modify its source code because the community improves it, adapts it and fixes it at speed. The set of roles and tasks that may be done in an open source project are classified by [20]. They also argue that OSS can be of high quality and very robust due to the independent peer review and prompt feedback. With time, passive users evolve into active or directly into non developers who end up reporting bugs or suggesting new features.

According to [5], OSS benefits for learning include: rapid and organic evolution, rapid fulfillment of user's needs, frequent updates of well tested superior quality software compared to COTS, collaboration and sharing of resources, and enhanced innovation in teaching and learning. While OSS has the advantage of limitless opportunities for system modification, COTS is highly scalable, comprehensive and extensible [41]. OSS is also making inroads into Government IT systems [17].

Disadvantages associated with OSS include: trapping of customers by using them to test and give feedback before charging them once the product is stable; lack of formal discipline in development methodologies; dependence on the initial designer for product quality despite the many reviews; lack of focus on ease of use; poor documentation; poor support; difficult to guarantee maintenance periods and low security levels [32; 5; 9]. Some of the disadvantages can be mitigated such as dependence on the initial designer. Initial design of products can be improved through joint collaborations of stakeholders with a common goal. A good example is the SAKAI project (<http://sakaiproject.org>) which was born out of collaboration between academic institutions, commercial organizations and individuals to develop a common Collaboration and Learning Environment (CLE). It can also be argued that security issues are not limited to OSS, as COTS or even Microsoft products are known to be vulnerable to attacks.

Moodle, which stands for Modular Object-Oriented Dynamic Learning Environment (www.moodle.org), requires a minimum of 160MB disk space, minimum memory of 1GB, Apache HTTP server and PHP as the scripting language (http://docs.moodle.org/en/Installing_Moodle). Its main advantage over other LMS is its strong grounding on social constructionist pedagogy (effective learning that is achieved when constructing something for others to experience or for later use such as taking notes); runs without modification on Unix, Linux, Windows, Mac OS X, Netware; and is available in 40 languages.

In summary, UTAUT takes care of the limitations in TAM and other models, making it the ideal model to apply in the MPUC. Performance expectancy, effort expectancy, social influence and internet access constructs that are used from UTAUT to determine eL acceptance by MPUC students using age, gender and experience as the moderating effects. The best eL implementation strategy for MPUC is the 'click- and-mortar', with many courses and programs online. The pure-play institution option is not viable for technical courses like engineering. Academic institutions have adopted different OSS for lack of a standard LMS. ATutor, SAKAI and Moodle are the most popular OSS LMS in use; however Moodle has an edge over the other two.

3 METHODOLOGY

The Survey used questionnaires and interviews to collect data from MPUC students. Use of two instruments ensured triangulation of findings in the research [10]. Depending on the population size, questionnaires are relatively inexpensive and allow easy statistical analysis of the results. When designed properly, questionnaires save on time and are much easier for the respondents. Structured questionnaires were administered on all students while interviews were accorded to a few representatives from each group.

The target population included the entire student fraternity. Due to the large size of the student population (7, 332), a representative sampling technique, in which important subgroups are represented according to their incidence in the population was considered. This entailed having at least one class of certificate, diploma, higher diploma and degree in each of the ten departments in MPUC. The degree classes were from three departments of Electrical, Business and Applied science. These were the only degree programs running at the time of the research. Largely there are two groups of students emanating from their modes of study, the regular students who are also known as full-time, and the part-time students who mainly study in the afternoon or evening. The questionnaire was administered to both regular and part-time students. The response rate was very high (87%), comprising of 871 students out of a sample of 1000.

The questionnaire draws on the hypotheses formulated from the UTAUT model, which combines closed question format with lists, category and scale. The instrument comprised of six parts that were meant to test the hypotheses formulated:

- i) Demographic information that captured the gender, study mode, age group, faculty, department and the course level
- ii) Internet access that captured the frequency of use, length of use, frequent source of internet access, main reason of using the internet and some of the problems encountered in the use of internet.
- iii) Effort expectancy that captured the percentage of students with basic internet skills and those who needed training.
- iv) Performance expectancy that captured the beliefs of students in excelling, using eL.
- v) Social influence that captured the influence of friends and family on MPUC students
- vi) Behavioral intention that captured the student intentions towards eL.

The items used to measure Performance Expectancy, Effort Expectancy, Social influence and behavioral intentions were adopted from [42] UTAUT model. For Internet access, the items used were mainly adopted from [33].

The instruments were Pre-tested with help from four key staff of Computer Science department. After the pre-test, the wording and the arrangement of the items were adjusted for precision. The Likert scales of 1 – 5 was used with the following anchors: “Strongly Agree (SA) - 1”, “Agree (A) - 2”, “Neutral (N) - 3”, “Disagree (D) - 4” and finally “Strongly Disagree (SD) - 5”. The responses were

analyzed using both quantitative and qualitative methods. For ease of data entry and analysis thereof, the data collected was coded and entered using the Statistical Package for Social Sciences (SPSS). The results of the analysis are shown in graphical forms such as bar charts, pie chart and pivot tables.

4. RESULTS AND DISCUSSION

The results and their evaluations outlined in this section follow the set of hypothesis developed from the related literature. Each hypothesis is stated, the results given in accordance to Crosstabs' ordinal-by-ordinal measure and then evaluated. The three main statistical tests considered are: Kendall's tau-b (Kb), Kendall's tau-c (Kc) and Gamma tests which classify pairs as concordant or discordant. The three statistical vales are also referred to as the "Kendall's three values".

H1: Performance Expectancy (PE) has a positive effect on Behavioral Intention (BI) to use eL.

Concerning PE, a total of 81% of the subjects responded to the relevant section of the questionnaire believed that eL would improve on their grades. 10% were neutral with less than 4% disagreeing. On BI, a total of 71% are positive, 15% neutral and 11% disagreed that they intended to use eL. Kendall's three values have an error margin of less than 4%.

The fact that 81% of the respondents agree that eL would improve on their grades indicate that students in MPUC have a positive attitude towards eL. This means they believe that eL positively impact on their performance compared to the current face to face learning. The results of Kendall's three values fall between 0 and 0.5, hence a statistically significant association is found, though not strong. There is confidence in these values as the margin of error is small for all the values. Therefore, given these findings, the hypothesis that Performance Expectancy (PE) has a positive effect on Behavioral Intention (BI) to use eL was accepted.

H1a: PE influences BI to use eL more strongly for the male students than for the female students.

Results based on gender show that Kendall's three values for female students are higher than those of male students. There is confidence in the values as the margin of error is small ranging between .045 – .074 for females and .032-.050. There is confidence in these values as the margin of error is less than 8% for all the values. This means that the association between the variables PE and BI is slightly stronger for the female students compared to their male counterparts. These findings do not support the hypothesis that PE influences BI to use eL more strongly for the male students than for the female students. The pointer to this finding is that the female students have realized and appreciated the importance of ICT in learning, a field that is mostly dominated by male students.

H1b: PE influences BI to use eL more strongly for younger students than their older counterparts.

The respondents were split into four age groups of between 17 and 20 years, 21 and 24 years, 25 and 27 years, and over 28 years. Results in the categories show: age group of over 28 years to have the highest values of Kb, Kc and Gamma followed by age group 17 – 20, age group 21 and 24 and lastly that between 25 and 27 years. However Kc value for age group 25-27 is higher than that of the age group 21 - 24.

The error margin for the over 28 category is a bit on the higher sides (21% for Gamma, 14% for Kc and 16% for Kb) hence the confidence level for these values is low. The findings indicate that PE influences BI to use eL more strongly for students between 17 - 20, then 21 - 24 and lastly those between 25 - 27 years. The high error value for over 28 years age group it attributed to the small number of respondents in this age group (36). All other age groups indicate Kendall's three values of between 0 and 0.5, hence a statistically significant association is found, though not strong. The findings support the hypothesis that PE influences BI to use eL more strongly for younger students than their older counterparts.

H2: Effort Expectancy (EE) has a positive effect on BI to use eL

85 % of the respondents to the relevant section are in agreement that they will find eL easy to use, 9% neutral and less than 5% disagreeing. A test of Crosstabs' ordinal-by-ordinal measure on whether EE has a positive effect on BI to use eL shows an error margin of less than 4% for all the values, hence there's high confidence in these values.

A big majority in agreement means that the mode of learning will be widely accepted. Ease of use represents effort expectancy. Some orientation will be necessary for the disagreeing group. The results indicate that Kendall's three values fall between 0 and 0.5, hence a statistically significant association is found, though not strong. This indicates that there's a positive association between students who believe that they will find eL easy to use and those that intend to use eL. These findings are in line with the hypothesis that effort expectancy (EE) has a positive effect on BI to use eL, hence the hypothesis is accepted.

H2a: EE influences BI to use eL more strongly for female students than for their male counterparts.

Comparative results based on gender cross tabulation on EE verses BI based on gender show higher figures of Kendall's three values for females compared to male students in all the three cases. There's confidence in these values as the error margin for the male student is less than 5%, while for the female it is less than 8%. This means that the association between the variables EE and BI is slightly stronger for the female students compared to their male counterparts. These findings support the hypotheses that EE influences BI to use eL more strongly for female students than for their male counterparts. The hypothesis is accepted.

H2b: EE influences BI to use eL more strongly for older students than for younger students.

Results show that the age group of over 28 years has the highest Kendall's three values, followed by the age group 25-27, 21 and 24 and lastly that between 17-20 years. The category of over 28 has a high error margin of 21% leading to low

confidence level, hence will not be considered. This, again, can be attributed to the low number of respondents in this category. The findings indicate that EE influences BI to use eL more strongly for students between 25 -27, then 21 and 24 and lastly those between 17 and 20. There is consistency in the values decreasing from age group 25 - 27 to the youngest age group. Ease of use is attributed to effort expectancy. The hypothesis that EE influences BI to use eL more strongly for older students than for younger students is supported by the data. It can be argued that younger students are characterized by inquisitiveness compared to their older counterparts. They will thus not mind adding more effort.

H2c: EE influences BI to use eL more strongly for experienced students in ICT than for the inexperienced students.

Kendall's three values for the different length of internet use show the highest error margin being 13% for the category of those who have never used internet. The results are not very consistent or in line with the literature that EE influences BI to use eL more for experienced students in ICT than the inexperienced. For the category of those who have never used the internet, Kendall's three values show a positive association, though not very strong. They also have a relatively high error margin (10%, 8% and 13% respectively) hence low confidence. The category with more than 4 years has the highest value of Gamma followed by that of between 1-2 years. Thus, based on the results, the hypothesis that EE influences BI to use eL more strongly for experienced students in ICT than for the inexperienced students is accepted.

H3: Social Influence (SI) has a positive effect on BI to use eL

A total of 34% of the respondents either strongly agree that they would use eL if their friends do so. 18% remained neutral while 46% disagreed that their friends would influence them. Kendall's three values show error margins of less than 5%. The results indicate that all Kendall's three values fall between 0 and 0.5, hence a statistically significant association is found, though not very strong. This indicates that there's a slight positive association between students who would use eL if their friends did so and those that intend to use eL. These findings support the hypotheses that Social Influence (SI) has a positive effect on BI to use eL hence validating the hypothesis further.

H3a: SI has a positive effect on BI to use eL more strongly for female students than for their male counterparts.

Results show Kendall's three values to be positive for male students and negative for the female students with error margins being less than 7%. The negative values depict a negative association between SI and BI to use eL, though not very strong (discordance relationship). Female students have a negative association between SI and BI to use eL while the reverse is true for the male students. The values are positive depicting a positive association between SI and BI, though again not very strong (concordance relationship). These results do not support the hypothesis that SI has a positive effect on BI to use eL more strongly for female students than for their male counterparts, which is therefore rejected.

H3b: SI has a positive effect on BI to use eL more strongly for older students than for younger students.

Kendall's three values are positive for the age group 17-20, 21-24 and 25-27 years and negative for over 28 years. The error margins for the over 28 age group are very significant (the highest is 23%), hence low confidence and could not be considered. This, again, can be attributed to the low number of respondents in this category. The findings indicate that SI influences BI to use eL more strongly for students between 25 -27 years. Those between 17-20 and 21-24 have almost similar values. The results are contrary to the hypotheses that SI has a positive effect on BI to use eL more strongly for older students than for younger students. The hypothesis is therefore rejected.

H3c: SI has a positive effect on BI to use eL more strongly for experienced students in ICT than for the inexperienced students.

Kendall's three values for the different length of internet use are show the highest error margin to be 14% for the category of those who have never used the internet. Those who have used the internet for 1-2 years, Kendall's three values show a negative association (discordance relationship), though not very strong. On the other hand, the other categories have positive association between the two variables (concordance) although there is no clear pattern of increasing or decreasing values in the measures. From these findings, the hypothesis that SI has a positive effect on BI to use eL more strongly for experienced students in ICT than for the inexperienced students was rejected.

H4: Internet Access (IA) influences student's acceptance of eL use.

Results show that out of 871 respondents in MPUC, 26% use the internet daily, 28% weekly, 6% monthly, 31% occasionally and 9% declaring never to have used the internet. Crosstabs' ordinal-by-ordinal measure of whether IA influences students acceptance of eL show that Kendall's three values fall between 0 and 0.5, hence a statistically significant association is found, though not strong (concordance relationship). There is confidence in these values as the margin of error is small for all the values. These findings support the hypotheses that Internet Access (IA) influences student's acceptance of eL use. The hypothesis is accepted.

H4b: IA influences student's acceptance of eL use more strongly for younger students than for older students.

Crosstabs' ordinal-by-ordinal measure results show that Kendall's three values are positive for the age group 17-20, 21-24 and 25-27 years and negative for over 28 years. The error margins for over 28 age group are very significant the highest being 24%. Due to the high error margin of the over 28 years category, the confidence level of its values is low hence will not be considered. The findings indicate that IA influences students acceptance of eL more strongly for students between 17-20 years followed by those between 21-24 and lastly 25-27 years, though with minor differences. The hypothesis that IA influences student's acceptance of eL use more strongly for younger students than for older students is supported by the findings.

H4c: IA influences student's acceptance of eL use more strongly for inexperienced students than for experienced students

Results show a positive association, though not very strong, of Kendall's three values for those who have never used the internet. The values have a relatively high error margin (10%, 8% and 13% respectively) hence do not have a high confidence. The category with more than 4 years has the highest value of Gamma followed by that of between 1-2 years. The results are not very consistent and do not support the hypotheses that IA influences student's acceptance of eL use more strongly for inexperienced students than for experienced students. The hypothesis is rejected.

H5: BI toward eL has a positive influence on eL acceptance.

Findings indicate that Kendall's three values fall between 0 and 0.5, hence a statistically significant positive association is found, though not strong (concordance relationship). There is confidence in these values as the margin of error is less than 4.5% for all the values. The findings support the hypotheses that BI toward eL has a positive influence on eL acceptance. The hypothesis is accepted.

The general findings are that BI toward eL has a positive influence on eL acceptance. PE has a positive effect on BI to use eL. This influence is stronger for younger students than older students and negatively affects the female student. EE has a positive effect on BI to use eL and is stronger for female students than male students. Though older students influence the association of EE and BI to use eL more than younger students, experience in ICT has no influence on the association. SI has a positive effect on BI to use eL but is not influenced by gender, age or experience in ICT. IA influences students' acceptance of eL use and is stronger for younger students.

5 SOLUTIONS AND RECOMMENDATIONS

The following should be considered with regard to those students who will undertake eL:

- They should consist of either gender and preferably above 21 years
- have proven computer literacy and internet skills
- be orientated to the eL system to ensure ease of use
- More access points should be availed by the institution

MPUC is to adopt a click-n-mortar strategy with many courses online. Courses that do not require workshops and laboratories such as in business can be offered wholly online. For a start, eL will be optional, with some subjects being run in both modes. Later on, these subjects can be offered online; after reviewing their outcome. The f2f will be faced out slowly depending on the needs of individual subjects and courses. As the number of Internet users increase, the bandwidth required increases exponentially but the bandwidth required per user decreases also exponentially [43]. It is thus recommended that MPUC undertakes a study on its optimal bandwidth requirements. The venture is long term and best implemented in phases.

6 CONCLUSION AND FUTURE RESEARCH DIRECTIONS

Majority of MPUC students would accept eL in conjunction with f2f learning (Blended learning). The institution should adopt OSS preferably Moodle LMS as opposed to COTS, whereby it can easily undertake benchmarking as Moodle is already widely used in most Kenyan institutions of higher learning. The implementation should be phased spanning three years. Phase one starting with Moodle and DMS adoption and implementation, phase two to bring on board online library and finally phase three to implement online payment. Though the venture will not lead to immediate noticeable increase in the student enrolment, being long term, partial benefits after implementation of each phase are rewarding and will help maintain the momentum.

The research undertaken covered only the students among stakeholders. Additional research is required to establish academic staff views. While the findings establish need for more bandwidth, further research should be done to ascertain the optimal institutional requirement. Other areas that need further research include: how best to integrate the eL system with the existing system, performance trends of e-learners compared to their f2f counterparts on the same courses, and on reliability and performance of OSS LMS.

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