DRIVING e-LEARNING TOWARDS UBIQUITOUS E-LEARNING

SUBTHEME: TECHNOLOGY

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Abstract

This paper reports the findings of a study that examined learners' beliefs and actual usage of e-learning in an open and distance learning (ODL) environment. The constructs used include perceived usefulness, perceived ease of use, computer self-efficacy and anxiety. The study was based on 438 usable questionnaires completed by a random sample of learners from the Open University Malaysia (OUM). It was found that the learners were generally receptive towards e-learning, evidenced by their low computer anxiety and positive perceptions for perceived usefulness, perceived ease of use, computer self-efficacy and attitude towards e-learning. Learners also reported a reasonably high usage of various devices such as laptops, mobile phones, MP3/MP4 players and tablet computers for downloading study materials such as HTML modules, iLectures and iRadio learning segments. Through a series of regression analysis, the study found that learners' perceived usefulness and ease of use, computer self-efficacy and anxiety had an impact on attitude towards e-learning. With regards to usage of e-learning, only perceived usefulness was found to be a significant factor. Learners also indicated that the top five most serious barriers to e-learning were (i) technological and academic support, (ii) demand for time and effort , (iii) interface, navigation and platform problems, (iv) awareness of availability of the e-learning materials and (v) costs of devices and Internet access. In its drive to move the present e-learning to ubiquitous e-learning, among others, OUM will have to focus its efforts in reducing the impacts of these barriers and to improve further the usefulness of e-learning materials and technology.

Introduction

Most universities are adopting e-learning for the realization of a 'learning society' and the development of innovative human resources for a 'knowledge society'. There is ample evidence which suggests that e-learning renders learning activities more effective and efficient by taking away the constraints of time and location. In addition, e-learning offers many advantages. For example, it provides convenient and speedy access to learning contents, tools and related infrastructure and it opens up new possibilities for combining learning with other personal and life activities in ways which are adapted to the needs and

preferences of the learners. Such features of e-learning are believed to be the solution to one of the key challenges posed by a 'knowledge society', that is how to engage the population in continuous learning across their lifespan. Open University Malaysia (OUM) is no exception to adopting e-learning, more so when it is an open and distance learning institution which carries a mission of democratizing education and upholding the motto 'University for All'. In order to maintain its enrollment growth and to sustain its efforts to become the best ODL institution, OUM has made e-learning as one of its strategic thrusts. Thus, OUM has been increasingly conscious of its investment in e-learning. It is always looking for clear evidence of the value that e-learning brings to learners, staff and the institution. It is also emphasising on the importance of e-learning to deliver a quality experience for learners and staff while at the same time to allow itself to meet its social and governmental obligations. With so much priority and significance placed on e-learning, it is essential for the university to monitor how learners are accepting and using it in their studies.

Objectives of Research

The objectives of this research are to obtain:

- a baseline assessment of learners' perceptions towards e-learning materials and technology, learners' actual usage of e-learning materials and technology, learners' feedback on the barriers, challenges and prospects of improving e-learning,
- a measure of relationship between learners' perceptions and actual usage of e-learning materials and technology.

The findings from this study would provide useful insights and guidelines in the formulation of new strategies to bring e-learning to the next wave.

Scope of Study

The study was confined to learners enrolled in one core course, i.e. "Learning Skills for Open and Distance Learners". The e-learning materials and technology included in the study include HTML modules, iRadio, iLectures, online discussion forum and mobile learning.

Literature Review

E-Learning

Ten years have passed since OUM first introduced e-learning at an institutional level in 2000. During the early years, focus was more directed towards developing the learning management system and in developing e-learning materials to complement the print modules, as support for the self-managed study. Due to the limited bandwidth, CD-ROMs were developed to include some multimedia content into the courses. To add the interactivity and currency in content, WebCT was used then as the platform for e-learning (Abdullah Sanusi A, 2001; Latifah A.L & Ramli B. 2003). Participation in e-learning was encouraged by allocating 5% marks to the final grade of a course when learners engaged themselves in the discussion groups facilitated by active subject matter experts. In order to integrate e-learning with its campus management system, WebCT was changed to myLMS, OUM's own home grown e-learning platform. Since the introduction of the new myLMS, a survey was administered to learners to assess the effectiveness and usage of e-learning. It was found that the use of e-learning was specifically aimed at achieving short term goals of obtaining good coursework and examination grades by capitalizing on the online discussion forum and course contents (Latifah A.L *et al*. 2006). In 2008, a comparative study on the ability, experience and perception of use of ICT in education between OUM and European learners was carried out, and the results revealed that the OUM learners faired better in terms of the use of ICT but lower in terms of ability. Both are equally positive towards the use of ICT, however, OUM learners

showed a higher preference for face-to-face and teacher-led learning (Latifah A.L. *et al.* 2008). The impact of learners' skills, usage and perception of ICT on e-learning was later looked into and it was revealed that in order to increase the use of e-learning, learners' perception and skills of ICT need to be improved (Latifah A.L. *et al.* 2009). Since then numerous initiatives were introduced to close existing gaps, resulting in the present status of e-learning in OUM, which has its own merits.

Handheld Devices

In education, handheld mobile technologies offer potential for ubiquitous-learning (or u-learning) through new ways of accessing information both individually and within the communities, where collaborating with others can enhance learning. Available technologies include mobile phones, laptops, tablet PCs, personal digital assistants (PDAs), MP3 players, iPods etc. These technologies allow learning to be more 'mobile'. This is the reason why u-learning is said to be e-learning which is usually associated with m-learning. Since mobile technology has not really matured, there are presently more possibilities with regards to what could be done with this technology for learning. There are various educational benefits of handheld mobile technology, and most cited are (i) its portability and ease of access, (ii) it promotes autonomous learning and organization, (iii) it promotes learner motivation, collaboration and communication and (iv) it supports inquiry-based instructional activities (Roshelle, J. & Pea, R., 2002). An interesting aspect of wireless mobile technologies for education is that tools that first existed only on desktop computers are now being made available on inexpensive handheld units (Soloway et al., 2001). The mobility offers the potential for u-learning, catering to the needs of distance learners as they are able to download course materials into the mobile devices and work with them at their convenience.

In 2008, in its efforts to make e-learning more 'mobile', m-learning was piloted with a view to vary and enhance the blend of the blended learning mode, increase flexibility and encourage and support ubiquitous e-learning. A m-learning readiness survey was conducted among learners and it was found that 98 percent of learners had mobile phones and 82.8% expressed an intention to use m-learning within 6-12 months from the day the survey was administered. Another survey was conducted after introducing m-learning using SMSes which were based on contents; tips; motivation; course management and forum discussions. Learners indicated that they were more engaged with the course and had more positive learning experience, and they even suggested that the SMSes be extended to other courses (Zoraini Wati Abas *et al*. 2009). In 2010, the use of SMSes was extended to ten other courses. It is most gratifying to note that learners were satisfied with the m-learning intervention and the study indicated that the top five items of highest satisfaction as far as the m-learning via SMS was concerned include: (i) it helped them to prepare better for tutorials, (ii) enabled them to learn anytime; (iii) enabled them to learn anywhere; (iv) encouraged them to stay more focused in their studies and (v) sustained their interest in the course for which m-learning was offered (Zoraini Wati Abas *et al.* 2010). Generally m-learning is new in OUM and it is at the 'adopters' stage'.

Back in 2007, iRadio OUM was launched and later became a thriving media mouthpiece, with 36 hours of broadcasts per week. Through iRadio, module-based segments as well as general infotainment segments were aired via the World Wide Web (WWW) and the audio contents that were made available on the WWW, called podcast can be automatically delivered to a personal computer or a laptop, personal digital assistant (PDAs), MP3, or personal tablet devices such as iPads or a mobile phone. The benefit of using podcasts is the enhanced mobility of learning materials, rendering greater flexibility in learning (Umi Hanim M.I. *et al*. 2009). Both handheld devices and mobile phones will become increasingly wireless-capable and multimedia savvy, and in view of this, OUM should embark in a more vigorous research, looking into the instructional design suitable for m-learning.

Ubiquitous e-learning

Ubiquitous learning (or u-learning) has been acknowledged as the 'next step' in e-learning. The successful development of a ubiquitous learning environment will owe itself to two critical factors, i.e.

utilising appropriate technologies and introducing new pedagogical practices; indicating the importance of both computing technologies and teaching and learning paradigms (Gringer, 2009). Various pilot projects within the last decade that attempt to introduce a ubiquitous learning environment have involved experimentation with high-end devices, as seen in the initiatives by Harvard University (Deiterle & Dede, 2006), University of Minnesota (Cunningham, 2010) and Reed College (Marmarelli & Ringle, 2010) in the United States of America. These devices invariably include handheld devices such as tablet computers, personal digital assistants (PDAs) and more recently, e-readers like the Amazon Kindle.

According to Lyytinen and Yoo (2002), learning environments can be classified into four types: desktop computer-assisted learning, pervasive learning, mobile learning and ubiquitous learning. As indicated in Figure 1, the type of learning environment offered by an institution is dependent on the level of embeddedness (in terms of the availability and use of technologies) and mobility of said technologies.

At the most basic level, learning takes place at a fixed and stationary location with the aid of a desktop computer. Both mobile and pervasive learning can be considered an improvement from this basic level of learning environment. With the former, learners can use mobile devices such as laptops and tablet computers (e.g. Apple iPad) with Internet connection, to learn anytime and anywhere; whilst the latter allows for contextual learning from devices that are usually embedded in a specific environment with a remote server. Ubiquitous learning is the most advanced of these learning environments, as it combines both high embeddedness and mobility. While a learner moves with his/her laptop, tablet computer or other devices, there is a system that can dynamically support his/her learning by communicating with embedded computers in the environment (Ogata & Yano, 2004). In reference to the different types of learning environment that is depicted in Figure 1, OUM's learning environment is currently positioned between desktop learning and mobile learning.

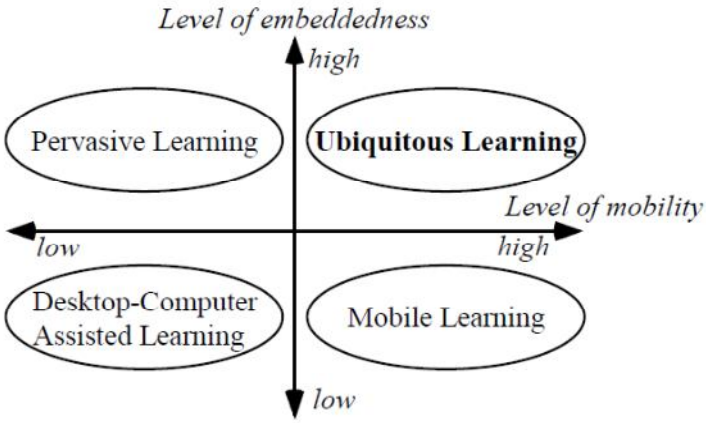

Figure 1: Four Learning Environments
(Lyytinen & Yoo, 2002; as cited in Ogata & Yano, 2004)

Theoretical Models

Various models have been developed to measure and explain the acceptance and usage of technology. One of the most widely accepted measurement tools is the Technology Acceptance Model or TAM (Davies, 1989). TAM originates from the theory of reasoned action, TRA (Fishbein & Ajzen, 1975). TRA proposes that belief affects attitude, which influences intention; while intention in turn brings about

behaviours. TAM adapts this belief-attitude-behaviour relationship and further postulates that two beliefs (perceived ease of use and perceived usefulness) are the key beliefs that lead to user acceptance of information technology. Perceived ease of use is supposed to influence perceived usefulness, which has a direct effect on both attitude and intention. In the TAM, two items were used to measure usage of the e-learning. The first refers to the frequency of use of e-learning and the second refers to the number of hours they normally spend using e-learning (Davies, 1993). Compeau, Higgins and Huff (1999) developed a model based on Bandura's Social Cognitive Theory (as cited in Gardner & Amoroso, 2004) to study the influences of self-efficacy, performance and personal outcome expectations, effect and anxiety on computer usage. They found that self-efficacy explained 18% of the variance in an individual's usage. A relationship between personal outcome expectations and use was not supported. However, Venkatesh, et al. (2003) found that self-efficacy and anxiety do not directly influence behavioural intention and suggested that these variables may be antecedents for one of the independent variables in their Unified Theory of Acceptance and Use of Technology (UTAUT).

Methodology

Research Model and Hypothesis

In light of the literature review, an integrated research model was adapted for this study from three theoretical models: the TAM model (1989), the model by Compeau, Higgins and Huff (1999), and the UTAUT model (2003). This study uses the integrated model to help identify the strengths and weaknesses of the present e-learning and its environment in providing value to the learners' learning experience. The proposed model adopted for this study is shown in Figure 2.

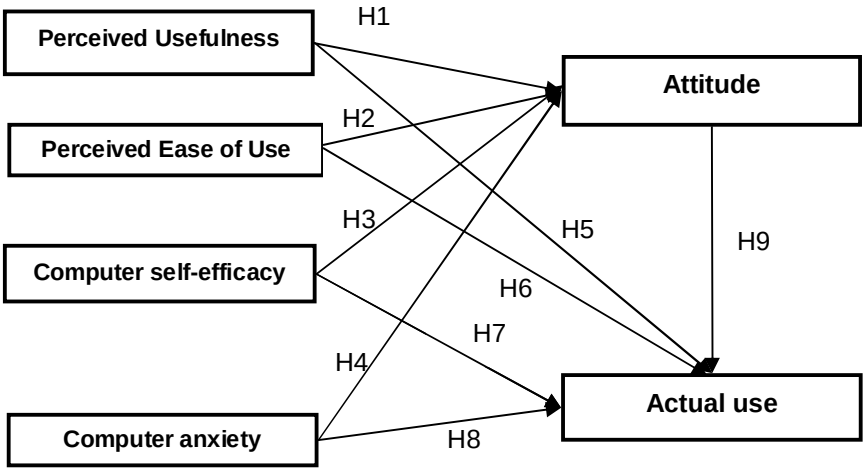

Figure 2: Proposed Integrated Model (based on TAM,1989, Compeau, Higgins and Huffs' model, 1999, and UTAUT model,2003)

From the Integrated Model, a total of nine null hypotheses were formulated and tested. The nine null hypotheses are:

H1: Perceived usefulness has no impact on attitude towards e-learning materials and technology
H2: Perceived ease of use has no impact on attitude towards e-learning materials and technology

H3: Computer self-efficacy has no impact on attitude towards e-learning materials and technology
H4: Computer anxiety has no impact on attitude towards e-learning materials and technology
H5: Perceived usefulness has no impact on actual use of e-learning materials and technology
H6: Perceived ease of use has no impact on actual use of e-learning materials and technology
H7: Computer self-efficacy has no impact on actual use of e-learning materials and technology
H8: Computer anxiety has no impact on actual use of e-learning materials and technology
H9: Attitude has no impact on actual use of e-learning materials and technology

Sample Size

The sample size determined for the study was 600 OUM undergraduate learners from the population of learners who had taken the course "Learning Skills for Open and Distance Learners" between 2008 and 2011.

Questionnaire and Data Collection

The research instrument with five constructs used in this study was adapted from three theoretical models. The first three constructs i.e. perceived usefulness, perceived ease of use and attitude, were adapted from the TAM (Davis, 1989), while the fourth and fifth constructs, i.e. computer self-efficacy and computer anxiety, were adapted from the model by Compeau, Higgins and Huff (1999) and the UTAUT by Venkatesh, et al. (2003).

The questionnaire for the study was designed to collect the following categories of data: (a) demographic and other socioeconomic data such as age, sex, race, degree programmes; (b) five constructs given in Table 1; (c) usage of e-learning technologies; and (d) issues related to e-learning materials and technology. For measuring the five constructs for e-learning technology, learners were asked to provide responses to 15 statements based on a five-point scale, i.e. (Strongly Disagree); 2 (Slightly Disagree), 3 (Neutral), 4 (Slightly Agree) and 5 (Strongly Agree).

Table 1: Five Constructs of the Integrated Model

No.	Construct	Statements/Items
1.	Attitude towards e-learning technology	1. Using e-learning technology is a good idea. 2. Using e-learning technology is beneficial for learning. 3. Using e-learning technology is innovative for learning.
2.	Perceived usefulness towards e-learning technology	1. Using e-learning technology has improved my learning performance. 2. Using e-learning technology has added value to my study. 3. Using e-learning technology makes my learning more engaging.
3.	Perceived ease of use towards e-learning technology	1. e-Learning technology is easy to learn. 2. e-Learning technology is easy to master. 3. e-Learning technology is easy to use.
4.	Computer self-efficacy	1. I use the computer for data analysis. 2. I use the computer for preparing reports. 3. I use the computer for searching information.
5.	Computer anxiety	1. I hesitate when using technology because I am afraid I will make mistakes. 2. I avoid using unfamiliar technology. 3. I am afraid I will break or damage the technology device that I am using.

The questionnaire was uploaded online and the 600 selected respondents were contacted via e-mail and given a link to access and complete the said questionnaire. The entire operation of online data collection

was carried out during the months of May to June, 2011. Learners were given a description of the e-learning materials and technology that were used for the "Learning Skills for Open and Distance Learners" module, as shown in Table 2 below:

Table 2: Descriptions of the e-learning materials and technology

e-Learning Materials	e-Learning Technology
HTML modules	myVLE
iRadio learning segments	iRadio (Internet radio station)
iLectures	CD-ROM
Online forum discussions	myVLE
Text messages	Mobile learning (mobile phone)

Results

Respondent Profile

Out of the 600 selected respondents, 500 learners responded of which 438 completed questionnaires were usable, thereby giving an effective response rate of 73%. The respondents who were all working adults from all the 13 states in the country were full-time employees either in the private or public sector. The mean age of the respondents was 32.7 years. The "19-29" age group formed 40.2% of the sample, with the two remaining age groups of "30-39" and "over 40" representing 40.9% and 18.9%, respectively. Female respondents represented 53.4% of the sample; slightly outnumbering their male counterparts. The undergraduate degree programmes taken up by the respondents were in the fields of nursing, business, education, social sciences and science studies. These figures show that the respondents have diverse demographic and socio-economic backgrounds, and hence, represent the general learner population of OUM.

Reliability and Validity of Instrument

As noted earlier, the five constructs chosen for this study were perceived usefulness, perceived ease of use, attitude, computer anxiety, and computer self-efficacy. Before deciding to use these constructs for analysis, the item ratings for the computer anxiety construct were also reversed in order to be in consistent order with the other four constructs. Next, the items representing all the five constructs were evaluated. This was done by examining their item-to-total correlations as suggested in Blaikie (2003). It was found that these correlations for all items exceeded the value of 0.8, which were above the recommended minimum level of 0.4. All the items were retained and further reliability test was carried out. The data was then factor analysed using both exploratory and confirmatory analyses. The factor analysis revealed that the Cronbach's Alpha values were in the region of 0.885 to .952 for the five constructs, which exceeded the minimum value of 0.7 as recommended in Nunnally (1988). Based on these test results, the five constructs were considered reliable.

The next test was to evaluate whether the measurement model for the five constructs provided a good fit to the actual data used. A total of five indices were used for the evaluation. The results as reported in Table 3 show reasonably goodness-of-fit indices ($\chi 2/df= 2.29$, NFI= .973, CFI = .985 and PCFI=.760, all of which exceeded the minimum recommended thresholds (Hair, *et al*., 2006); the value of RMSEA = .054 was less than the maximum allowed. These test results demonstrated that the measurement model and the instrument were acceptable for this study.

Table 3: Goodness-of-fit indices (n=438)

Indices	Observed Values	Desired range
Chi-square/df (X^2/df)	2.29	Less than 3
Normal fit index (NFI)	.973	> 0.90
Comparative fit index (CFI)	.985	> 0.90
Parsimony Comparatives-of-fit Index (PCFI)	.760	> 0.50
Root Mean Square Error of approximation (RMSEA)	.054	<0.07

The research instrument was also evaluated from the perspectives of two criteria namely (a) convergent validity; and (b) discriminant validity. To establish convergent validity, it was necessary to evaluate whether or not the item loadings on their respective five constructs exceeded the value of 0.5 (Hair, *et al*., 2006). To meet this goal, the instrument was subjected to confirmatory factor analysis (CFA) using the AMOS version 16.0 software to produce the factor loadings. It was found that the factor loadings as indicated by the standardised coefficients ranged from 0.787 to 0.969, thus suggesting convergent validity for the measurement instrument. The instrument was also evaluated for discriminant validity. Discriminant validity refers to the extent to which a construct is distinct from the other constructs. To establish discriminant validity, the average variance extracted (AVE) for a construct should exceed the shared variance (or square of the correlations) between two constructs (Fornell & Larcker, 1981). As indicated in Table 4, this condition was met and therefore discriminant validity for the research instrument was established.

Table 4: Average variance extracted (AVEs) for discriminant validity analysis (n=438)

Construct	Shared variances	AVE
Attitude	0.026 - .790	0.912
Perceived usefulness	0.001 - .790	0.909
Perceived ease of use	0.038 - .529	0.902
Computer anxiety	0.009 - .042	0.845
Computer self-efficacy	0.042 -.303	0.818

Perception towards e-Learning Materials and Technology

The mean ratings for perceived ease of use, perceived usefulness, attitude, computer anxiety and computer self-efficacy for both e-learning materials and technology were computed. As shown in Table 5, the mean ratings for perceived ease of use and perceived usefulness of e-learning technology together with perceived usefulness of e-learning materials were moderately high at about 3.7- 3.9 points on the five-point Likert scale; the ratings for computer self-efficacy and attitudes were higher with values between 4.1 and 4.2 points. The reported computer anxiety was 2.6 points, which was considered low. This finding is consistent with the high computer self-efficacy noted earlier. The first six indices suggest that learners had a positive perception towards e-learning. As computer anxiety was low, learners' positive perceptions towards e-learning were not affected by this construct. While these observations may be true for the average learners, it should be pointed out that a significant proportion of between 3% and 10% reported low perception (of less than three points) towards the use of these materials and technologies for e-learning.

A comparative analysis of the mean ratings for e-learning technology was carried out to gauge the perception levels across age groups. For this purpose, learners in the sample were classified into three broad categories, i.e. the "19-29", "29-39" and "40+" age groups. An ANOVA was carried out to assess

whether or not there were significant differences in the perception levels among the two older groups against the youngest group.

Table 5: Mean ratings of constructs

Construct	Mean	Std. deviation
Computer self-efficacy of e-learning technology	4.2	.789
Attitude towards use of e-learning materials	4.1	.859
Attitude towards use of e-learning technology	4.1	.835
Perceived usefulness of e-learning materials	3.9	.878
Perceived usefulness of e-learning technology	3.9	.846
Perceived ease of use of e-learning technology	3.7	.865
Computer anxiety	2.6	1.116

As shown in Table 6, the mean ratings were significantly different for attitude and computer self-efficacy for both the two older groups against the younger 19-29 age group. For the perceived usefulness construct, the difference was only significant for the 40+ group. However, there was no significant difference between the older 40+ and the younger 19-29 group for perceived ease of use for e-learning technology. A detailed inspection of the figures revealed an interesting result. With the exception of perceived ease of use, the mean ratings for the older learners were in fact higher than the younger 19-29 cohort, suggesting that this group of learners perceived technologies more favourably for e-learning. For computer anxiety, there was no significant difference in the mean rating between the older and the younger age groups.

Table 6: ANOVA results of mean ratings for e-learning technology by age groups

Constructs (for e-learning)	**Age group (I)**	**Age group (J)**	**Mean difference (I-J)**	**P-value**
Attitude	19-29	30-39	-.202	.050 (s)
		40+	-.486	.000 (s)
Perceived usefulness	19-29	30-39	-.158	.230 (ns)
		40+	-.364	.004 (s)
Perceived ease of use	19-29	30-39	-..009	1.000 (ns)
		40+	-.189	.302 (ns)
Computer self-efficacy	19-29	30-39	-.234	.014 (s)
		40+	-.417	.000 (s)
Computer anxiety	19-29	30-39	+.011	1.000 (ns)
		40+	-.124	1.000 (ns)

Usage of e-Learning Materials and Technologies

As indicated in Table 7, the study found that a learner spent a total of 10.7 hours a week using e-learning for the "Learning Skills for Open and Distance Learners" course. This finding augurs well with the institution's recommendation for an online course. The usage was primarily focused on the HTML module (35.5%), online discussion forum (30.8%), followed by iLectures (20.6%) and iRadio learning segments (13.1%).

Table 7: Usage of e-learning

Types of e-learning materials	% (hours per week)
HTML module	35.5% (3.8 hours)
Online discussion forum	30.8% (3.3 hours)
iLectures	20.6% (2.2 hours)
iRadio learning segments	13.1% (1.4 hours)
Total for all types	100.0% (10.7 hours)

Another analysis using ANOVA was performed to determine whether or not there were significant differences in the usage of e-learning technologies between the younger and older age groups of learners. As is evident in Table 8, time spent on the HTML module by the two older groups of learners was not significantly different from that of the youngest group. A similar usage pattern was also apparent for the other three remaining technologies, i.e. iRadio, iLectures and online discussion forum. These results suggest that older learners are just as likely to spend time using e-learning technologies as their younger counterparts.

Table 8: ANOVA results on usage of e-learning technologies

Types of e-learning technologies	**Age group (I)**	**Age group (J)**	**Mean difference (I-J)**	**P-value**
HTML module	19-29	30-39 40 +	-.739 +.283	.093 (ns) 1.000 (ns)
iRadio	19-29	30-39 40 +	+.261 +.178	.721 (ns) 1.000 (ns)
iLectures	19-29	30-39 40 +	+.241 +.664	1.000 (ns) .166 (ns)
Online discussion forum	19-29	30-39 40 +	-.704 +.108	.088 (ns) 1.000 (ns)

While it is noteworthy that, on average, a learner spent 10.7 hours using e-learning in a week, a fair proportion of the learners spent much less time on it. Table 9 shows that between 25.1% (or one in four) and 39.7% (or two in five) of the respondents did not use the iLectures and iRadio learning segments. While the non-usage of the HTML module and online discussion forum was considerably less, the proportion of this group of learners is still substantially large at about 7%. The under-utilisation of e-learning is also revealed by the high proportions (i.e. 13.5% - 31.1%) of learners who used these technologies for only one to two hours a week.

Ownership and Usage of Mobile Devices

In an effort to bring e-learning towards ubiquitous e-learning, it is not adequate for the institution to merely develop and provide an e-learning system for the learners. Learners themselves must also equip themselves with devices that can be used for e-learning. It is therefore essential for learners to have mobile devices such as laptop, mobile telephones, MP3 or MP4 players that can utilise the e-learning materials and technology that are accessible through the Internet via myVLE.

Viewed in this context, ownership of mobile devices amongst OUM learners is notably high, with rates of 95.4 % for mobile telephones, 90.9% for laptop computers, 36.3% for MP3 players and 13.7% for MP4 players (Table 10). Tablet computers, still a relatively novel device, were owned by only 8.2% of the

Table 9: Usage of e-learning materials and technology (%)

Usage (hours)	HTML module	Online forum	iLectures	iRadio
	%			
0	6.6	6.2	25.1	39.7
1	20.5	29.0	30.1	31.1
2	20.5	22.4	19.2	13.5
3	13.0	11.4	7.3	5.3
4+	39.4	31.0	18.3	10.4
Total	100.0%	100.0%	100.0%	100.0%

learners. These figures strongly suggest that there is a great potential for diffusing e-learning among all learners via the use of mobile devices, in particular laptop computers. In the near future, as tablet computers become more popular and affordable, they too can be utilised as a device for e-learning. When there is a conducive environment, both in terms of what the institution provides and what learners are comfortable with, learners can take up learning any place and at any time as long as they carry the appropriate mobile devices that can connect them to the Internet. This augurs well for lifelong learning as learners of all age groups can thus benefit from e-learning.

Table 10: Ownership of devices

Devices	Ownership (%)
Mobile telephone	95.4
Laptop computer	90.9
Desktop computer	56.8
MP3 player	36.3
MP4 player	13.7
Tablet computer (e.g. iPad)	8.2

The future for acculturating lifelong learning via e-learning among learners appears bright provided that attention is given to several key requisites, i.e. learners themselves take advantage of the e-learning materials and technologies provided by OUM; and OUM take the necessary steps to enhance and improve its e-learning system so that it is conducive to them. As a measurement indicator, learners in this study were asked whether or not they downloaded the iLectures and iRadio learning segments. The study found that the majority of learners had downloaded the materials into laptop computers, i.e. at 55.5% for iRadio learning segments and 61.2% for iLectures, respectively (Table 11). Downloads into desktop computers were less popular, with corresponding figures falling between 34.5% and 36.3% for iRadio learning segments and iLectures, respectively. These figures demonstrate that a large number of learners did make use of e-learning for their learning purposes..

Table 11: Downloads by devices

Devices	Download iRadio learning segment (%)	Download Lectures (%)
Mobile telephone	15.8	-
Laptop computer	55.5	61.2
Desktop computer	34.5	36.3
MP3 player	11.9	-
MP4 player	6.6	-
Tablet computer (e.g. iPad)	-	6.8

Factors Affecting Attitude towards and Usage of e-Learning

The next step was to identify the factors that have an impact on the attitude towards and usage of e-learning technologies. Once the influencing factors were identified, intervention measures could be devised and implemented to increase the usage of technology for e-learning. A multiple regression analysis (Table 12) found four factors (perceived usefulness, perceived ease of use, computer self-efficacy and computer anxiety) had positive and significant impacts on attitude towards e-learning (with an R-square of 74.4% and p-values < .05).

Table 12: Factors affecting attitude towards e-learning (n=438)

Variable	Unstandardised coefficient b	Standardised coefficient Beta	p-value
Constant	.519		.000
Perceived usefulness (H1)	.681	.689	.000
Perceived ease of use (H2)	.123	.116	.000
Computer self-efficacy (H3)	.128	.133	.000
Computer anxiety (H4)	-.038	-.051	.041

Dependent variable = Attitude, and R-square = 74.4%

However, a separate regression analysis found only perceived usefulness had a significant impact on usage of e-learning technologies, with a R-square of 6%. This finding was in line with an earlier study carried out by Latifah, et al. (2008) but was not consistent with the TAM theory.
In summary, the results of the hypotheses testing are as follows:

H1: Perceived usefulness has an impact on attitude towards e-learning materials and technology
H2: Perceived ease of use has an impact on attitude towards e-learning materials and technology
H3: Computer self-efficacy has an impact on attitude towards e-learning materials and technology
H4: Computer anxiety has an impact on attitude towards e-learning materials and technology
H5: Perceived usefulness has an impact on actual use of e-learning materials and technology
H6: Perceived ease of use has no impact on actual use of e-learning materials and technology
H7: Computer self-efficacy has no impact on actual use of e-learning materials and technology
H8: Computer anxiety has no impact on actual use of e-learning materials and technology
H9: Attitude has no impact on actual use of e-learning materials and technology

Barriers and Challenges to e-Learning

Despite the various institutional efforts that have been initiated towards an effective e-learning system, learners still face many challenges. As can be observed in Table 13, the mean seriousness (SI) values ranged from 3.3 to 3.5 out of five points, thus signalling the need to reduce or eliminate the impact of these barriers which are considered quite serious by the learner respondents. The top five most serious barriers are as shown in the table below:

Table 13: Seriousness Index (SI) for Barriers to e-Learning

No.	Barrier /Issue	Mean rating
1.	Technology and academic support	3.54
2.	Time and effort required	3.50
3.	Interface, navigation and platform	3.48
4.	Awareness of availability of e-learning materials	3.47
5.	Costs involved for devices and Internet access	3.43

Discussion and Conclusion

It is gratifying to note that OUM learners are generally receptive towards e-learning. This is seen by their low anxiety and positive perceptions for perceived usefulness and ease of use, computer self-efficacy and attitude towards e-learning. Learners also reported a reasonably high usage of laptops, and mobile phones, and a moderate usage of other devices like MP3, MP4 players and tablet computers, for downloading study materials such as HTML modules, iLectures and iRadio learning segments. In addition, the study found that there was no significant difference in e-learning usage between older and younger cohorts of learners, a finding that is not quite in line with others reported in the literature (Czaja & Sharit, 1998; Wagner, Hassanein & Head, 2010). Overall, all these findings reflect, to a certain extent, the university's success in addressing issues commonly associated with e-learning and lifelong learning in an ODL environment.

With regards to use of e-learning, the regression analysis found that perceived usefulness was the only significant factor, and that the other factors including attitude were not significant. These findings strongly suggest the importance of ensuring the usefulness of e-learning in order to achieve acceptable take up rate. This requires a thorough review of the relevancy and usefulness of the course contents and technologies to ensure that e-learning enhances the achievement of the learning outcomes. The non-significant factors such as attitude in influencing e-learning usage suggest that learners in an ODL environment are receptive to using any e-learning tool that is presented to them as long as it is deemed useful for their learning. This perhaps stems from the likelihood that most ODL learners acknowledge the importance of e-learning in achieving educational success, irrespective of their attitude and perceptions towards technology.

With regards to e-learning barriers, OUM will have to put in greater efforts in making e-learning easy to use and ensuring that it improves learning. It is quite common for learners to give up e-learning due to lack of technology support. Technology factors include competence with the tools of the course, such as online discussion, file uploads and downloads; collaboration tools as well as use of online resources such as online library databases. It is not sufficient just to ensure enough PCs to allow free access to e-learning; the hardware must be able to support acceptable performance; access that is not unduly complex or subject to constant breakdowns. Access must be kept simple, all interfaces should be kept intuitive, and in case of problems, it should be easy for learners to access support. Another critical factor in e-learning success is time management. Learners need to create a study environment, understand their individual learning style, and balance personal obligations with the demands of the course. Finally, the study found that a section of the learner community had not only low perceptions towards e-learning but also not using e-learning at all. For the university to move towards ubiquitous e-learning, greater efforts should be directed in reducing the impacts of e-learning barriers, and to improve the usefulness of e-learning technology for this minority group of learners.

Promoting lifelong learning via e-learning among all learners in an ODL environment is made easier as there appears to be no significant differences in learners' perceptions towards e-learning and actual e-learning usage between the older and younger groups. The ODL environment for acculturating lifelong learning appears conducive provided that learners themselves take advantage of the e-learning materials and technologies and the institution take the necessary steps to enhance and improve its e-learning. The way forward in terms of bringing the e-learning to the next level is for the institution to create applications to run on mobile devices, to extend existing capabilities as well as to explore new opportunities that will enable the institution to support ubiquitous e-learning.

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