AN INVESTIGATION ON E-LEARNING READINESS OF ENGINEERING STUDENTS

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ABSTRACT

With advancement in technology, education has taken a new dimension with the introduction of e-learning. Many institutions of higher learning in Malaysia have ventured into e-learning. Although e-learning offers attractive benefits, its effectiveness is important to ensure the quality of learning, notably among engineering students. Numerous foreign and local researchers have indicated that the effectiveness of e-learning correlates mostly with students' behaviour. Thus, this study aims to probe further on effectiveness of e-learning by conducting an observational survey to investigate engineering students' readiness in accepting e-learning at a local university. Numerous factors were investigated, namely, student demographics, ICT infrastructure availability and accessibility, information technology literacy, e-learning experiences, e-learning acceptance, course pedagogy, e-learning functions and training necessities. Information technology literacy was found to be the only factor that affects students' acceptance on e-learning.

Keywords: *E-learning, Student Readiness, Supervised Self-Administered Questionnaire*

1.0 INTRODUCTION

With advancement in technology, there have been changes in education especially in terms of approaches, materials and technology. Looking into the application of internet in education, online learning known as e-learning, has emerged on a global scale. Universiti Tun Abdul Razak (UNITAR) was the first university to introduce e-learning in Malaysia in September 1998 [1]. Since then, other institutions have also followed suit. It was found that the effectiveness of e-learning in Malaysia depended on five main factors, namely, students' behaviour and attitude, technology/ system, interactive applications, institutional factors and instructors' characteristics [2]. Students' behaviour and attitude was reported to be the most prominent factor. By using a self-developed survey instrument, this study investigated engineering students' readiness in accepting e-learning in Malaysian tertiary institutions.

This study involved survey and sampling design, development of survey instrument, data collection and statistical analysis. Samples were selected from the three engineering faculties (Electrical, Civil and Mechanical Engineering) of a local university. A self-administered questionnaire with group administration was developed with scopes including construction of questionnaire, pretesting and pilot testing and validity and reliability testing. The data collected from the survey was processed and analysed using SPSS.

2.0 LITERATURE REVIEW

e-Learning refers to internet technologies being used to deliver a broad array of solutions that enhance the instructional process [2]. e-Learning can take many forms. Jaiballan and Asirvatham [3] listed three common forms of e-learning as online support, asynchronous learning or self study and synchronous learning or instructor led. In Figure 1, a survey conducted on 120 government and private institutions in October 2003 by Asirvatham *et al.* [4] listed many benefits of implementing e-learning.

e-Learning in Malaysian institutions of higher learning was initiated by the government under the Smart School and e-Learning for Life (ELFL) programme. Smart School is a project initiated by the Malaysian government to develop and implement e-learning solutions to schools in Malaysia. In Malaysia, many universities have ventured into the path of e-learning with Universiti Tun Abdul Razak (UNITAR) being the first university to introduce e-learning in September 1998 [1]. As e-learning is still at its infancy stage in Malaysia, only UNITAR and OUM offer almost 90% of their

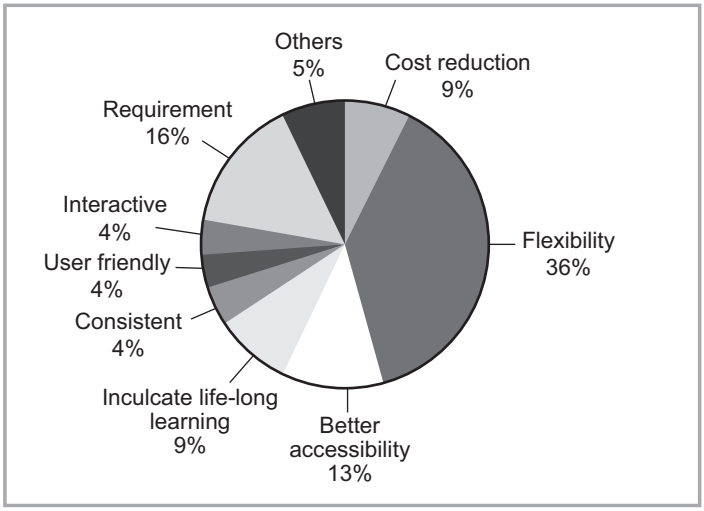

Figure 1: Main considerations for implementing e-learning (after [4])

courses online and with e-learning environment, while many public institutions of higher learning, like, UMS, UPM, UiTM and USM use e-learning in a mixed-mode environment [5]. Tengku Azmi Tengku Majid [6] also commented that e-learning in Malaysia is not meant to replace traditional classroom face-to-face training but rather to complement it. To summarise the e-learning development in Malaysia, Figure 2 presents the e-learning availability in institute of higher learning in late 2004 [7]. It can be seen that 88% of institutions of higher learning in Malaysia are already equipped with Learning Management System (LMS). However, only 60% of the institutions of higher learning adopt common standard among universities (SCORM). The reported average e-learning usage is only about 33% in late 2004.

Although many Malaysian higher learning institutions have adopted e-learning, there are issues and challenges that affect its effectiveness. Numerous studies ([1], [2], [3], [8], [9], [10] among others) have been conducted to identify these issues and challenges and some studies are reviewed in detail in the subsequent paragraph.

As discussed by Syed Othman Alhabshi [1], apprehension in technology/user readiness, changing technology and competition with other providers of education are three issues and challenges faced by UNITAR. Learners are found not confident when there is lesser physical interaction with instructors or virtual interaction. The rapidly changing technology also required continuous upgrading of technology for the e-learning system.

Jaiballan and Asirvatham [3] discussed four main challenges in e-learning, namely readiness of the learner, availability of digital content, short concentration span of learner and distraction on learner in an online environment. Suggestions were given such as gradual implementation to switch the learner from teacher-oriented to learner-oriented system, multimedia-based and interactive content to retain learners' concentration span and reduce distractions.

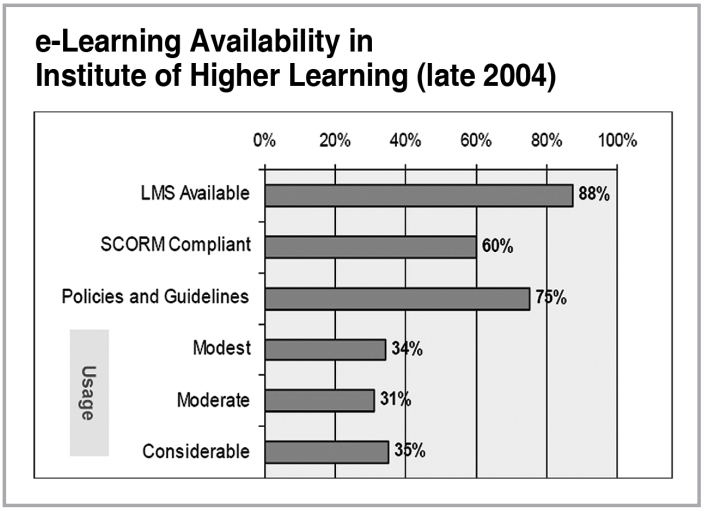

Figure 2: e-Learning availability in institutions of higher learning in late 2004 (after [7])

Kanendran *et al.* [8] discussed the issues and strategies of e-learning. Among the issues discussed are creating an e-learning system, e-learning technology, components of an e-learning system, learning participation and quality issues. Kanendran et al. [8] also concluded that e-learning concept may work best when it is combined with some face-to-face classroom experiences.

Poon *et al.* [2] conducted a survey on web-based learning (WBL) environment in eight universities in Malaysia. Five main factors influencing the effectiveness of WBL were identified, namely students' behaviour, characteristics of lecturers, interactive application, technology or system and the institution. Students' grades were found highly affected by student perception, self-efficacy and interactivity. WBL learners' grades were found not to be better than traditional learner. Poon et al. [2] therefore recommended improvement on quality of WBL to accommodate different adaptation styles of learners in the process.

Chong [9] conducted a survey to evaluate the e-learning system (INTI Online) in INTI College. INTI Online acts as a support system of INTI's distance learning program. Questionnaire and random interviews were conducted on 100 final year students respectively to evaluate the features of INTI Online. Chong [9] reported readiness of users as the major problem faced by INTI online. Many learners are more inclined to teacher-oriented system and therefore take time to switch to e-learning that is learner-oriented.

Ahmad Jelani Shaari et al. [10] discuss Universiti Utara Malaysia (UUM)'s experience in development and implementation of its e-learning system known as Learning Care. Problems and issues faced in the implementation of Learning Care were discussed, namely course suitability for e-learning, development of standard courseware, replacement of face-to-face teaching with e-learning and IT infrastructure availability. Ahmad Jelani Shaari et al. [10] further commented that a good strategic planning for the university's vision and mission has to be developed and at the same time, a well-organised e-learning management needs to be implemented in the organisation.

It is observed that most studies imply user readiness as one of the main factors in affecting the effectiveness of e-learning in Malaysian institutions of higher learning. Economist Intelligence Unit [11] reported that Malaysia ranked 36 among 69 countries in Economist Intelligence Unit e-readiness ranking for year 2007. Malaysia also attained a score of 5.97 over full score of 10 in the ranking. Therefore, Malaysia is considered moderately ready for e-learning. In view of this, in-depth study should be conducted to identify the factors affecting the user readiness.

3.0 METHODOLOGY

3.1 SAMPLING DESIGN

Multistage cluster sampling was adopted in this study. Multistage cluster sampling is an extension of cluster sampling in which clusters are selected and is drawn from the cluster members

Table 1: Distribution of respondents

Faculty of Electrical Engineering		Faculty of Civil Engineering		Faculty of Mechanical Engineering		Total
Degree	Diploma	Degree	Diploma	Degree	Diploma	
30	30	30	30	30	30	180
60		60		60		**180**

Table 2: Number of questions and response categories according to sections in questionnaire

Section		Description	Number of Questions	Types of Response Category
1	Demographics	To investigate gender, course discipline and program level of respondent	3	Nominal
2	ICT infrastucture availability and accessibility	To investigate ICT infrastructure availability and accessibility to respondents inside and outside campus	6	Ordinal: 4 Point Likert Scale
3	Information technology literacy	To investigate computer and internet literacy of respondent	10	Ordinal: 4 Point Likert Scale
4	e-Learning experiences	To investigate the e-learning experiences of respondents	4	Nominal
5	e-Learning acceptance	To investigate the e-learning acceptance of respondents	10	Ordinal: 4-Point Likert Scale
6	Course pedagogy	To investigate the influence of course pedagogy on e-learning acceptance of respondents	6	Ordinal: 5-Point Likert Scale
7	e-Learning functions	To determine the e-learning functions desired by respondents	1	Ordinal: 4-Point Likert Scale
8	Training necessities	To determine the training necessity of respondents to increase e-learning acceptance	1	Ordinal: 4-Point Likert Scale

by simple random sampling. Multistage cluster sampling is an efficient way of collecting survey information when either it is impossible or impractical to compile an exhaustive list of the units constituting the target population [12]. In this study, the population comprises engineering students of a local university. Three faculties of engineering were the segments of the study, namely Faculty of Electrical Engineering, Civil Engineering and Mechanical Engineering. The students from each faculty were further divided into diploma and degree study.

A statistical rule-of-thumb suggests that about 30 people in each group are needed [12]. Thus, sample size 30 is selected to satisfy the statistical analysis requirement. Table 1 shows the distribution of respondents. Anonymous questionnaires were randomly administered to a total of 180 students according to their faculty and level of study. Students were selected randomly and the sessions were administered by the surveyor.

3.2 CONSTRUCTION OF SURVEY INSTRUMENT

In this study, supervised self-administered questionnaire adopting group administration was developed in which each person is expected to complete the questionnaire without consulting other persons in group, but the surveyor or another supervisory person is available to provide introductory instructions, answer questions, and monitor the extent to which questionnaires are completed and individual respondents communicate with each other during the period of administration [13].

The questionnaire consists of eight sections with a total of 41 questions as shown in Table 2. In general, only closed questions were constructed in this study. However, some open questions were included to ask respondent to specify responses other than those given. These open questions were not included in the statistical analysis but merely to provide quotable material.

3.3 PRETESTING AND PILOT TESTING

Upon completing the first draft of questionnaire, pretesting and pilot testing were conducted before data collection. Pretesting is defined as the process of testing parts of the questionnaire during questionnaire development, generally with a convenience sample of respondents who are thought to be the "most different" on the section of the questionnaire being tested [13]. There are numerous methods of pretesting, such as expert review, forms appraisal, cognitive interviewing, focus group, behavior coding, respondent debriefing among others. Two pretesting methods were adopted namely expert review and form appraisal. A special appraisal form was developed to obtain feedbacks from expert during expert review. Three experts in the field of e-learning are selected as respondents in pretesting. The questionnaire was improved using the feedbacks obtained.

Subsequently, pilot testing was conducted using the improved questionnaire. Pilot testing involved testing of completed questionnaire using the administrative procedures that will be used in the study [13]. A representative sample size of 30 with 10 respondents from each faculty was adopted using simple random sampling method. Based on the outcome of pilot test, amendments were done on few questions, response category and formatting.

3.4 VALIDITY AND RELIABILITY TESTING

In order to ensure the accuracy of the survey instrument, the design of the survey instrument also takes into account its reliability and validity. Reliability is a statistical measure of how reproducible the survey instrument's data are [14]. On the other hand, validity is an assessment of how well a survey measures what it is intended to measure [14].

Cronbach's coefficient alpha was used to measure the internal consistency reliability of the survey instrument. A high value of Cronbach's coefficient alpha could imply that the items are measuring the same scale. Several items/questions are used to gain information about a particular factor. For example, 10 items are used to evaluate students' IT literacy and 4 items are used to evaluate student e-learning experiences. Cronbach's coefficient alpha is used to measure how well these different items measure the same issue and hence reflects the internal consistency reliability of the survey instrument.

Table 3: Cronbach's coefficient alpha for Sections 2 to 8 of the questionnaire

Section	Factors	Cronbach's coefficient aplha, α
2	ICT infrastructure availability and accessibility	0.553
3	Information technology literacy	0.710
4	e-Learning experiences	0.655
5	e-Learning acceptance	0.486
6	Course pedagogy	0.907
7	e-Learning functions	0.752
8	Training necessities	0.808

Two types of validity of the survey instrument are assessed, namely content validity and face validity. In order to assess the content validity, reviewers who have some knowledge of the subject matter in e-learning are approached to review the survey's contents. Three reviewers were selected in which two of them have great experience in teaching and learning research while another one is engaged in developing e-learning program in a university. Their valuable opinion and suggestion on the newly developed survey instrument were considered. In order to assess face validity, a cursory review of items is done by some untrained judges who do not know the subject matter of e-learning well. Ten person including friends and family members reviewed the survey instrument and their opinions were noted.

4. RESULTS

4.1 RELIABILITY ASSESSMENT

Assessment of internal consistency reliability by using Cronbach's coefficient alpha was conducted for Sections 2 to 8 in this questionnaire. Reliability assessment on Section 1 is not required as it gathers information on student demographics. The results of the reliability assessment are summarised in Table 3.

It is observed that there are four sections in this survey instrument having Cronbach's coefficient alpha higher than 0.7. These four sections are Sections 3, 6, 7 and 8 in this survey instrument. This indicates that four sections in this survey instrument achieve high satisfactory level on internal consistency reliability. Another three sections in this survey instrument have Cronbach's coefficient alpha less than 0.7, but the values are between 0.486 – 0.655. This indicates that three sections in this survey instrument achieve moderate satisfactory level on internal consistency reliability.

4.2 DEMOGRAPHICS OF RESPONDENTS

Figure 3 presents the SPSS output for demographics of the respondents. There are a total of 180 respondents taking part in this survey. All respondents are full-time students from a local university. Among the respondents, 54% of them are male respondents while the rest are female respondents.

4.3 ICT INFRASTRUCTURE AVAILABILITY AND ACCESSIBILITY

Tables 4 and 5 present the respondents' feedback on ICT infrastructure availability and accessibility inside and outside campus. Feedbacks were obtained on accessibility of ICT infrastructure inside and outside campus in terms of computer availability, internet availability and internet speed. More than half of the respondents agree that ICT infrastructure is accessible inside and outside campus. They are also satisfied with the internet speed inside and outside campus. Higher feedback (71.8%) on accessibility of ICT infrastructure outside campus was observed as compared to inside campus (56.1%). In general, 63.9% of the respondents agree that ICT infrastructure is accessible and available.

4.4 ICT LITERACY

Table 6 presents the investigation on computer and internet literacy of respondents. Overall, there are only 10.1% of respondents who never use any of the computer functions such as word processing, computer game, graphic/photo processing, technical software and programming. There are 28.8% of the respondents who never deal with any of the internet functions such as searching for information online, online chatting, emailing, online banking and blogging. Thus, overall, 80.6% of the respondents are considered computer and internet literate.

In order to evaluate the association between ICT literacy and demographic of respondent, several tests for independence were conducted between ICT literacy and demographic of respondents (gender, faculty and program level). Chi-Square test is used to perform the test for independence. Table 7 presents the summary of Chi-Square tests' result. It is observed that the p-values for all Chi-Square tests are larger than 0.05. Therefore, there is insufficient evidence to conclude that there is an association between ICT literacy and demographic of respondent at 5% level of significance. In short, demographics of respondent have no influence on their ICT literacy.

Faculty			Gender		Total
			Male	Female	
Faculty of Electrical Engineering	Program level	Diploma	12	18	30
		Degree	21	9	30
	Total		33	27	60
Faculty of Mechanical Engineering	Program level	Diploma	15	15	30
		Degree	20	10	30
	Total		35	25	60
Faculty of Civil Engineering	Program level	Diploma	15	15	30
		Degree	15	15	30
	Total		30	30	60

Figure 3: SPSS output for demographics of the respondents

4.5 E-LEARNING EXPERIENCES

The e-learning experiences of respondents are derived based on two aspects; namely respondents' understanding on the definition of e-learning and the e-learning usage history of respondents.

Three definitions of e-learning from difference sources were included in the questionnaire to assess the respondents' understanding of e-learning. Table 8 shows the percentage of responses on the

Table 4: Respondents' feedback on ICT infrastructure availability and accessibility inside and outside campus

Item		Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree(%)	Total (%)
Availability and accessibility of ICT infrastructure inside campus	Accessibility of computer inside campus	10.0	35.6	50.0	4.4	100
	Accessibility of internet inside campus	7.2	38.9	50.0	3.9	100
	Satisfactory internet speed inside campus	3.3	36.7	56.1	3.9	100
Availability and accessibility of ICT infrastructure outside campus	Accessibility of computer inside campus	5.6	19.6	54.7	20.1	100
	Accessibility of internet inside campus	3.9	24.4	55.0	16.7	100
	Satisfactory internet speed inside campus	1.7	29.4	51.7	17.2	100

Table 5: Overall responses on ICT infrastructure availability and accessibility inside and outside campus

Item	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree(%)	Total (%)
Availability and accessibility of ICT infrastructure inside campus	6.9	37.0	52.0	4.1	100
Availability and accessibility of ICT infrastructure outside campus	3.7	24.5	53.8	18.0	100
Overall availability and accessibility of ICT infrastructure*	**5.3**	**30.8**	**52.9**	**11.0**	**100**

**average values of rows 1 and 2*

Table 6: The overall percentage of responses for computer literacy and internet literacy

Item	Never (%)	Sometimes (%)	Fairly often (%)	Very often (%)	Total (%)
Frequency of using computer	10.1	44.0	28.6	17.2	100
Frequency of using internet	28.8	31.1	20.1	19.9	100
Overall frequency of using computer and internet*	**19.5**	**37.6**	**24.4**	**18.6**	**100**

**average values of rows 1 and 2*

Table 7: Association between ICT literacy and demographic of respondent

Associated Factor with ICT literacy	*p*-value for the Chi-Square test
Gender	0.897
Faculty	0.106
Program Level	0.600

three different definitions. In general, an overall 69.6% of the respondents understand all the three definitions. In term of preference over the three e-learning definitions, it is observed that most respondents prefer definition 3 ("e-Learning" is learning using information and computer technology) followed by definition 1 ("e-Learning" is learning activities based on any electronic format) and lastly definition 2 ("e-Learning" refers to internet technologies used to deliver a broad array of solutions that enhance the instructional process).

Table 9 presents the e-learning usage history of respondents. Most respondents were found to have experiences in finding information online for coursework (83.8%), followed by accessing digital library online (54.2%), downloading lecture notes online (48.6%), answering quiz online (25.8%) and lastly communicating with lecturer using e-mail or e-forum (18.4%). It is found that most respondents have the most experience in finding information online for coursework but least experience in communicating with lecturer using e-mail or e-forum.

4.6 E-LEARNING ACCEPTANCE

Table 10 presents the investigation on the e-learning acceptance of respondents. The e-learning acceptance of students are assessed based on preference over face-to-face teaching, group study after class, ability to understand written instruction, classroom discussion and acceptance on new technologies. A respondent with low e-learning acceptance would prefer face-to-face learning, group study after class, assistance in understanding written instruction, classroom discussion and resistant to new technology. It was observed that the respondents have strong preference for face-to-face teaching (88.8%), group study after class (53.9%), prefer assistance in understanding written instruction (59.1%), classroom discussion (84.2%) and resistant to new technology (20.4%).

It is observed that only 20.4% of respondents are resistant to new technology indicating 79.6% of respondents find learning new technologies exciting and challenging. As such, higher e-learning acceptance might be achieved with proper e-learning training and implementation schemes. Examples of such schemes that could be considered include developing hardcopy handbook/ user guide, online guide/tutorial, lecturer supervision in the first month of e-learning implementation, hands-on training in forms of short course or seminar, setting up of customer service centre

Table 8: Understanding of respondents on e-learning definitions

e-Learning Definition	Yes (%)	No (%)	Unsure (%)	Total (%)
Definition 1 (www.teach-nology.com)	67.6	3.4	29.1	100
Definition 2 (Poon *et al.*, 2004)	61.8	6.7	31.5	100
Definition 3 (Authors' definition)	79.8	5.6	14.6	100
Overall understanding on the definition of e-learning*	**69.6**	**5.3**	**25.1**	**100**

**average values of rows 1 and 2*

Table 9: Past e-learning experiences of respondents

Item	Yes (%)	No (%)	Unsure (%)	Total (%)
To access digital library online	54.2	36.3	9.5	100
To find information online for coursework	83.8	8.4	7.8	100
To download lecture notes online	48.6	44.1	7.3	100
To communicate with lecturer using e-mail or e-forum	18.4	73.7	7.8	100
To answer quiz online	25.8	66.3	7.9	100

Table 10: e-Learning acceptance of respondents

Item	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree(%)	Total (%)
Prefer face-to-face teaching	2.0	9.2	50.8	38.0	100
Prefer group study after class	7.3	38.8	46.1	7.8	100
Prefer assistance in understanding written instruction	5.6	35.3	51.8	7.3	100
Prefer classroom discussion	2.5	13.2	62.6	21.6	100
Resistant to new technologies	24.6	55.0	18.4	2.0	100

Table 11: Association between e-learning acceptance and the various factors

Associated factor with e-learning acceptance	*p*-value for the Chi-Square test
Gender	0.465
Faculty	0.125
Program Level	0.581
ICT infrastructure availability and accessibility	0.885
ICT literacy	0.000*
e-Learning experiences	0.481

** denotes association with e-learning acceptance at p-value < 0.05*

and online helpdesk. Students' preference on these proposed schemes was evaluated in Section 8 of the questionnaire.

In order to evaluate the association between the various factors (demographics of respondent, ICT infrastructure availability and accessibility, ICT literacy and e-learning experiences) and e-learning acceptance, several tests for independence were conducted. Chi-Square test is used to perform the test for independence. Table 11 presents the summary of the association between e-learning acceptance and the various factors. It is observed that the p-values for all Chi-Square tests are larger than 0.05 except ICT literacy. Therefore, it is evident that ICT literacy is the only factor that would affect e-learning acceptance at 5% level of significance.

4.7 COURSE PEDAGOGY

Table 12 illustrates the influence of course pedagogy on e-learning acceptance of respondents. The number of respondents who prefer no online learning or 25% online learning is more than the number of respondents who prefer 75% online learning or fully online learning for each type of courses. However, there are around 19% to 32% of the respondents who prefer to have equally online learning and classroom learning.

Table 13 presents the influence of course discipline on e-learning preference. The percentage of respondents choosing 75% or 100% online learning according to course discipline in descending sequence is humanity, language, business, mathematics, science and lastly hardcore engineering.

To investigate the influence of teaching pedagogy (lecture, tutorial and laboratory) on e-learning preference, an overall percentage of responses is summarised in Table 14. The descending order of e-learning preference according to teaching pedagogy is lecture, tutorial and laboratory respectively.

4.8 E-LEARNING FUNCTIONS

The questionnaire also investigates some common e-learning functions desired by respondents. The percentage of responses for each of the e-learning functions desired by respondents is

presented in Table 15. These e-learning functions are reading notices online, downloading lecture notes online, watching lecture video online, communicating with lecturer using e-mail and answering quiz online. There are more than half of the respondents having a preference on all of the e-learning functions except watching lecture video online. There are only 45% of the respondents who prefer watching lecture video online.

To rank the respondents' preference over the e-learning functions, it is observed that most respondents prefer downloading lectures online, followed by communicating with lecturer using e-mail, reading notices online, answering quiz online and lastly watching lecture video online that is the least favorable function.

There are also some open responses/suggestions by the respondents as follows:

- To prepare links to compare lecture notes and to find references
- To post question and answer (solution of the questions) online
- To answer tests online

4.9 TRAINING NECESSITIES

Section 8 in the questionnaire investigates the training necessity of respondents to increase e-learning acceptance. It is important to determine the training needs of the students as it will affect student readiness in accepting e-learning. The percentage of responses for each training necessity is presented in Table 16. The statistics shows that all of these training needs are necessary for the respondents to use e-learning. The sequence of the training items according to preference in descending scale is the hardcopy handbook/user guide, online guide/tutorial, lecturer supervision in the first month of e-learning implementation, hands-on training, customer service centre and online helpdesk. There are also some open responses/ suggestions by the respondents such as to provide video compact discs (VCD) about the e-learning system and to provide online tutorial using graphical approach such as Flash etc.

5.0 DISCUSSIONS

This study does not represent the overall picture of e-learning readiness of engineering student in Malaysia as the samples involved are from only one local university. However, it can provide some insights into the implementation of e-learning among engineering students. It is also observed that some Sections 2, 4 and 5 in the questionnaire achieved only moderately satisfactory level on internal consistency reliability. This study reported a close association between student acceptance and ICT literacy.

Table 12: e-Learning preference of respondent according to course

Item		0% online learning (%)	25% online learning (%)	50% online learning (%)	75% online learning (%)	100% online learning (%)	Total (%)
Hardcore engineering courses	a) lecture	27.7	31.6	26.0	7.9	6.8	100
	b) tutorial	23.7	28.2	31.6	9.6	6.8	100
	c) laboratory	31.1	26.6	19.8	15.3	7.3	100
Science courses	a) lecture	28.4	27.8	29.0	9.7	5.1	100
	b) tutorial	25.6	29.0	30.1	10.2	5.1	100
	c) laboratory	31.6	28.2	20.9	13.6	5.6	100
Mathematics courses	a) lecture	35.8	24.4	20.5	11.4	8.0	100
	b) tutorial	28.8	26.6	24.9	9.6	10.2	100
	c) laboratory	37.9	27.6	20.7	9.8	4.0	100
Business courses	a) lecture	24.6	24.6	22.9	16.6	11.4	100
	b) tutorial	23.4	25.7	26.9	14.9	9.1	100
Language courses	lecture	22.2	20.5	29.5	13.1	14.8	100
Humanity courses	lecture	18.5	22.5	30.9	10.7	17.4	100

Table 13: Overall influence of course discipline on e-learning preference

Item	0% online learning (%)	25% online learning (%)	50% online learning (%)	75% online learning (%)	100% online learning (%)	Total (%)
Hardcore engineering	18.0	41.6	29.2	6.7	4.5	100
Science	19.2	41.2	27.7	9.0	2.8	100
Mathematics	24.2	38.8	21.9	12.4	2.8	100
Business	18.8	25.0	31.3	14.8	10.2	100
Language	22.2	20.5	29.5	13.1	14.8	100
Humanity	18.5	22.5	30.9	10.7	17.4	100

Table 14: Influence of teaching pedagogy on e-learning preference

Item	0% online learning (%)	25% online learning (%)	50% online learning (%)	75% online learning (%)	100% online learning (%)	Total (%)
Lecture	25.5	26.6	25.6	11.8	10.5	100
Tutorial	15.2	34.3	35.4	10.1	5.1	100
Laboratory	25.3	32.6	29.2	9.6	3.4	100

Table 15: Preference of respondents on various e-learning functions

Item	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	Total (%)
Reading notices online	8.9	20.7	59.2	11.2	100
Downloading lecture notes online	5.6	14.0	60.1	20.2	100
Watching lecture video online	14.4	40.6	30.0	15.0	100
Communicating with lecturer using e-mail	5.0	20.6	61.7	12.8	100
Answering quiz online	6.1	26.3	55.3	12.3	100

Table 16: The percentage of responses for each training necessity

Item	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)	Total (%)
Hardcopy handbook/user guide	3.4	6.7	70.9	19.0	100
Online guide/tutorial	2.2	8.9	74.4	14.4	100
Hands-on training	3.9	21.9	57.3	16.9	100
Lecturer supervision in the first month of e-learning implementation	4.5	18.4	68.2	8.9	100
Online helpdesk	6.7	35.0	47.8	10.6	100
Customer service centre	6.7	27.8	53.9	11.7	100

Therefore, any higher learning institutions implementing e-learning can consider increasing students' ICT literacy by various measures such as introducing more ICT elements in course content, providing incentives for e-learning users and providing short-courses on ICT. Different level of e-learning implementation can also be considered according to course pedagogy. This survey revealed that e-learning preference descends with humanity courses followed by language courses, business courses, mathematics courses, science courses and lastly hardcore engineering courses. This is probably due to the nature of the courses as humanity, language and business courses involved less numerical and hands-on applications than mathematics, science and hardcore engineering courses. Students would naturally prefer face-to-face learning for such courses involving tutorials and laboratory sessions. Therefore, students were also found to prefer more e-learning in lecture followed by tutorial and lastly laboratory. This study also investigated preference of students on some typical e-learning functions. Based on this study, it was found that most students prefer downloading lectures online, followed by communicating with lecturer using e-mail, reading notices online, answering quiz online and lastly watching lecture video online. Therefore, implementation of e-learning could also be done in stages by first introducing the most preferred function and followed by the less preferred functions. To increase student acceptance, it is also important to provide training and guide to the students. It was found that students preferred hardcopy handbook/ user guide the most, followed by online guide/tutorial, lecturer supervision in the first month of e-learning implementation, hands-on training, customer service centre and online helpdesk.

6.0 CONCLUSIONS

A survey has been conducted to investigate engineering student acceptance on e-learning in a local university. Multistage cluster sampling was adopted with a total sample size of 180. A supervised self-administered questionnaire adopting group administration was then developed. There are eight sections totaling 41 questions in the questionnaire, namely demographic, ICT infrastructure availability and accessibility, information technology literacy, e-learning experiences, e-learning acceptance, course pedagogy, e-learning functions and training necessities. Pretesting, pilot testing, face and content validity assessment were conducted prior to data collection with positive results. Reliability analysis was conducted on the survey data. Moderate satisfactory level

was observed on internal consistency reliability with Cronbach's coefficient alpha between 0.486 and 0.710.

In summary, the respondents give positive feedback on ICT infrastructure accessibility and accessibility inside and outside campus. They are also satisfied with the internet speed inside and outside campus. There are about 80% of the respondents are computer and internet literate. It was also found that the demographic of respondent (gender, faculty and program level) has no influence on their ICT literacy. For e-learning experiences, an overall 69.6% of the respondents understand the definitions of e-learning.

For e-learning acceptance, it is also found that ICT literacy is the only factor that affects e-learning acceptance. This survey revealed that e-learning preference descends with humanity courses followed by language courses, business courses, mathematics courses, science courses and lastly hardcore engineering courses. Positive feedback was also obtained on preference over e-learning function such as reading notices online, downloading lecture notes online, watching lecture video online, communicating with lecturer using e-mail and answering quiz online. To implement e-learning, all types of training are necessary for the respondents especially hardcopy handbook/ user guide. ■

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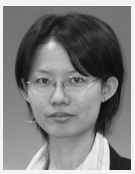
PROFILES



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