Usability Evaluation of University Putra Malaysia (UPM) Learning Management System

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Abstract:- The objectives of any academic Learning Management System is to provide valuable academic information to its users without any difficulty. Nowadays, web usability is becoming a crucial issue for LMS development, most users perceive usability as a key factor in e-learning application planning and use . It is possible that website visitors will find it very difficult in getting their needs due to the issue of usability. However there is increased concern whether to improve the UPM learning Management system or not because various users encountered many problems when using the LMS. These result lead to less use of the system and affect the goals of learning management system. Therefore this study identifies the usability level of UPM learning Management System from 376 UPM students perspectives, A proposed UPM-LMS was developed to overcome the usability problems of UPM-LMS which was achieved through post-test and Expert Evaluation. . The result of the pre survey shows that all the usability factors were found to be at high level but looking at their point they are not up to the mid-point of high usability level, their point are closer to low usability level thus, more attention needs to be given to the factors for better students satisfaction especially efficiency and error prevention which their values were found to be at the border line of low usability level. However 30 students and 3 usability experts evaluated the proposed UPM LMS, and found out that, there is significant improvement on all the usability factors.

Keywords: - Usability, Learning, Management, System, UPM.

I. INTRODUCTION

One of the popular phrases used in our present education sectors and it operates all over the world is the electronic Learning, which is synonymously abbreviated as e-Learning and is more or less related to other internet services such as e-research, e-library, e-commerce, e-payment and other e-transactions. This method evolves as a result of a sort of revolution taking place in the field of information technology (IT). In a nutshell, this newly emerged method of learning portrays itself as distance learning, which is globally made accessible to all and sundry irrespective of location, distance, cost or time. The method is electronically designed to be accomplished through various electronic gadgets, such as internet, intranet, extranet, satellite, audio, video, CD ROM as well as through others sources audio-video media of information dissemination. Close observation of the exponential development taking place in the field of information dissemination technology shows that, e-learning nowadays metamorphoses and becomes part and parcel of what is presently known as Learning Management System (LMS). In support of this (Pituch & Lee, 2006) argued that e-learning or virtual learning system (VLS) is gradually turning into method of teaching and learning through LMS. In further support, (Wang & Shee, 2007) reaffirmed the aforementioned argument, thus, e-learning or learning through internet has become a major phenomenon in recent years. Detailed analysis of the developmental trends of LMS over period of time concurs with the impressions of many educationalists and researchers world over that, the long awaited revolution in teaching methodology has evolved, i.e. the traditional method of acquiring and imparting knowledge is being replaced with e-learning or Learning Management System LMS. In agreement with the assertion, people using LMS, particularly end-users, have the notion that, the method is very influential in the sense that, it encourages good interactions between teachers and students, by providing various materials one needs within the time frame. End-users here refers to students, teachers, researchers, administrators, board management, staff etc. people and various materials are refers as education teaching aids, that are not only cost effective but accessible to everybody at any part of the world to carry out their activities with up to most ease or with the highest peak level of satisfaction. In line with this general concept, Frey (2005) described LMS as a means of assisting learners and instructors to accomplish their instructional goals through the use of problem-solving team, simulation online, and questions and answers session, rather than be a tool that just allows printing lecture notes, evaluating lecturers or seeing any updated information made by the instructors. In a similar concept, Naidu (2006) defined LMS "as a means an electronic Moodle that include a suite of tools for teaching and learning online". Based on these definitions, my conceptual understanding of the term, LMS is an electronically designed instructional Moodle which is made accessible and cost effective to all and sundry irrespective of distance, time or location in any part of the world.

II. RELATED WORK

Among the various commendations made on the impart and importance of LMS to the world- wide educational sectors, include those from the end users of the system, who unanimously express their views, that, this globalized method is one of the rapidly growing technology in our educational institutions, this is as a result of its worldwide advantages such as significant reduction in travelling time,

cost effective, availability of efficient training materials that suite one level of interest and to crown it up, convenience as the method is accessible to everybody in the world regardless of distance, time or location. For instance (Andersson, & Grönlund, 2009; Linna, 2013) independently enumerated a number of LMS applications which are advantageous to the world educational sectors and they include among others, cost reduction, worldwide accessibility and overall improvement of the general quality of education. In line with these enumerated advantages of LMS, institutions in not only technologically advanced countries in the world but also institutions in Sub-Saharan countries derived numerous benefits in using LMS, which range from uplifting their educational institutions to becoming complementary to various methods used in teaching and learning. This is buttressed by the adoption of various LMS models in many educational institutions in Sub-Saharan countries. (Munguatosha et al, 2011) expressed the view that, out of approximately 80.2% of educational institutions in Sub-Saharan countries, 78% uses Moodle LMS, while the remaining adopts blackboard. Also in Sudan (El-Mubarak et al., 2013) revealed that 25% of tertiary institutions in Sudan use Moodle LMS. In re-affirming the aforementioned, research conducted by (Unwin et al., 2010) showed tremendous expansion, adoption and utilization of different LMS, in Sub Saharan countries, these include online system that used to arrange and encourages end-users to learn through the web. In a similar contribution (Pituch & Lee, 2006) reported that learning these online systems are ordinarily integrated with learning resource tools for audio-video messages and communication (email, discussion forum, chat) and evaluation tools. Moreover (Ssekakubo et al., 2011; Unwin et al., 2010) further confirmed that, the most relevant frameworks conveyed in several institutions in Sub- Saharan countries are Moodle, blackboard, Atutor, Sakai, and Kewl as they demonstrate the capacity to alleviate the difficulties confronting education sectors in Sub-Saharan countries. In further commendations made on the importance of LMS, coupled with the advanced trends in teaching and learning, LMS, is as paramount important to the worldwide educational sectors, as majority of universities, polytechnics and colleges in the most advanced countries such as USA, United kingdom, Japan etc. in the world embrace LMS to support instructors showing activities and students learning process. According to (Epping, 2010) the most outstanding feature of LMS is to provide an enabling environment for learning, irrespective of distance, time or location. Further observation on the expanded technology in internet, LMS has as of now been connected to different educational institutions round the world. (Falvo & Johnson, 2007) shared the views that, LMS helps end-users particularly instructors and lecturers to explore various LMS models to discuss course content by exchanging information to one another, keep track of students learning and control educational activities in an online environment. On the other hand (Boggs & shore 2004) emphasized on the way and manner LMS enhances students and instructors learning and teaching activities.

In view of the numerous factors adduced to explain the importance of LMS to the world-wide learning sectors,

many end-users discovered that, not all LMS are efficient; therefore careful assessments are needed in selecting the most suitable LMS. For instance, usability is one of the non-functional requirement for choosing any system especially LMS, which allows us to know the level of its usability. In collaborative efforts to define the term usability in relation to LMS. Different researchers and standard institute defined usability from different perspective, among them include [IEEE Std.610.12-1990] as "The ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component". In view of the fact that, usability is a component of Human Computer Interaction (HCI), ISO 9241 part ii, viewed usability as "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". Recent reviews of the components of LMS, shows that, usability is becoming a strategic factor level that needs special attention, particularly in the software development processes. That is why (Juristo et al., 2007) said; usability evaluation has now become an increasingly major concern area of human-computer interaction (HCI). Similarly, (Nielsen, J. 2012) defined usability in relation to its factors, i.e. efficiency, satisfaction, memorability, learnability and error prevention. He continued to describe usability as an important factor in designing any web-site, especially LMS, which is of great concern to many web-site visitors all over the world. These Learning Management Systems LMS include that of University Putra Malaysia, UPM, where students from all walks of life avail themselves with UPM system. Reactions from end-users of UPM: LMS especially students revealed that UPM web-site visitors encounter with many problems in getting the result expected when working with the UPM: LMS due to some usability hurdles. Based on these encountered problems, the needs to know the usability strength and weaknesses level of UPM: LMS becomes absolutely imperative, as the result obtained could be of great helping to the management and website developers of not only that of UPM but also others institution LMSs. In view of the aforementioned, the researchers of this paper find it of economic importance to explore the presumed usability factors that affect UPM: LMS, and at the same time open up related areas for further research.

To embark on this research, the entire work is organized as follows; a brief literature review, followed by Nielsen and WAMMI usability factors, then, methodological stages of the research, further pilot study, actual study, evaluation metrics, reliability and validity test and sample selection were all described in this paper. The results obtained were analyzed and evaluation of the proposed UPM: LMS was made from both the students and usability experts, and finally, contributions, recommendation and conclusion of the research work were summarized.

Different researchers from different domains have conducted usability studies in Learning Management System LMS) and other applicable field of usability, among such are the work of (Al-Khalifa, 2010) evaluated the usability of JUSUR Learning Management System of the department of information and technology in King Saudi University. In the

study, two standard questionnaires were used as an evaluation method, which comprises: a) system usability scale (SUS) developed by John Brooke, 1986, the questionnaire consists of ten questions which were used and adapted. b) Learning Management System usability questionnaire (LMSUQ) , this questionnaire was constructed and supported by two existing questionnaires which are Web based learning Environment Instrument WLEI (Chang, 1999) and usability and user satisfaction questionnaire adapted from PSSUQ (Zins et al., 2004). The questionnaire consists of 31 questions, 18 questions from usability and user satisfaction and 13 from WLEI. A non-probability sampling of 155 female students were selected as respondents for the research work. Furthermore, the evaluation of JUSUR learning management system (LMS) is based on 7 factors namely: system usefulness, learnability, satisfaction, outcome/future use, design/layout and functionality. However some students observed that JUSUR LMS was user-friendly and easy to use but functionality of the system was complex, as some students revealed that the font size is too small and difficult to find its back button.

The study of (Gorgi et al, 2008), evaluated the usability of LMS Moodle from four units, namely learning, synchronous and asynchronous communication, submissions of assignment and testing. In the study, four course creators known as teachers, four university professors and two system administrators were included in the evaluation techniques. Also the course creators create courses and add blocks and tools into the courses. Three different set of questionnaires were used with three different types of questions (open, closed ended questions, and scaled answers). The questionnaires were given to the students after one, two and six weeks of using the Moodle LMS respectively. A non-probability of 84 students participated in the study from the faculty of economic, science and informatics. Based on the survey, it was observed that the Moodle LMS was usable in the perspectives of usability factors: memorability, effectiveness, efficiency, ease of use and satisfaction.

In-order to come up with an appropriate questionnaire for UPM Learning Management System, various related papers based on usability evaluation of LMS were reviewed. The observation shows evaluation methods of LMS usability, which includes questionnaire based evaluation, heuristic evaluation, frameworks, models and checklist method, thus, most previous works focus on the Nielsen concept, as more than half of the researchers adopted questionnaire as an instrument for usability evaluation of LMS upon which 80 percent directly or indirectly adopted the concepts of Nielsen usability evaluation which comprised of 5 usability factors i.e. learnability, error prevention, satisfaction, efficiency and memorability. Some researchers used all the Nielsen usability factors, whilst others used two to three of the factors. The remaining reviewed papers adopted some of the Nielsen usability factors in their models, framework and heuristic evaluation, but generally most researchers focus on Nielsen concept in evaluating the usability of LMS either directly or indirectly. In this particular research which is related to UPM: LMS evaluation, three factors from (Nielsen, 2012) together with WAMMI based evaluation questionnaire (Caglar & Mentes, 2012) similar to Nielsen usability factors were adopted as an instrument for the study.

The figure 1 below shows the relationship between WAMMI and Nielsen usability factors both are used for LMS usability evaluation. Efficiency and learnability are the common factors between the two.
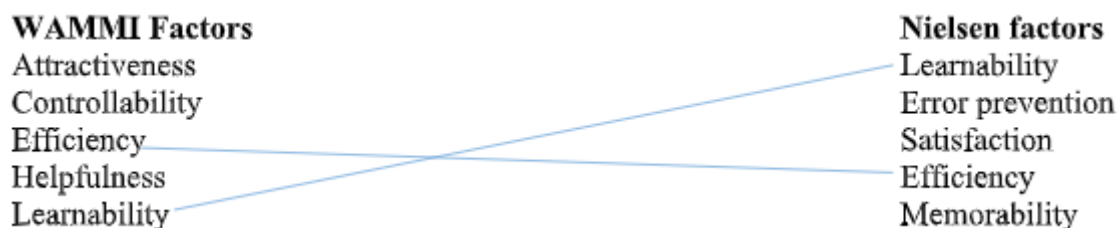
Fig 1 WAMMI- Nielsen Usability Factors

In order to come up with an appropriate usability questionnaire we combined the two usability factors of WAMMI and Nielsen as shown below.

➢ *WAMMI-Nielsen Usability Factors*

- Attractiveness
- Controllability
- Efficiency
- Learnability
- Helpfulness
- Memorability
- Satisfaction
- Error prevention

III. METHODOLOGY

The main goal of this paper is to identify the level of usability strength and weaknesses of UPM Learning Management System, based on usability factors of WAMMI and Nielsen (2012) and these has been achieved by adopting the methodological phases and activities as described below.

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┌─────────────────────┐          ┌──────────────────────────┐
│  Research Planning  │─────────▶│ To identify the title,    │
└─────────────────────┘          │ problem and              │
          │                      │ objectives of the        │
          ▼                      │ research work            │
┌─────────────────────┐          └──────────────────────────┘
│  Literature Review  │─────────▶┌──────────────────────────┐
└─────────────────────┘          │ To find related articles │
       ┌───┐                     │ on Usability evaluation  │
       │ A │                     │ of LMS                   │
       └───┘                     └──────────────────────────┘
          ▼
┌─────────────────────┐          ┌──────────────────────────┐
│ Preliminary studies │─────────▶│ To identify the usability│
└─────────────────────┘          │ levels of Putra LMS and  │
       ┌───┐                     │ improve it.              │
       │ B │                     └──────────────────────────┘
       └───┘
          ▼
┌─────────────────────┐          ┌──────────────────────────┐
│     Pre-Survey      │─────────▶│ To know the population and│
└─────────────────────┘          │ number of faculties in UPM│
          │                      │ To select the faculties and│
          ▼                      │ members for representation.│
                                 │ To carry out Research     │
                                 │ Hypothesis                │
                                 └──────────────────────────┘
┌─────────────────────┐          ┌──────────────────────────┐
│     Pilot Study     │─────────▶│ To distribute questionnaire│
└─────────────────────┘          │ among the chosen members  │
          │                      │ from the selected faculties.│
          ▼                      │ To check the validity and │
                                 │ reliability of the instrument│
                                 └──────────────────────────┘
┌─────────────────────┐          ┌──────────────────────────┐
│    Actual Survey    │─────────▶│ To distribute questionnaire│
└─────────────────────┘          │ among the chosen members  │
          │                      │ from the selected faculties│
          ▼                      │ based on the sample size. │
                                 │ To check the validity and │
                                 │ reliability of the instrument│
                                 │ To analyze the data received│
                                 │ from the students         │
                                 └──────────────────────────┘
┌─────────────────────┐          ┌──────────────────────────┐
│ System Development  │─────────▶│ To develop and improve    │
└─────────────────────┘          │ the existing UPM LMS      │
          │                      └──────────────────────────┘
          │                              ┌──────────────────────┐
          │                         ────▶│  Students Post-Test   │
          ▼                        /     └──────────────────────┘
┌─────────────────────┐          /
│  System Evaluation  │─────────
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                                   ────▶│  Experts Evaluation   │
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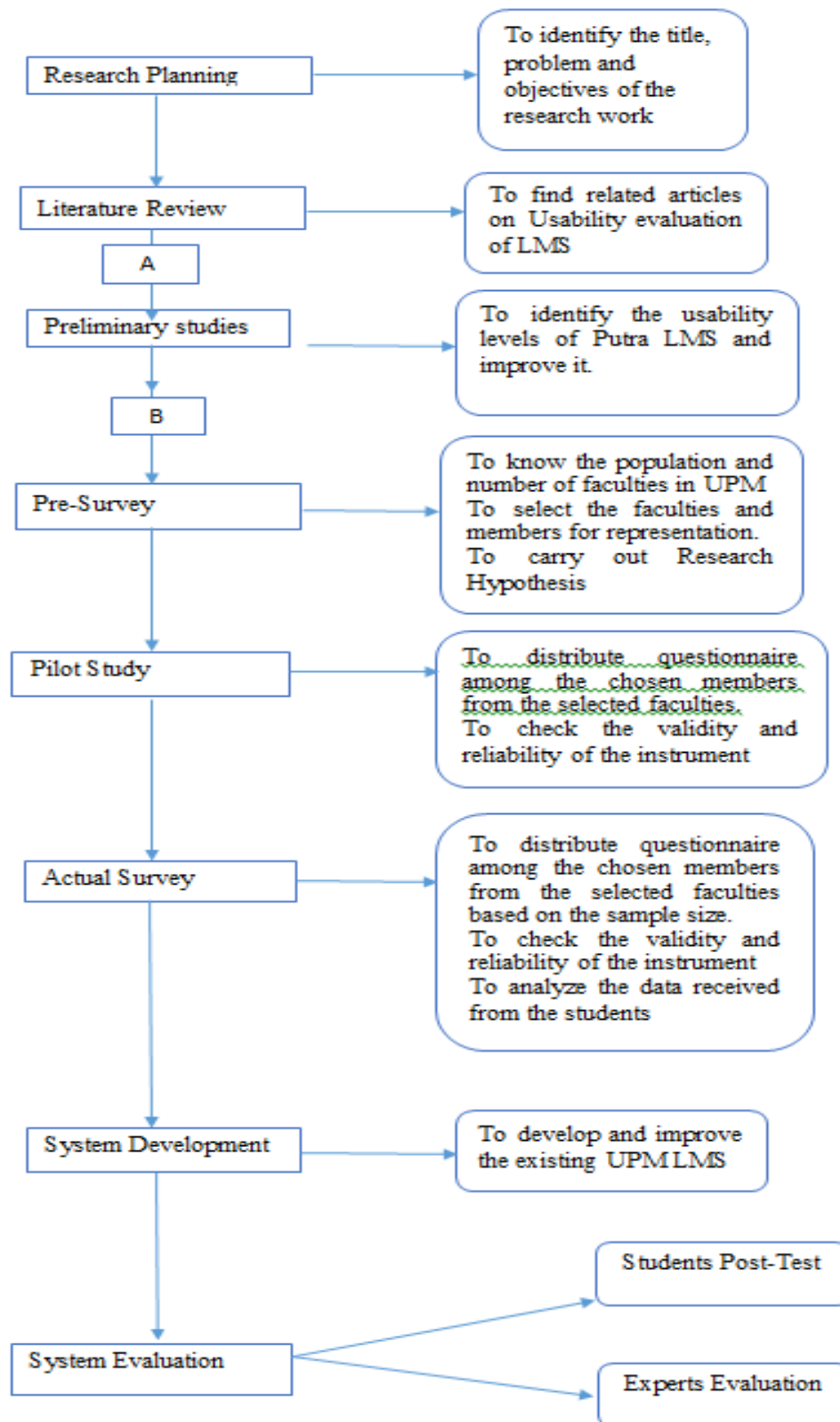
Fig 2 Flowchart of the Research Methodology

➢ *Questionnaire*

This study adopts WAMMI-Nielsen questionnaire based evaluation techniques of (Caglar & Mentes, 2012) together with three Nielsen (2012) usability factors (memorability, error prevention and satisfaction). The questionnaire comprised of two sections, the first part contained the information about the respondents, such as age, internet experience, gender, faculty, nationality and access to UPM LMS. The second section consisted of thirty two questions, four questions from each of the 8 categorized factors namely: attractiveness, satisfaction, memorability, efficiency, learnability, controllability error prevention and helpfulness. The questionnaire aims to identify the usability level (strength and weaknesses) of UPM LMS.

➢ *Evaluation Metrics*

In-order to evaluate the usability of UPM LMS from students' point of view, responses will be evaluated based on the adopted merit point of (Islam & Tsuji, 2011).

Table 1 Usability Merit Point of UPM LMS

Option	Strongly Disagree	Disagree	Agree	Strongly Agree
Merits	1	2	3	4

There are four questions in each usability factors and each question represents the participant merit point. Table 1 above shows four usability likert scale with their corresponding merit points, ranging from 1 to 4. According to (Abdullah & Wei, 2008), usability point for a category, x, is defined as: $X = [\Sigma$ (Merit for each question of the category)] / [number of questions]. Overall mean, minimum mean, maximum mean, range and standard deviation were all calculated to get the usability strength and weaknesses level of the UPM LM.

Table 2 Usability Level and Corresponding Usability Points.

Usability level	Point X
Very low	$0 \leq x \leq 1.49$
Low	$1.5 \leq x \leq 2.49$
High	$2.5 \leq x \leq 3.49$
Very high	$3.5 \leq x \leq 4.00$

The usability strength and weaknesses level of UPM LMS was determined by using the corresponding merit values of usability levels. Table 2 above shows the usability level with their corresponding usability points ranging from 0 to 4.

➢ *Pilot Study*

In any survey research work, there is need to conduct a pilot study to know whether the instrument used is appropriate for the study or not. Because it is very difficult for usability evaluation to be free from error. The pilot study determines the workability of the actual study. Four faculties were randomly selected from the 15 faculties of the University Putra Malaysia where 30 postgraduate students were selected for the study, and in the process of conducting this research, Comments, suggestion and ambiguities were met, and all possible corrections were made, before the result was taken into considerations.

➢ *Reliability*

Reliability and validity are the main elements used, as instrument in measurements evaluation, such as questionnaire. Reliability is the extend in which the questionnaire (instrument) gives the same result consistently, whereas validity refers to the degree in which an instrument such as questionnaire measures what is intended to measure. The value of alpha measures the internal consistency of the test (Cronbach, 1951) and it is defined "as number ranging from 0-9" (Cronbach, 1951). (George & Mallery, 2003) (p. 231). Provide the following rules of thumb: "> .9 – Excellent, > .8 – Good, > .7 – Acceptable, > .6 – Questionable, > .5 – Poor and < .5 –

Unacceptable". Cronbach's alpha, is the most widely used objective measure of reliability and it is used to measure the reliability of the questionnaire adopted for this study. The closer the Cronbach's alpha coefficient is 1.0 the greater the internal consistency of the items in the scale. Reliability test was conducted on the data that was obtained from the pilot study.

Table 3 Reliability Statistic of Pilot Study

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.822	0.823	8

Table 4 Reliability Statistic of Pilot Study

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.896	0.897	8

Table nand 4 above show the Cronbach's Alpha result of both pilot and actual study to be 0.823 and 0.897 respectively. This reveals that the instrument used in the study is up to expectation as such appropriate for the study.

➢ *Sample Selection*

In order to select the respondents that will participate in the study, a probability sampling called cluster sampling method was applied. University Putra Malaysia was grouped into two clusters, cluster1 consists of institutes and cluster2 consists of faculties. Simple random sampling was randomly applied, in which cluster2 was chosen. All the faculties were numbered from 1 to 15 and each numbers was written in a small piece of papers, and the papers were folded and thrown in a bowl. Hence, 4 numbers were randomly selected from the 15 numbers and the numbers that correspond to such faculties are the faculty of economic and management, science, engineering and computer science.

In-order to know the required number of sample size, slovins formula (Ariola, 2006) was applied:

$n = N / (1 + Ne^2)$
Where n = number of respondents
N= total population
e = error tolerance
n= 9585 / (1 + 9585 (0.05)^2)
= 383.9 = 384.

The sampling size obtained from slovins formula was compared with that of (krejcie & Morgan, 1970) which sample size of 370. The difference between the number of samples size obtained from the slovins formula and that of (Krejcie & Morgan 1970) is 384- 370= 14 which is negligible, therefore sample size of 384 was used for this study.

In-order to get the exact number of the sample size, 10 percent of the sample size was added to the actual number of the sample size.To know the number of questionnaire to be

distributed, number of sample size was assigned to each faculty based on the percentage of their population.

➢ *Descriptive Statistics of Respondents*

Descriptive statistics of respondents that participated in the survey are showed in table 5 below.

Table 5 Descriptive Statistic

Factors	Category	NQD	NQR	Percentage
Gender	Male		217	57.7
	Female	422	159	42.3
Access To UPM LMS	Daily		47	12.5
	After 2 days	422	31	8.20
	Weekly		105	29.7
	Two weeks and above		154	41.0
Age	23-33		229	60.9
	34-43	422	112	28.9
	44-53		33	8.8
	54 and above		2	5
Internet Experience	< 1 Year		10	2.7
	1-5 years	422	62	16.2
	6 Years and above		304	80.9
Faculty	Science	71.74	69	16.35
			52	12.32
	Economics and Management	55.95	193	45.73
	Engineering		62	14.69
		226.74		
	Computer Science			
		67.52		
Have you ever used Putra LMS?	Yes	422	337	89.6
	No		39	10.4
Students	Local	422	224	59.6
	International		156	40.4

NQD = Number of questionnaires distributed

NQR = Number of questionnaires returned

As showed in Table 5 above, more than half of the students were males, whereas 42.3% were females. For Access to UPM : LMS 12.3%, 8.2%, 29.7% and 41.0% students have access to the UPM: LMS daily, after 2 days, weekly and more than 2 weeks respectively. More than 60% of the students were below 23-33 years. 28.9%, 8.8% are students within the age 34-43 and 44-43 years of age respectively, whilst 5% of the students were above 54 years of age. This result is obviously true because of the students' academic nature of age. 51.3% of the students were from faculty of engineering. This result is not surprising because faculty of Engineering has the highest number of students among the other three faculties thus; hence more participants are expected from the faculty. 13.8% of the students are from the faculty of economics and 18.4% from the faculty of science, whereas 16.5% of the students comes from the faculty of science. More than 80% of the students have computer experience for more than 6 years whereas 16.2% and 2.7% of the students have one to five years' experience and less than one years' experience respectively. 89.6% are found to be the users of UPM LMS, whereas 10.4% were not using the UPM LMS. This result is also not surprising if we consider the students that offer a course while studying, hence most of the students happen to take one or two courses before graduating from his or her study, therefore this necessitates the students to make use of the LMS. 59.6% and 40.4% of the students were local and international students studying in UPM respectively.

➢ *Usability Strength and Weaknesses Level of UPM LMS*

In this research work, four usability levels with their merit points were adopted based on the work of (Abdullah & Wei, 2008), very low, low, high and very high usability levels. In-order to determine the usability level of a given factor, whether it is very low, low, high and very high usability, we first divide the range of a given factor by the number of usability level i.e. RUF/NUL.

Where

RUF=Range of Usability factor

NUL=Number of usability level

After the divided range value of a given factor was obtained, then very low usability level is obtained from the minimum mean value of a given factor to the maximum mean value of that factor i.e. MaxMVVLU = MinMVVLU+ DRV.

Where

MaxMVVLU = Maximum Mean value of very low usability

MinMVVLU=Minimum Mean value of very low usability

DRV=Divided range value

Low usability level was obtained from the maximum mean value of very low usability which becomes the minimum mean value of low usability i.e. MaxMVVLU = MinMVLU +0.01.

Where
MinMVLU=Minimum Mean value of low usability

And the Maximum Mean value of low usability is also obtained from the Minimum Mean value of low usability plus the divided range value i.e. MinMVLU + DRV.

Similarly high usability level was obtained from the Maximum value of low usability which becomes the minimum mean value of high usability i.e. MaxMVLU = MinMVHU +0.01.

Where
MinMVHU=Minimum Mean value of high usability

And the Maximum Mean value of high usability is also obtained from the Minimum Mean value of high usability plus the divided range value i.e. MinMVHU + DRV.

Very high usability level was determined from the maximum mean value of high usability which becomes the minimum mean value of very high usability i.e. MaxMVHU = MinMVVHU +0.01.

Where
MinMVVHU=Minimum Mean value of very high usability

And the Maximum value of very high usability is also obtained from the Minimum Mean value of very high usability plus the divided range value i.e. MinMVHU + DRV.

IV. RESULT FROM EVALUATION METRICS

The summary of the usability level of UPM LMS is shown in table 6 below and depicted graphically in figure 3

Table 6 Pre Survey Usability Result

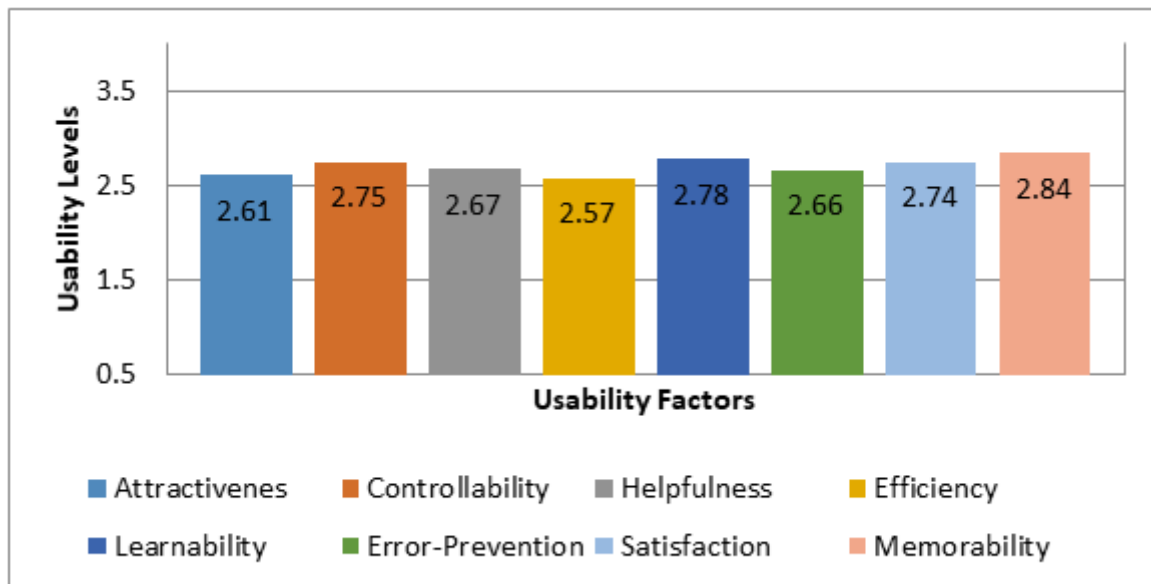| Factors	Usability level	Point
Attractiveness	High	2.61
Controllability	High	2.75
Helpfulness	High	2.67
Efficiency	High	2.58
Learnability	High	2.78
Memorability	High	2.84
Satisfaction	High	2.74
Error prevention	High	2.66

Fig 3 Students Pre survey Usability Result

Figure 3 above shows the overall responses of 376 students to each factors of WAMMI-Nielsen usability questionnaire, which varies from 0-4 likert scale. All the usability factors were found to be at a "High" level with the value above 2.50. Even though all the usability factors were found to be at high level but looking at their points they are not up to the mid-point of high usability level thus, their point are closer to low usability level than high usability level. Error prevention and efficiency have the low usability level points with 2.54 and 2.58 respectively, and then followed by attractiveness and helpfulness with 2.61 and 2.67 respectively. Satisfaction, controllability are close to each other with the value 2.74 and 2.75, thus this result is not surprising because satisfaction can lead to the acceptance of any factor, but this revealed that, the students are more satisfied towards the controllability. Similarly, learnability and memorability points are also close to each other with the point 2.78 and 2.84, hence this result is

obvious because learnability and memorability go hand in hand, you cannot remember without learning and vice versa. Therefore among all the usability factors students find it easier to remember the features of UPM LMS. Although the UPM LMS was found to be usable but still there is need to improve the level of the usefulness to reach the peak level of students' satisfaction. Therefore the overall mean of usability level of UPM LMS was found to be towards the high level with the point 2.69 as shown in the figure 4 below.
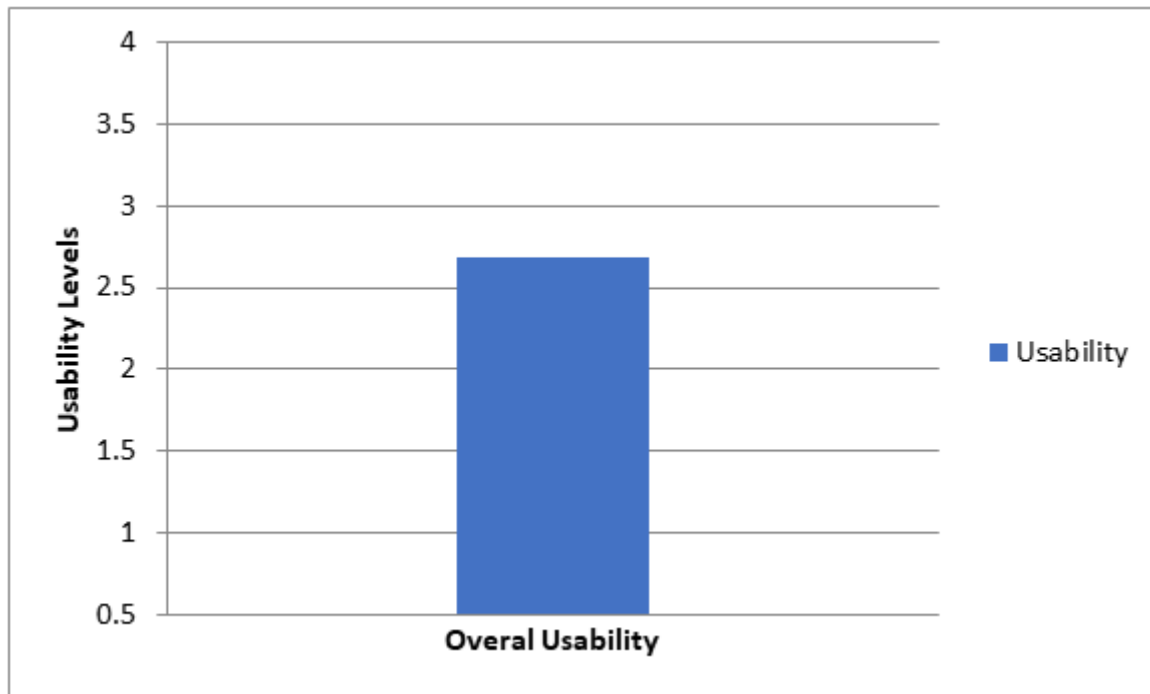

Fig 4 Overall Usability Levels of UPM LMS

Figure 4 above shows the overall usability level of UPM LMS; however it was found to be towards the "High" usability level with the point 2.69.

V.   CONTROL VARIABLES

Due to the differences that occur between the existing UPM: LMS and the proposed one, it becomes necessary to control some factors that lead to such differences. There is need to controls memorability, efficiency and learnability factors when evaluating the proposed UPM LMS. Memorability deals with remembering other features and regaining proficiency when not in use of the system for a long time. So it is not possible for the students to remember the features of the Proposed UPM LMS when using the system for the first time. However Learnability goes hand in hand with memorability because remembrance is part of learning thus, if a person cannot remember, is very difficult for him to learn. From the authenticated results obtained from the university more than 10,000 students access the existing UPM LMS therefore the efficiency of the system depends on the number of students accessing the UPM LMS at a time. Hence the efficiency of the existing UPM LMS system cannot be compare with the proposed UPM LMS which was accessed by one student at a time. At last memorability, learnability and efficiency factors were not considered in evaluating the proposed UPM LMS.

Table 7 Experts' Usability Result

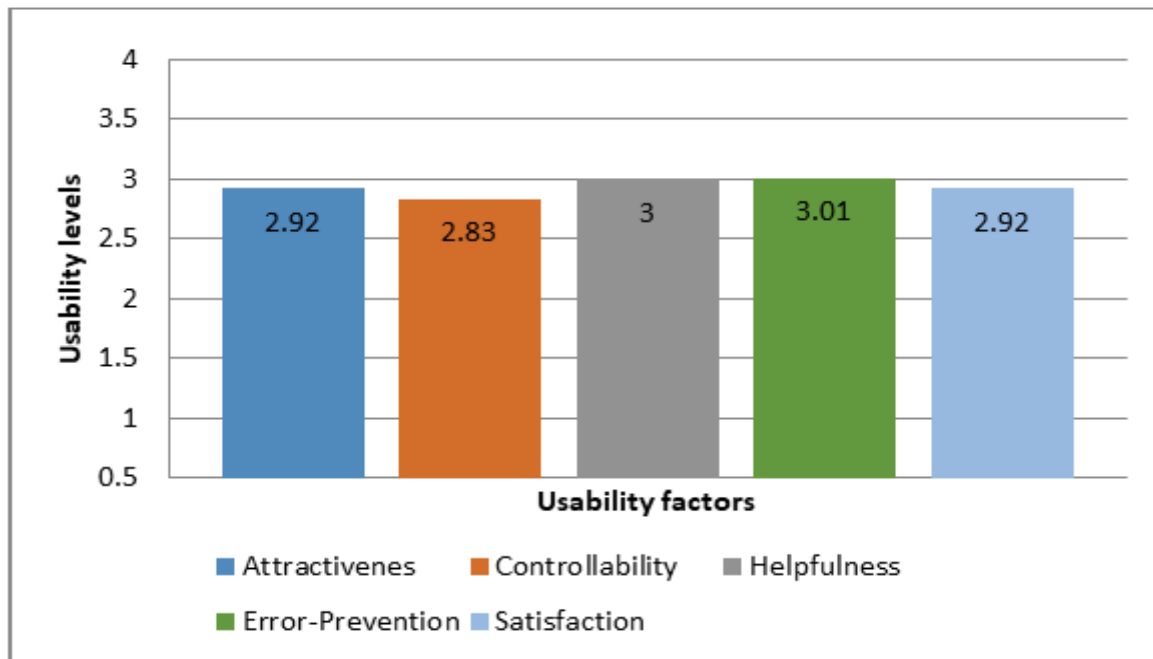| Factors	Usability level	Point
Attractiveness	High	2.92
Controllability	High	2.83
Helpfulness	High	3.00
Satisfaction	High	2.92
Error prevention	High	3.01

Fig 5 Experts Usability Result

Figure 5 above shows the post-test evaluation result of the proposed UPM LMS from three usability experts. All the usability experts navigates through the proposed UPM LMS and found that the proposed UPM LMS was usable based on the usability factors defined above. Comparing the result with the pre-survey it reveals that there is improvement on the usability factors of the existing UPM LMS.

Table 8 Post-Test students' Usability Result

Factors	Usability level	Point
Attractiveness	High	3.33
Controllability	High	3.54
Helpfulness	High	3.43
Satisfaction	High	3.61
Error prevention	High	3.51

Fig 6 Students Post-Test Usability Result

Similarly, figure 6 above reveals that there is great improvement on the proposed UPM LMS based on the usability factors defined above. 30 students evaluated the proposed UPM LMS and majority of the respondents answered the same usability likert scale. Hence the evaluation result from the 30 students is enough to represent the number of students that participated in the pre survey since most of the students answers were saturated and fall within the same likert scale.

VI. CONCLUSION

In this section, we summarized the whole research work in order to show the result obtained from the study. The usability strength and weaknesses level of UPM LMS was revealed out based on the usability factors of WAMMI and Nielsen (2012), Attractiveness controllability, efficiency, learnability, memorability, helpfulness, error prevention and satisfaction. The result of the pre survey shows that all the usability factors were found to be at high level but looking at their point they are not up to the mid-point of high usability level their point are closer to low usability level thus, more attention needs to be given to the factors for better students satisfaction especially efficiency and error prevention which their values were found to be at the border line of low usability level. However 30 students and 3 usability experts evaluated the proposed UPM LMS, and found out that, there is significant improvement on all the usability factors.

FUTURE WORK

In recommendation for future research, the experts are requested to suggest a way forward to improve the UPM LMS. The interface of the prototype was found to be good and usable. However, In order to obtain more usable and successful UPM LMS the menus and the text have to be consistent in all the pages. In addition the experts also comments on the message page, which lack in differentiating from the read and un-read message. Also the experts continue to recommend in adding social media in the prototype for active collaboration and networking. This study can also be extended to assess the usability levels of other Learning Management system beside UPM and outside Malaysia. However there is great need to employ other users such as lecturers, administrators to participate in the study.

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