Journal of Scientific Research and Development 2 (13): 29-36, 2015
Available online at www.jsrad.org
ISSN 1115-7569

A study on effectiveness of Mobileschool system for secondary schools in Malaysia

Ahmad Sobri Hashim *, Wan Fatimah Wan Ahmad

Department of Computer & Information Sciences, University Technology PETRONAS, Seri Iskandar, Perak, Malaysia

Abstract: MobileSchool system is one of the mobile learning management systems (MLMS), which developed for secondary schools in Malaysia including school administrators, teachers, students and parents. This paper presents the study on effectiveness of this system to enhance students' academic performance of secondary level of education in Malaysia. As a case study, it involved 90 Form 4 students of Cempaka School Physics class. Quasi Experimental Design (QED) was adopted in this study where the students were divided into three groups namely control (X_1), experimental 1 (X_2) and experimental 2 (X_3). Besides, this study also conducts pre-test and post-test as one of the methods to measure the improvement of students' marks. The questions of both tests were selected from Form 4 Physics topic which is Forces. Students in X_1 studied this topic using conventional way and students in X_2 utilized currently implemented learning management system (LMS) called Cempaka Virtual Learning Environment (VLE) while the students in X_3 utilized the newly developed MobileSchool system. In analysing the results, both descriptive and inferential statistics were conducted. At the end of this study, it was found that, students who utilized MobileSchool system demonstrated better marks and increment as compared to the students who utilized existing system and conventional method. Therefore, it was proven that MobileSchool system an effective learning tool for secondary school students in enhancing their academic achievements.

Key words: Country specific development; Distance education; Human-computer interface; Improving classroom teaching

1. Introduction

Learning management system (LMS) is widely used in tertiary education where it is used to manage and store students' accounts, courses, academic-related files, conversations and others (Uzunboylu et al., 2006, Azahari, 2007, Siti Aswani et al., 2011). However, very limited emphasises have been given to the utilization of this technology in secondary level of education especially in the developing countries. Many studies have been conducted on the benefits of adopting mobile devices especially smartphones and tablets in education purposes. The benefits include eliminate the restriction of location and time to conduct teaching and learning activities, improve communication and collaboration among students and teachers, allow sharing of teaching and learning related resources and others (Geddes, 2004, Brown and Johnson, 2007). With taking these advantages, the field of mobile learning management system (MLMS) has been deeply studied in various researches (Hemabala and Suresh, 2012, Seyitogullari and Katrancioglu, 2012).

MobileSchool system is an MLMS that has been developed for the use of secondary schools in Malaysia (Sobri and Fatimah, 2012). This system was developed based on MobileSchool conceptual model that was formed from the integration of several theories and concepts to solve the issues of current practices of teaching and learning in Malaysian secondary schools and the design and development problems of existing mobile learning (m-learning) systems (Sobri and Fatimah, 2012).

The main problem that wants to be addressed in this study is the lack of empirical evidence on the effectiveness of m-learning systems especially in secondary level of education. As the systems are used for teaching and learning purposes, the effectiveness evaluation supposed to be conducted to measure the students' academic performance. In existing studies that have been conducted, emphasizes were given to the implementation of the systems in tertiary level especially in universities (Evans, 2008; Al-Fahad, 2009; Choi, 2012) and industrial usage (Haag, 2011). As to produce new contribution to this field, this study is conducted to evaluate the effectiveness of MobileSchool system in Malaysian secondary schools. This evaluation will be focusing on the ability of the system in improving students' academic performance.

This paper has been organized into five sections; Introduction, Related Works, Methodology, Results & Discussion and Conclusion.

2. Related works

Nowadays, there are various mobile applications that have been developed to support teaching and

* Corresponding Author.

learning. These applications provide medium for the students to conduct learning activities especially access learning materials at any place and time. For example, Mobile Learning Tool (MOLT) has been developed by a research team of Near East University where it aimed to improve students' achievement to master the English language (Cavus and Ibrahim, 2009). MOLT is computer software to send the messages via Short Message Service (SMS) to the students' mobile phones. The experimental study was conducted with 45 first year students who were majoring in Computer Information System on the effectiveness of the tool to improve their mastery of English language. The tool works between 9 am to 5 pm every day and every half an hour, the messages were sent to the students. The messages contain the new technical English vocabularies. For this particular experiment, 16 messages were sent daily and total of 48 messages for three days. At the end of this experiment, it was found that the students obtained better achievement after utilizing MOLT as compared to the previous test. The students admitted that they were able to easily memorize new vocabularies that were received in their mobile phones.

Another study was conducted using a mobile tool that has been developed to improve students' knowledge especially for junior school, high school and college (Hilera et al., 2010). A web-based system was developed to support mobile self-assessment in the context of traditional class-based learning. The main objective of this study was to evaluate the effectiveness of mobile self-assessment activities on students' learning performance from different ages. This study involved three experimental groups; 50 14 to 15 years old students, 48 17 to 18 years old and 28 20 to 12 years old university students. Ten questions for each learning objective have been created by the teachers for the self-assessment test. The developed systems were installed in all students' mobile phones. Students were required to complete all questions. The results indicated that the students in all three experimental groups achieved higher score as compared to the students who implemented traditional class-based learning.

Based on the presented literature studies, there were strong evidences on the effectiveness of m-learning to the students' learning. However, less evidence was presented on the effectiveness of m-learning system implementation in secondary level of education. Therefore, in the next section, the research methodology of conducting effectiveness evaluation of MLMS called MobileSchool system for secondary schools usage will be explained in detail.

3. Methodology

Previously, MobileSchool system has been developed by implementing the elements that was incorporated in MobileSchool conceptual model (Sobri and Fatimah, 2012). As a result, the derived elements of this integration of the concepts are communication, learning structure, user autonomy, SaaS, mobile web technology, layout, content and navigation. MobileSchool system can be accessed by secondary school communities including school administrators, teachers, students and parents. The system also provides eight functions including account and profile management, course management, learning material, discussion, feedback, academic report, announcement and chat.

In this study, effectiveness evaluation was conducted to measure students' academic performance after using MobileSchool system as compared to any currently utilized system and conventional class-based teaching and learning. Fig. 1 illustrates the overall research design for this study.

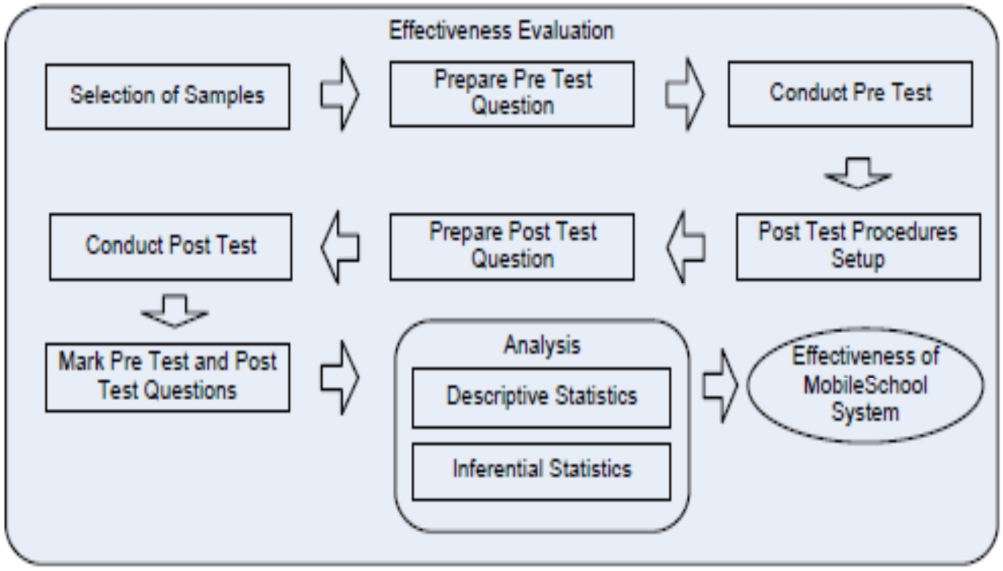

Fig. 1: Research design of MobileSchool system effectiveness evaluation

Quasi Experimental Design (QED) has been practiced for this study where it involved three groups of participants namely controls (X_1), experimental 1 (X_2) and experimental 2 (X_3). The samples of this study were selected due to their familiarity with the use of learning management system (LMS) such as e-learning and mobile device technologies. Therefore, 90 secondary school students were selected for this study from Cempaka School Cheras where this school optimized the utilization of LMS called Cempaka Virtual Learning Environment (VLE) in their teaching, learning and administrative processes. Similar with MobileSchool system, the system can be accessed by school administrators, teachers, students and parents. The Forces topic of Form 4 Physics course has been chosen as a case study for this evaluation. The students were divided into three groups; 30 students in each group X_1, X_2 and X_3 respectively.

The main purpose of conducting pre-test was to measure students' level of knowledge on the tested topic before getting treatment. Meanwhile, post-test was conducted to measure students' performance after getting the treatment using the developed system as compared to other treatments. All students' marks from pre-test and post-test were entered and analyzed using SPSS software.

In analyzing the effectiveness of MobileSchool system implementation, both descriptive and inferential statistics were practiced. Mean analysis of descriptive statistics was used determine the highest mean marks obtained by the students in all three groups for pre-test, post-test and increment. This analysis also determined the best learning approach that was effectively improve students' performance. To support the descriptive data, inferential statistics involving hypothesis analysis was performed. For this analysis, three null hypotheses were constructed as follows:

H01: There is no significant difference between the pre-test mean marks between control group (X1), experimental group 1 (X2) and experimental group 2 (X3).

H02: There is no significant difference between the post-test mean marks between control group (X1), experimental group 1 (X2) and experimental group 2 (X3).

H03: There is no significant difference between the mean of increment between control group (X1), experimental group 1 (X2) and experimental group 2 (X3).

To further elaborate the analysis of the hypotheses, one-way analysis of covariance (ANCOVA), one-way analysis of variance (ANOVA) and covariance analysis were applied.

4. Results & discussion

MobileSchool system comprised of teaching and learning functions including learning materials, online course discussion, feedback and chat. These integrated functions should enhance students' academic performance as compared to performing only traditional way of conducting teaching and learning activities and utilization of current LMS namely Cempaka Virtual Learning Environment (VLE). Here, MobileSchool system is a tool to complement the existing teaching and learning processes instead of replacing them. Therefore, the evaluation of the system effectiveness was done using Quasi Experimental Design by comparing the performance of 3 groups (30 students for each group) which using MobileSchool system to conduct the revision, using existing LMS and not using the system.

4.1. Pre-test evaluation

As mentioned by Dimitrov & Rumrill (2003) and Levy & Ellis (2011), the purpose of conducting pre-test of Quasi experiment is to evaluate the level of existing knowledge that respondents acquired before getting any treatments as the preparation for post-test. The measurement of existing level of knowledge was used to know the level of improvement that would be achieved after getting necessary treatments by calculating the increment of post-test marks from the pre-test marks.

Table 1 illustrates the descriptive analysis of pre-test marks for control (X_1), experimental 1 (X_2) and experimental 2 (X_3) groups. Based on Table 1, most of the students in X_1 (33.33%) obtained 21-25 and 26-30 out of 30 marks followed by 16-20 marks (26.67%) and 11-15 marks (6.67%). In X_2, 50.00% of total samples obtained 21-25 marks, followed by 16-20 marks (26.67%), 26-30 mars (20.00%) and 6-10 marks (3.33%). Meanwhile, majority of the students in X_3 (53.33%) obtained 21-25 marks followed by 26-30 marks (30.00%), 11-15 and 16-20 marks (13.33%) and 6-10 marks (3.33%). The mean of marks obtained in X_3(23.07) is higher than X_2 (22.30) and X_1 (22.37). The lowest mark obtained by the students in $X_1$was between 11-15 marks whereas the lowest mark obtained by the students in X_2 and X_3 was between 6-10 marks. However, the highest mark obtained by all groups was between 26-30 marks. Based on mean and standard deviation value, students in X_3 obtained better mean marks as compared to the students in X_1 and X_2 with small difference.

Apart from pre-test evaluation, hypothesis testing to evaluate the level of existing students' knowledge has been performed. Hypothesis is a logical relationship between two or more variables presented in the form of statement (Coakes and Ong, 2011). The variables were tested to examine whether the relationship that had been stated does in fact, got true. The constructed null hypothesis for this analysis is:

Hypothesis ($H_0$1): There is no significant difference between the pre-test mean marks of control group (X_1), experimental group 1 (X_2) and experimental group 2 (X_3).

Table 1: Descriptive analysis of pre-test marks

Mark	Control Group (X_1)		Experimental Group 1 (X_2)		Experimental Group 2 (X_3)	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
0-5	0	0	0	0	0	0
6-10	0	0	1	3.33	1	3.33
11-15	2	6.67	0	0	4	13.33
16-20	8	26.67	8	26.67	4	13.33
21-25	10	33.33	15	50.00	16	53.33
26-30	10	33.33	6	20.00	9	30.00
Mean	22.37		22.30		23.07	
Std. Dev.	5.15		4.59		3.93	

In evaluating the hypothesis ($H_0$1), one-way ANOVA had been performed to analyses significant difference of all groups. According to Sekaran & Bougie (2010) and Coakes & Ong (2011), the *p* value (Sig.) determines the acceptance or rejection of the hypotheses. In the case of presented result in Table 2, the *p* value is 0.774 which was greater than α value 0.05.

Table-2: One-Way ANOVA result for pre-test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.822	2	5.411	.257	.774
Within Groups	1829.133	87	21.025		
Total	1839.956	89			

Therefore, the null hypothesis ($H_0$1) was accepted. Thus, it could be concluded that there was no significant difference between the pre-test mean marks of the students in control (X_1), experimental 1 (X_2) and experimental 2 (X_3) groups. The finding of this evaluation indicated that the same level of knowledge was acquired by the students in all three groups on the tested topic. This finding also fulfilled the aim of conducting pre-test where students in all groups including control and experimental groups should have similar level of knowledge on the tested topic.

4.2. Post-test evaluation

The purpose of conducting post-test of Quasi Experimental Design is to identify significant difference between two different groups of participants after undergoing a particular treatment (Dimitrov and Rumrill, 2003; Coakes and Ong, 2011; Levy and Ellis, 2011). Students in X_1 would conduct revision using traditional approach while students in X_2 would do the revision using the existing LMS called Cempaka VLE and students in X_3 would do the revision using MobileSchool system. The measurement of this significant difference was the second process of identifying the effectiveness of MobileSchool system. The result of this test would also be used as a variable to identify level of improvements that was achieved due to the conducted treatment.

Table 3 illustrates the descriptive analysis of post-test marks for control (X_1), experimental 1 (X_2) and experimental 2 (X_3) groups. Based on Table 3, most of the students in X_1 (36.67%) obtained 21-25marks followed by 16-20 marks (23.33%), 11-15 and 26-30 marks (20.00%) respectively. In X_2, 46.67% of total samples obtained 21-25 marks, followed by 26-30 marks (36.67%), 16-20 marks (10.00%) and 11-15 marks (6.67%). Meanwhile, majority of students in X_3 (56.67%) obtained 26-30 marks followed by 21-25 marks (26.67%), 16-20 marks (13.33%) and 11-15 marks (3.33%). The mean of marks obtained in X_3 (25.23) was higher than X_2 (23.80) and X_1 (21.23). The lowest mark obtained by all groups was between 11-15 marks. Similarly, the highest mark obtained by all groups was between 26-30 marks. Based on mean and standard deviation value, students in X_3 obtained better marks as compared to the students in X_2 and X_1. In making the conclusion on the difference between the effect of using MobileSchool system and traditional learning approach, hypothesis evaluation was considered.

Table 3: Descriptive analysis of post-test marks

Mark	Control Group (X_1)		Experimental Group 1 (X_2)		Experimental Group 2 (X_3)	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
0-5	0	0	0	0	0	0
6-10	0	0	0	0	0	0
11-15	6	20.00	2	6.67	1	3.33
16-20	7	23.33	3	10.00	4	13.33
21-25	11	36.67	14	46.67	8	26.67
26-30	6	20.00	11	36.67	17	56.67
Mean	21.23		23.80		25.23	
Std. Dev.	4.80		4.22		3.97	

Similar to pre-test evaluation, hypothesis testing had been conducted to compare students' performance for both groups after getting the treatment. The constructed null hypothesis for this evaluation is:

Hypothesis ($H_0$2): There is no significant difference between the post-test mean marks of control group (X_1), experimental group 1 (X_2) and experimental group 2 (X_3).

In evaluating the above hypothesis ($H_0$2), one-way ANCOVA had been performed to analyses the significant difference between the groups by controlling pre-test marks (covariate). Table 4 presents the one-way between-groups analysis of covariance (ANCOVA) result. Referring to the GROUP row, the p value was 0.00 lesser than α value 0.05.

Table 4: One-way ANCOVA result for post-test
(Tests of Between-Subjects Effects)

Source	Type III Sum of Squares	df	Mean Square	F	Sig. (p)	Partial Eta Squared
Corrected Model	889.743(a)	3	296.581	25.501	.000	.471
Intercept	347.313	1	347.313	29.863	.000	.258
PRETEST	643.320	1	643.320	55.314	.000	.391
GROUP	205.496	2	102.748	8.834	.000	.170
Error	1000.213	86	11.630			
Total	51264.000	90				
Corrected Total	1889.956	89				

More detail finding was obtained from Pairwise Comparisons evaluation displayed in Table 5. Referring to Sig. (p) column, the p values for all associations either between X_1 and X_2, X_1 and X_3 or X_2 and X_3 were also lesser than α value 0.05. This indicates the significant differences between all relationships between the groups.

Table 5: One-way ANCOVA result for post-test
(Pairwise Comparisons)

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.(p)	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
X_1	X_2	-2.606(*)	.881	.012	-4.756	-.456
	X_3	-3.585(*)	.882	.000	-5.739	-1.431
X_2	X_1	2.606(*)	.881	.012	.456	4.756
	X_3	-.979	.883	.012	-3.134	1.177
X_3	X_1	3.585(*)	.882	.000	1.431	5.739
	X_2	.979	.883	.012	-1.177	3.134

Therefore, the null hypothesis ($H_0$2) was rejected. Thus, it could be concluded that there was a significant difference between the post-test mean marks of the students in control (X_1), experimental 1 (X_2) and experimental 2 (X_3) groups after controlling the covariate (pre-test marks). The finding of this evaluation indicated that different level of knowledge was acquired by the students from all three groups. One of the three tested groups obtained the highest mean marks as compared to other groups.

4.3. Increment evaluation

The purpose of conducting the increment analysis is to identify significant improvement that had been achieved by participants in all groups (X_1, X_2 and X_3) from pre-test to post-test result. In the simplest way, the improvement was calculated by deducting students' post-test marks with pre-test marks. Then, the values of this operation were averaged to determine the mean of improvement for both groups. Better improvement result could also be determined by comparing the means of improvement for all groups.

Table 6 illustrates the descriptive analysis of increment result for control (X_1), experimental 1 (X_2) and experimental 2 (X_3) groups. Based on Table 6, 63.33% of students in X_1 had not improved as compared to the number of students in X_2 (36.67%) and X_3 (13.33%). In contrast, only 36.67% of the students in X_1 group obtained positive improvement as compared to higher number of students in X_2 (63.33%) and X_3 (86.67%). In average, there was no improvement that was recorded in X_1 while positive improvement was achieved by the students in X_2 and X_3. Based on standard deviation value, students in X3 obtained better increment as compared to X_1 and X_2. In producing better conclusion on improvement of the utilization of MobileSchool system as compared to the traditional learning approach, hypothesis evaluation was considered.

Similar to both pre-test and post-test evaluation, hypothesis evaluation had been conducted to compare significant improvement of all groups after getting the treatment. The constructed null hypothesis for this analysis is:

Hypothesis ($H_0$3): There is no significant difference between the mean of improvement of control group (X_1), experimental group 1 (X_2) and experimental group 2 (X_3).

Table 6: Descriptive analysis of increment result

Mark	Control Group (X_1)		Experimental Group 1 (X_2)		Experimental Group 2 (X_3)	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
(-10)-(-6)	2	6.67	3	10.00	0	0
(-5)-0	17	56.67	8	26.67	4	13.33
1-5	11	36.67	14	46.67	24	80.00
6-10	0	0	3	10.00	2	6.67
11-15	0	0	2	6.67	0	0
Mean	-1.13		1.50		2.17	
Std. Dev.	2.87		2.69		2.09	

One-way ANCOVA had also been applied to evaluate $H_0$3. Table 7 illustrates the one-way between-groups analysis of covariance (ANCOVA) result. Referring to the GROUP row, the p value was 0.00 lesser than α value 0.05.

Table 7: One-way ANCOVA result for increment
(Tests of Between-Subjects Effects)

Source	Type III Sum of Squares	df	Mean Square	F	Sig. (p)	Partial Eta Squared
Corrected Model	485.609(a)	3	161.870	13.918	.000	.327
Intercept	347.313	1	347.313	29.863	.000	.258
PRETEST	302.920	1	302.920	26.046	.000	.232
GROUP	205.496	2	102.748	8.834	.000	.170
Error	1000.213	86	11.630			
Total	1550.000	90				
Corrected Total	1485.822	89				

More detail finding was obtained from Pairwise Comparisons evaluation displayed in Table 8. Referring to Sig. (p) column, the p values for all associations either between X_1 and X_2, X_1 and X_3 or X_2 and X_3 were also lesser than α value 0.05. This indicates the significant differences between all relationships between the groups.

Therefore, the null hypothesis ($H_0$3) was rejected. Thus, it could be concluded that there was a significant difference between the mean increment of marks of the students in control (X_1), experimental 1 (X_2) and experimental 2 (X_3) groups after controlling the covariate (pre-test marks). One of the three groups obtained the highest increment of mean marks as compared to the other groups. By examining the means and p values from both ANOVA and ANCOVA analyses, there was no sufficient prove to identify the best group who obtained the best marks.

Table 8: One-way ANCOVA result for increment (Pairwise Comparisons)

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.(p)	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
X_1	X_2	-2.606(*)	.881	.012	-4.756	-.456
	X_3	-3.585(*)	.882	.000	-5.739	-1.431
X_2	X_1	2.606(*)	.881	.012	.456	4.756
	X_3	-.979	.883	.012	-3.134	1.177
X_3	X_1	3.585(*)	.882	.000	1.431	5.739
	X_2	.979	.883	.012	-1.177	3.134

Therefore, covariance has been calculated to evaluate the relationship between post-test marks obtained by the students in X_1, X_2 and X_3 with their pre-test marks. In order to calculate the covariance, formula 1 has been used.

$$\frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{n-1} \quad \text{..... (1)}$$

A positive covariance value indicates the variables are positively related, while a negative value means the variables are inversely related. Then, smaller positive covariance value obtained from any of the three groups indicates better group who obtained better marks during post-test with relative to the marks obtained in pre-test. Table 9 presents the calculated covariance for all groups.

Table 9: Covariance for control, experimental 1 and experimental 2 groups

Group	Covariance
Control (X_1)	20.67
Experimental 1 (X_2)	-0.56
Experimental 2 (X_3)	17.29

Based on Table 9, the covariance values for X_1 and X_3 indicated the positive relationship between post-test marks and pre-test marks while covariance

value for X_2 indicated the negative relationship. It means the students in X_1 and X_3 obtained significant improvement from the conducted pre-test and post-test while X_2 did not improve. Then, the value of covariance for X_3 was smaller than X_1. Therefore, it indicated that the group of students who utilized MobileSchool system obtained better improvement as compared to X_1.

5. Conclusion & future work

This study has presented the effectiveness of MobileSchool system as compared to the learning using conventional class-based and currently utilized LMS. The result showed that there was statistically proven on the effectiveness of MobileSchool system where the students who were using the system obtained better improvements in their performance as compared to other approaches (LMS and class-based).

This study was limited only to the case study of ninety students of Form 4 Physics class, Cempaka School Cheras. For the future works, this study can be expanded to other courses and to the larger sample size. Basically, MobileSchool system is just a mobile platform for online teaching and learning. Teachers are the one who responsible to manage and organize the content of the system where they have to create course, manage learning materials, facilitate course discussion and others. For this particular study, it was proven that the utilization of this system for Physics course was effective. However, it might be less effective for the implementation to other courses. Besides, this study involved only thirty students in the group that utilized the system. The experiment that involves larger sample size might influence the effectiveness result. Larger number of students might be more difficult to be monitored and entertained by the teachers. Therefore, further studies are required for the mentioned aspects.

References

Ahmad Sobri, H. and W. A. Wan Fatimah (2012). Development of MobileSchool System for Secondary Boarding Schools in Malaysia. Visual Informatics International Seminar 2012 (VIIS'12). Universiti Kebangsaan Malaysia.

Ahmad Sobri, H. and W. A. Wan Fatimah (2012). The Development of New Conceptual Model for MobileSchool. International Conference on Intelligent System and Informatics (ISI 2012). Bandung, Indonesia.

Al-Fahad, F. N. (2009). "Students' Attitudes and Perceptions towards the Effectiveness of Mobile Learning in King Saud University, Saudi Arabia." The Turkish Online Journal of Educational Technology (TOJET) 8(2).

Azahari, M. N. (2007). An Initial Study on Effectiveness of Learning Management System (LMS) at Rezzen. Faculty of Information Technology. Sintok, Universiti Utara Malaysia. Master of Science.

Brown, A. and J. Johnson (2007). Five Advantages of Using a Learning Management System, Microburst Learning

Cavus, N. and D. Ibrahim (2009). "M-Learning: An experiment in using SMS to support learning new English language words." British Journal of Educational Technology 40(1): 78-91.

Cavus, N., et al. (2006). The Effectiveness of Using Learning Management System and Collaborative to Tools in Web-Based Teaching of Programming Languages. 3rd International Symposium and Education on Electrical, Electronic, and Computer Engineering (ISEECE 2006). Near East University, Lefkoşa, Cyprus.

Choi, S.-K. (2012). "The Effectiveness of Mobile Learning: A Critical Review of Empirical Literature." Educational Studies 54: 205-211.

Coakes, S. J. and C. Ong (2011). SPSS Version 18.0 Analysis without Anguish, John Wiley.

De-Marcos, L., et al. (2010). "An experiment for improving students' performance in secondary and tertiary education by means of m-learning auto assessment." Computer & Education 55: 1069-1079.

Dimitrov, D. M. and P. D. Rumrill (2003). "Pretest-posttest designs and measurement of change." Speaking of Research 20: 159-165.

Evans, C. (2008). "The Effectiveness of M-Learning in the Form of Podcast Revision Lectures in Higher Education." Computer and Education 50: 491-498.

Geddes, S. J. (2004). Mobile Learning in the 21st Century: Benefit for Learners.

Haag, J. (2011). "From eLearning to mLearning: The Effectiveness of Mobile Course Delivery." Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)(11053): 1-13.

Hemabala, J. and E. S. M. Suresh (2012). "The Frame Work Design of Mobile Learning Management System." International Journal of Computer and Information Technology 1(2): 179-184.

Khadijah, A. R., et al. (2011). "The Effectiveness of Learning Management System (LMS) Case Study at Open University Malaysia (OUM), Kota Bharu Campus " Journal of Emerging Trends in Computing and Information Sciences 2(2): 73-79.

Levy, Y. and T. J. Ellis (2011). "A Guide for Novice Researchers on Experimental and Quasi-Experimental Studies in Information Systems Research " Interdisciplinary Journal of Information, Knowledge, and Management 6: 151-161.

Sekaran, U. and R. Bougie (2010). Research Methods for Business: A Skill Building Approach, John Wiley and Sons Inc.

Seyitogullari, K. and S. Katrancioglu (2012). "Mobile Learning Management System as a Course Supplementary" Procedia - Social and Behavioral Sciences 83: 443-447.