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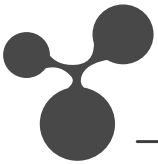

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am 04. und 05. Oktober 2012 in Dresden

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E.6 The Impact of Learning Management System Usage on Cognitive and Affective Performance

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1 Introduction

Since learning management systems (LMSs) are offering a great variety of channels and workspaces to facilitate information sharing and communication among learners during learning process, many educational organizations have adopted a specific LMS into their educational context. A LMS is a software that handles learning tasks such as creating course catalogs, registering students, providing access to course components, tracking students within courses, recording data about students, and providing reports about usage and outcomes to teachers [1]. LMSs include several applications such as OLAT, WebCT, Moodle, ATutor, Ilias, and Claroline. However, LMSs can be utilized to integrate a wide range of multimedia materials, blogs, forums, quizzes, and wikis. Therefore, the researchers suggest that studying the influence of technology usage on end-users, especially students, is fundamental in learning and teaching environment. Despite educational organizations routinely make decisions regarding the best pedagogical approaches for supporting students' performance, there is very little research on the impact of LMSs on learning outcomes [2]. Indeed, a considerable number of studies were conducted to examine the adoption of various LMSs, whereas little researches focused on understanding how educational institutes can enhance learning and teaching process through a particular LMS [3]. Consistent with this, the researchers found virtually no research on investigating the relationship between LMSs usage and attitude toward learning.

This study seeks to bridge some of theoretical and empirical gapes in the existing literature by proposing a model based on the Technology Acceptance Model (TAM) [4] to examine the impact of using a LMS on students' cognitive and affective performance. The study employs OLAT (Online Learning And Training) as a LMS. The OLAT is based on Java and completely free of charge. The initial development started in 1999 at the University of Zurich in Switzerland. However, the OLAT offers a personalized authoring and learning environment, groupware functions, and powerful administrative course tools. Currently, OLAT is available in 15 languages and another 17 are in the process of being translated. As a part of this study, the whole OLAT was translated to the Arabic language.

2 Theoretical Framework and Hypotheses

The TAM is the most widely used to address users' behavior toward technology either in initial or continuous adoption. This study used the TAM as a basic theory to study the relationships between technology usage and students' performance. Our research model, as represents in Figure 1, consists of system quality (SQ), self-efficacy (SE), perceived usefulness (PU), perceived ease of use (PEOU), attitude toward OLAT (ATO), academic achievement (ACH), attitude toward learning (ATC), and OLAT usage (U).

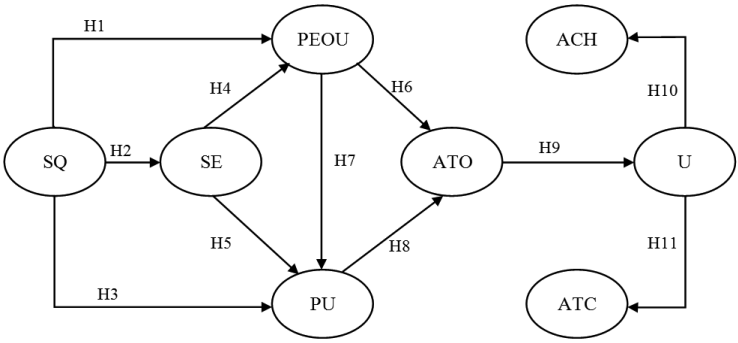

Figure 1: The proposed research model

2.1 System and Individual Constructs

From the given importance of system characteristics, several studies examined system attributes. The quality of systems is considered a critical for using LMSs within learning and teaching processes. Therefore, system quality was selected in our proposed model as an external variable. Adaptability, availability, reliability, response time, and usability are some aspects for system quality [5]. A positive link between system quality and perceived usefulness was found in a number of studies (e.g., [6], [7], [8]).

In the context of current study, self-efficacy was included in our research model as another external variable. Self-efficacy is defined as the students' confidence in their own ability to utilize OLAT system to accomplish a certain educational task. Previous studies reported that self-efficacy impacted on perceived ease of use and perceived usefulness (e.g., [6], [9], [10], [11]). Furthermore, self-efficacy construct was stronger determinant than other variables from the user system interaction [12]. As a result, the following hypotheses are proposed:

H1. The quality of system will have influence on perceived ease of use.
H2. The quality of system will have influence on self-efficacy.
H3. The quality of system will have influence on perceived usefulness.
H4. Self-efficacy will have influence on perceived ease of use.
H5. Self-efficacy will have influence on perceived usefulness.

2.2 Original TAM

It was assumed in our model that perceived ease of use construct is predictor of perceived usefulness and attitude toward using system, as the organic TAM. For this study standpoint, perceived ease of use is defined as the degree to which the students believe that using the OLAT system will be effortless. Several previous studies indicated that perceived ease of use, perceived usefulness, and attitude were linked together (e.g., [9], [10], [13], [14], [15], [16], [17], [18], [19], [20]).

Perceived usefulness is another original construct in TAM. It might be a critical construct of the usage of OLAT. Thus, the research model was proposed that perceived usefulness influences on attitude toward OLAT. From our point of view, perceived usefulness is defined as the degree the students believe that using the OLAT system will enhance their learning performance. However, many studies asserted the relationship between perceived usefulness and attitude toward system (e.g., [13], [14], [16], [17]).

The TAM suggested also that the attitude toward use system has a direct effect on the actual system usage as a behavioral dimension. From the perspective of TAM, the students who had a positive attitude toward a particular system will intend to use this system more through their learning. A considerable number of studies found that attitude toward use system impacted on the actual usage of these systems (e.g., [2], [3], [4], [17], [19], [20]). Therefore, the following hypotheses are proposed:

H6. Perceived ease of use will have influence on attitude toward OLAT.
H7. Perceived ease of use will have influence on perceived usefulness.
H8. Perceived usefulness will have influence on attitude toward OLAT.
H9. Attitude toward OLAT will have influence on system usage.

2.3 Cognitive and Affective Performance

The most common concepts that received more attention by educational organizations are academic achievement as a cognitive performance and attitude toward learning as an affective performance. Simply, the achievement refers to the knowledge obtained by a student through school program or curriculum. Moreover, the attitude toward learning is considered as an affective output of studying a specific course. From the importance of student's performances in the educational context, it is necessary to do the process of investigating the relationship between them and technology usage. Therefore, academic achievement and attitude toward learning were selected in our proposed model as performance variables.

According to Pan, Sivo, Gunter, and Cornell [2], there was association between attitude toward WebCT usage and students' final grade. Furthermore, the final grades were not impacted by the frequency of technology usage. Also, McGill and Klobas [3] indicated that the usage of LMS positively influenced perceived on learning, while perceived learning did not influence students' grades. Thus, the following hypotheses are proposed:
H10. The usage of OLAT will have influence on academic achievement.
H11. The usage of OLAT will have influence on attitude toward learning.

3 Methodology

3.1 Instruments

Three main instruments were utilized to capture data for this study. First, an achievement test was used to assess student's academic achievement in electrical engineering. The academic achievement test was created, developed, and analyzed within the current study. The final form of the test consisted of 60 multiple-choice format. The test reflected four Bloom's cognitive taxonomy namely; knowledge, comprehension, application, and analysis. The value of Cronbach's alpha for the entire test was around 0.96.
Second, an attitude questionnaire was employed to gather evidence regards student's attitude toward learning the electrical engineering. This study developed a set of statements appropriate for exploring student's attitude. The final version of the questionnaire contained of two sections: a) the demographic and personal information section; and b) statements section which included 27 statements using five-point Likert scale. The 27 statements questionnaire had an acceptable reliability of 0.94.
Third, the usage of OLAT system scale was aimed to collect data to investigate the factors that might impact on the usage of OLAT. Twenty-seven items were selected from the previous studies ([21], [22], [4], [11]) to cover the constructs in our research model. The items were rewritten to suit OLAT system; moreover, the items were translated from English to Arabic language. The usage questionnaire utilized, in general, a five-point Likert scale to measure the usage OLAT system. The findings of the reliability value showed that the Cronbach's alpha is 0.78, which is an acceptable value.

3.2 Sample and Procedures

A total of 112 male students were chosen to participate in the current study. The participants were from Tanta Secondary Industrial School which is a public school under the administration of the Ministry of Education in Egypt. Moreover, the ages of participants ranged from 14 to 16 year. The students used the OLAT system as a part of blended learning program over nine weeks. After finishing studying electrical engineering course, the instruments were administrated. The incomplete responses and missing values were deleted, resulting in as sample size of 92 students for an overall response rate of 82%.

OLAT did not originally support the Arabic language. Consequently, it was translated to the Arabic language from October 2009 until April 2010. The initial phase was focused on establishing contact with Switzerland University to acquire permission to carry out the translating of the OLAT to Arabic. So, the first researcher received personal registration to an online translation tool from Switzerland University. All text strings used in the interface of OLAT are stores in packages. Each package belongs to a particular key which is based on a specific function. For example, there is a key for creating a course, blog, and forum. The online translation tool offers two methods to translate OLAT in a new language. A mixture of the two methods was employed in the translation and correction phases.

3.3 Statistical Analysis

The partial least squares (PLS) technique was conducted for the data analysis in this study. This approach overcomes the restrictive requirements for applying structural equation techniques such as the normality distribution of data and largely sample size [23]. However, the software of SmartPLS version 2.0 was used to assess the measurement model and structural model respectively.

4 Results

4.1 Assessment of the Measurement Model

This is the first phase of carrying out PLS technique that focused on determining the reliability as well as validity of research model. The reliability of model was assessed by computing composite consistency coefficients. The coefficient values, as views in Table 1, for each latent factor ranged from 0.78 (in OLAT usage) to 0.94 (in perceived ease of use). For reliability to be adequate, a value should be larger than the restrictive criterion of 0.7 that put forth by [24]. Therefore, the results indicate that the model is deemed fit concern the reliability issue.

Table 1: The descriptive statistics and composite reliability coefficients

Construct	Mean	St. Deviation	Reliability
Academic achievement (ACH)	47.90	4.75	1.00
Attitude toward learning (ATC)	89.16	10.94	1.00
Attitude toward OLAT (ATO)	4.28	0.83	0.92
Perceived ease of use (PEOU)	4.11	0.98	0.94
Perceived usefulness (PU)	4.23	0.67	0.92
Self-efficacy (SE)	3.69	0.67	0.87
System quality (SQ)	4.02	0.86	0.90
Usage (U)	3.56	0.79	0.78

On the other hand, there are various measures for evaluating the validity of the research model. First, the factor loadings should be greater than 0.5 [25]. The results indicated that the factor loadings ranged from 0.85 to 0.90 in attitude toward OLAT, 0.84 to 0.91 in perceived ease of use, 0.77 to 0.88 in perceived usefulness, 0.74 to 0.85 in system quality, and 0.71 to 0.88 in OLAT usage. Second, the average variance extracted (AVE) should be more than 0.5 [26]. The results reported that more than half of the variances for all constructs are explained by their corresponding construct, as views in Table 1. Third, all t-values of the items are supposed to be significant at $p<0.05$ as recommended by [27]. The results from bootstrapping procedures showed that all loading values were significant and ranged from 6.36 to 47.05. Forth, each item in the measurement model should be strongly related to its respective construct; moreover, the square root of the AVE should be higher than the correlation of the specific latent factors in the model. The results referred that each item was loaded greater on its respective construct. Furthermore, Table 2 views that the square root of average variance extracted (the diagonal elements) were greater than the correlations between constructs in the corresponding rows and columns (off-diagonal). Hence, the previous statistics showed that the model provided reasonably good fit for validity issues.

Table 2: The correlation matrix and average variance extracted (AVE)

Construct	AVE	ACH	ATC	ATO	PEOU	PU	SE	SQ	U
ACH	---	1.00							
ATC	---	0.12	1.00						
ATO	0.76	0.14	0.14	0.87					
PEOU	0.77	0.15	0.16	0.85	0.88				
PU	0.67	0.03	0.08	0.86	0.85	0.82			
SE	0.57	0.11	0.18	0.67	0.65	0.68	0.76		
SQ	0.66	0.07	0.06	0.80	0.80	0.80	0.71	0.81	
U	0.64	0.11	0.09	0.45	0.50	0.45	0.47	0.45	0.80

4.2 Assessment of the Structural Model

The second phase of performing PLS focused on the determining of the path coefficients (β) between constructs. Moreover, a re-sampling (bootstrapping) technique was conducted to examine the significance of the relationships in the model. Figure 2 views a graphical presentation of the results testing the structural model.

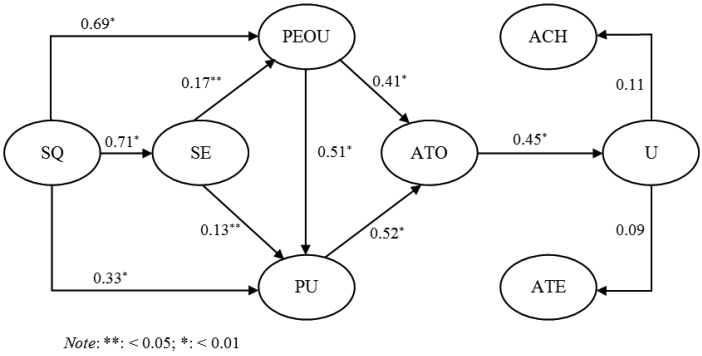

Figure 2: The structural model

In regards to system quality and self-efficacy constructs, the findings showed that system quality had a strong positive impact on perceived ease of use ($\beta = 0.69$), self-efficacy ($\beta = 0.71$), and perceived usefulness ($\beta = 0.33$). All these relationships were statistically significance at the confidence level of 99%. Moreover, the results pointed out that self-efficacy had a positive significance association at the confidence level of 99% with perceived usefulness ($\beta = 0.13$) and perceived ease of ($\beta = 0.17$). Therefore, H1, H2, H3, H4, and H5 were supported.

Concerning perceived ease of use, perceived usefulness, and attitude toward OLAT, the output of analysis implied that perceived ease of use had a direct positive effect on perceived usefulness ($\beta = 0.51$, $p < 0.01$) and attitude toward OLAT ($\beta = 0.41$, $p < 0.01$). Moreover, the findings presented that perceived usefulness had a significant positive influence on attitude toward OLAT ($\beta = 0.52$, $p < 0.01$).Furthermore, there was significant relationship between attitude toward OLAT and OLAT usage at the confidence level of 99% ($\beta = 0.45$). As a result, H6, H7, H8, and H9 were supported.

Regarding to students performance, the findings pointed out that the use of OLAT had not a significant positive influence on students' academic achievement ($\beta = 0.11$, $p > 0.05$). Additionally, the results indicated that the use of OLAT had not a significant positive effect on students' attitude toward learning electrical engineering ($\beta = 0.09$, $p > 0.05$). Consequently, H 10 and H11 were rejected

4.3 Learning Management System Usage

In terms of the usage of OLAT system, further analysis was made on the OLAT usage questionnaire. The findings, as represents in Figure 3, reported that the highest percent of students (45%) worked with OLAT from five to six times, whereas the lowest percent of students (6%) worked with OLAT system for only one or two times. Moreover, the percent of students who used OLAT in an intensive way for more than seven times was around 20%.

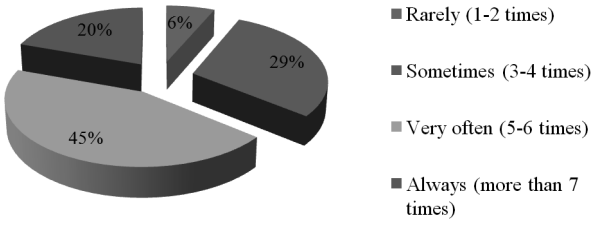

Figure 3: The frequently of using OLAT

Concerning the number of hours of using OLAT, the results pointed out that 5% of students exploited OLAT system for only one hour per week. Additionally, 60 students out of the experimental group sample of 92 utilized OLAT system for two or three hours per week. Furthermore, 18% of students used OLAT system for more than six hours per week.

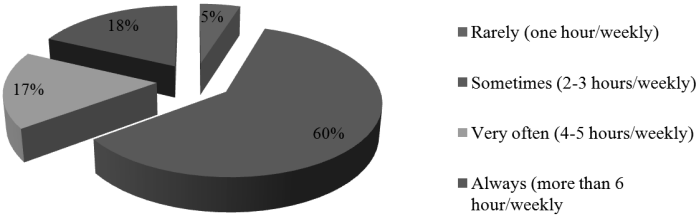

Figure 4: The percent of hours of using OLAT

5 Discussion and Conclusion

The purpose of this study is investigating the relationships among some factors which might effect on the usage of OLAT and learning performance. The research model included eight constructs namely; system quality, self-efficacy, perceived ease of use, perceived usefulness, attitude toward OLAT, academic achievement, attitude toward learning, and OLAT usage. The results of this study clarified that the system quality lead to greater perceived ease of use, self-efficacy, and perceived usefulness. The same results were found in previous studies ([6], [7], [8]). From this stand point, when students are dealing with a technological system which has more quality features, they will be convinced that such system is effortless to use and supporting their learning tasks. In the same vein, the results indicated that self-efficacy increased perceived usefulness and perceived ease of use. As expected, students' beliefs about their capabilities toward OLAT system would be essential for predicting the perceived ease of use.

The findings of this study indicated that perceived ease of use increased perceived usefulness and attitude toward OLAT. Moreover, the analysis revealed that there was a strong relationship between perceive usefulness and attitude toward OLAT. Furthermore, the findings illustrated that attitude toward OLAT had a strong impact on the actual usage of OLAT. These results were consistent with the previous studies ([3], [4], [9], [10], [13], [14], [15], [16], [17], [18], [19], [20]). This refers that student' perceived ease of use should not be ignored when they are interacting with

technology system. Besides, students hold positive feeling toward using OLAT when they convinced that system would help to realize their educational goals.

Although the current study suggested that the proposed model was suitable for this educational context, the results revealed that usage of OLAT was neither impact on students' achievement nor their attitude toward learning. The relationship between OLAT usage and academic achievement was little bit higher than the association between OLAT usage and attitude toward learning. The slight association existing between students' performance and system usage would suggest that cognitive and affective performance did not influenced by how frequently or how long students use OLAT while completing their learning tasks. One possible explanation is the nature of electrical engineering course which involve low of entertainments issues. Consequently, low playfulness and enjoyment was involved in OLAT course.

Any implications or findings from the current study need to be considered in the light of its limitation. One limitation is the characteristics of our research sample (i.e. vocational secondary school from Egypt). Another major limitation is that the selective focus on the OLAT as LMS.

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