Perceptions of engineering professors and students regarding the acceptance and use of Moodle

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Abstract: Based on the Unified Theory of Acceptance and Use of Technology (UTAUT), this study investigates users' intentions toward the course management system Moodle. The participants were 27 engineering professors and 501engineering students who completed an online survey, evaluating a set of 30 items on a scale of five that reflected the UTAUT keys applied to Moodle. An exploratory factor analysis was employed and generated five factors: community influence, satisfaction, service quality, learnability and technical quality. Repeated measures ANOVA showed community influence as the highest rated by participants, followed by satisfaction, service quality, learnability and technical quality. The findings are discussed providing evidence for the usefulness of implementing Moodle as a free open source course management system for both teaching and learning.

Introduction

Moodle, the most popular free open source course management system (CMS), was developed from a social constructivist perspective by Martin Dougmias in Australia [1]. This free application provides instructors with useful features such as the ability to embed resources, activities that are centred on a topic of study and a variety of modes of operation. The main advantage of integrating free open source software (FOSS) such as Moodle on campus is the discharge of license costs. In addition, system administrators have the ability to modify and customize the product. On the other hand, adopting FOSS can be a challenging procedure because no guaranteed maintenance is offered, whereas with proprietary applications the software manufacturers provide support. In the absence of manufacturers' support, institutions have to establish a team to maintain the free application. This team should have adequate knowledge to implement, upgrade and sustain the software; therefore, administration and maintenance costs must be considered [2]. Still, Blackboard is certainly much more expensive to maintain because it incurs an annual licensing cost.

Developing learning systems with good educational models on the Web to provide successful learning experience has been addressed at the system level in today's Web-based learning paradigm [3]. Several studies have discussed the benefits and risks of adopting an open source application versus a commercial one. Most of these studies have compared the existing CMS, mainly to explore the advantages and disadvantages of both Moodle and Blackboard. As such, Bremer and Bryant [2] reported that 80% of students preferred Moodle over Blackboard. In Hong Kong, Kennedy [4] reported that 49% respondents had no preference, while 45% preferred Moodle over Blackboard. Also, Machado and Tao [5] showed that Moodle was rated higher than Blackboard regarding the organization of course material and communication. Recently, Carvalho, Areal and Silva [6] showed that 46.5% of Portuguese students preferred Blackboard over Moodle, while 34.7% preferred Moodle. Interestingly, nearly 20% had no preference.

This study does not aim to compare Moodle with another CMS, but investigates the use and acceptance of the system from the engineering students' and professors' point of view at the American University of Beirut (AUB). In fact, very little is known about the adoption of course management systems in Lebanese academic institutions and its practical applications. This study, therefore, aims to examine engineering professors' and students' attitudes toward the use of the free open source course management system Moodle. In the summer of 2005, the AUB decided to switch from the proprietary application WebCT to the Free Open Source Moodle. The implementation process was completed in the spring of 2007, and Moodle became the official CMS at the AUB. Professors upload learning materials, grades and quizzes, while students upload their assignments and receive feedback from professors through the same system.

Theoretical Framework

After reviewing literature on user acceptance, Venkatesh et al. [7] introduced the Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT model includes four direct determinants of behavioural intention and usage behaviour: performance expectancy, effort expectancy, social influence and facilitating conditions. *Performance expectancy* is the degree to which an individual believes that using the system will help to attain better job performance. *Effort expectancy* is the degree of ease associated with the use of a system. *Social influence* is the degree to which an individual perceives that important people believe they should use the new system. *Facilitating conditions* are defined as the degree to which an individual believes that organizational and technical support is available to use the system.

Venkatesh et al. [7] showed that performance expectancy is the strongest predictor of intention to use a technology, whereas social influence plays the role of a subjective norm and is a direct determinant of behavioural intention. Marchewka, Liu and Kostiwa [8] tested the UTAUT model to understand students' perceptions about using Blackboard and showed that effort expectancy and social influence were significant determinants of students' behavioural intention. Chiu and Wang [9] indicated that performance expectancy, effort expectancy, computer self-efficacy, attainment value, utility value and intrinsic value are significant predictors of individuals' intentions to continue using Web-based learning, while anxiety can have a significant negative effect.

Because of its novelty in the field of user acceptance research, the UTAUT model was chosen as a theoretical framework in this study for investigating students' perceptions of using Moodle. The scales used in the UTAUT model are a combination of a number of prior scales from several different models, and therefore, the suitability of these scales needs to be further tested in different contexts.

Method

Because choosing a CMS to implement at an academic institution is a major decision, the focus of this study is to identify and discuss the acceptance of the FOSS Moodle by engineering students and professors.

As of fall 2011, the teaching personnel in the engineering college at the AUB were accounted as 104 professors and the number of students attending the college of engineering was 1683. Using their email addresses, users were invited to participate in an online survey while ensuring them of complete anonymity; 27 professors and 501 students completed the questionnaire. This resulted in a 26% and 30% response rate, respectively. Data from partially completed surveys were discarded.

The survey was based on available literature on the acceptance and use of e-learning systems [10-12]. The same instrument was used for both students and professors, but the questions were adjusted for each sample. The first section included questions related to demographics and general information such as gender, comfort level using information technology, and the number of courses using Moodle . In the second section, participants were asked to rate 20 Likert-scale items on a scale of five (1 = strongly disagree, 5 = strongly agree). These items were based on the four determinants of UTAUT. To ensure its validity, the instrument was administered to 15 professors and 50 students in a pilot study. Feedback was obtained from these pilot respondents and further changes were made to the responses so that the wording of the sentences was comprehensible.

Findings and Discussion

Seventy one percent of the professors' sample and 75% of the students' sample were male. The students were distributed as 9% freshmen, 21% sophomores, 38% juniors, 20% seniors and 12% graduates. Eighty eight percent of professors and 81% students rated their comfort level using information technology (from comfortable to highly comfortable). Fifty four percent of professors and about one third of students (32%) attended a workshop related to using Moodle.

The results show that the majority of both engineering professors and students use Moodle in more than one course where students seem more active on Moodle compared to professors, with the majority of students (80%) login into the system at least once a day. Such a finding is realistic because students are expected to check for any new updates more frequently than their professors.

When compared to other software, the majority of students (90%) believe that Moodle is easy to use and 76% of the professors agree with that assessment. With the current generation, engineering students are exposed to a variety of software applications; therefore, they may feel more acquainted with using software applications compared to professors. Regardless, the majorities of both professors and students possess a positive impression of Moodle.

Also, 81% of professors and 72% of students agree on the benefits of using Moodle in their courses, mainly by enhancing their instruction and organizing their teaching/learning materials. Regarding communication, 78% and 68% of professors and students believe that Moodle results in better communication between students and professors, and 71% and 62% of professors and students agreed that Moodle provides

students with prompt feedback from professors. However, only 32% and 35% of professors and students consider Moodle as a tool for collaboration among students. Although Moodle is regarded as a communication medium between students and professors, it appears that engineering professors and students do not find any means for collaboration through Moodle. Moodle provides collaborative tools like email, chat, discussion forums and other features that assist students as they develop knowledge. However, it appears that students and professors use these tools for communication, not collaboration. With the current Web 2.0 applications, users may use wikis or Google Docs for collaboration instead of the restricted features of Moodle.

To test the acceptance and use of the CMS Moodle, participants were asked to rate 30 items related to the UTAUT model. The 30 Likert-scale items revealed a reliability of 0.90 for professors and 0.91 for students. Descriptive statistics were calculated to obtain the measures of central tendency and those of variability of each of the identified items. By examining the frequencies, consistency in the evaluation was observed where both professors and students agreed upon almost all the items regarding the acceptance of Moodle. An independent-sample t-test was applied to compare the samples and showed no significant difference between the two groups for all the items ($p > .05$). Given the non-significant difference in the findings between both samples, all available 528 observations (27 professors and 501 students) were combined into one dataset to investigate the acceptance of Moodle.

An Exploratory Factor Analysis (EFA) was employed to the data to determine which of the 30 items formed related subsets. EFA was applied with principal components extraction, eigenvalues greater than 1.00 and absolute value greater than .40 [13, 14]. Results of a Kaiser–Meyer–Olkin (KMO) measure of sampling equal to .935 and Bartlett's test ($p < .0001$) showed that using EFA was appropriate for this study [15]. The EFA with principal components extraction yielded five factors that accounted for 63.93% of the total variance.

Table 1 shows the rotated factor loadings, which are the correlations between the variable and the factor. The size of each loading reflects the extent of the relationship between each variable and each factor. For items that were loaded under two factors, only the highest loading was retained. The following variances were reported for the factors: factor1, $\sigma^2 = 38.62\%$; factor2, $\sigma^2 = 8.41\%$; factor3, $\sigma^2 = 6.73\%$; factor4, $\sigma^2 = 5.36\%$; and factor5, $\sigma^2 = 4.81\%$.

After evaluating the items loaded under each factor, factor1 was labelled *Community Influence* (CI), factor2 *Satisfaction* (S), factor3 *Service Quality* (SQ), factor4 *Learnability* (L) and factor5 *Technical Quality* (TQ). Five new variables were computed on the basis of the means of the items falling under each factor. To compare the factors as rated by users, one-way repeated measures ANOVA was applied to the five variables. Repeated measures ANOVA indicated significant differences among the five factor scores, (F(4, 8220) = 150.61; $p < .001$).

	Component				
	Community Influence	**Satisfaction**	**Service Quality**	**Learnability**	**Technical Quality**
People who are important to me think that I should use Moodle	.786				
People who influence my behavior think I should use Moodle.	.764				
My professors/my students think that I should use Moodle	.774				
The University encourages the use of Moodle	.710				
I find Moodle useful for my teaching/learning tasks		.718			
Using Moodle increases the effective use of my time in handling my teaching/learning tasks		.694			
Using Moodle enable me to organize my teaching/learning tasks		.655			
I find Moodle reliable for my work		.609			
The University staffs are helpful in the use of Moodle.			.759		
On the Moodle course, I can find contact information of my professors/ my students (e.g. email addresses)			.616		
Questions/feedback (students/professors) can be provided through Moodle			.509		
The system is well maintained and up-to-date			.469		
My interaction with Moodle is clear and understandable				.640	
I am skillful at using Moodle				.626	
Learning to use Moodle system is easy for me				.610	
Moodle is user friendly				.462	
The functions (files, grading book, online quizzes..) are easy to manage					.699
Moodle has many communication features (e.g. Blogs, Wikis, Discussion Forums…)					.595
Warning messages prevent possible errors from occurring such as deleting a file.					.522
Moodle uses Multimedia features properly					.486

Table1: Rotated factor matrix with extraction method: principal component. Rotation method: Varimax with Kaiser Normalization

The results show that *Community Influence* received the highest rate from participants with a mean of $\mu = 3.72$, followed by *Satisfaction* ($\mu = 3.70$), *Service quality* ($\mu = 3.62$), *Learnability* ($\mu = 3.59$) and *Technical Quality* ($\mu = 3.50$). The findings are consistent with previous research wherein social influence appears as a motivator to accept and use new technology [7-9].

It appears that engineering professors are influenced by their peers and the university administration to use the CMS Moodle as a delivery medium for their courses, and students will consequently use Moodle to keep track of their learning materials. The post hoc tests using the Bonferroni technique indicated significant difference ($p < .05$) between the five factors; however, this difference is not significant because it is not important on a scale of '5'.

This finding can be compared with the Roger's Diffusion of Innovation theory[16] that provides the possible rate of diffusion of technology, adoption and implementation, and identifies numerous factors that facilitate or hinder technology adoption and implementation. Roger[16] classified users of new technologies into five categories: (1) the innovators who play an important role in launching new ideas into a social system, (2) the early adopters who serve as a role model for many members in the social system, (3) the early majority who adopt new ideas before the average members of the social system, (4) the late majority who adopt technology when most others in their social system have already done so and their adoption behavior maybe a result of peer pressures, and (5) the laggards who are the last in the social system to adopt. Accordingly, it appears that the greater part of the engineering professors belongs to the late majority category where the community influence was the main reason behind adopting Moodle as their CMS. It would be interesting to further investigate the percentage of early adopters as well as laggards in using Moodle at AUB.

Conclusion

The findings provide evidence for the usefulness of implementing Moodle as a CMS for both teaching and learning in the engineering college. *Community influence* appears to have the most important role in the use and acceptance of Moodle followed by *Satisfaction* and *Service quality*. Such results identify the key drivers of the selection of a free open source CMS to be adopted by institutions to assist in teaching and learning tasks. With the constant pressure to implement technology in higher education, there is a need to maximize technology investments while providing quality education.

However, this study has some limitations. First, the findings do not provide insights to the reasons why Moodle is not adopted by several engineering professors. More investigations should be done to determine whether these professors are laggards in using technology or have some objections about the use of Moodle. Interviews would allow the full tracking of users' activities on Moodle, providing more insights about the weaknesses and shortcomings this system might have, and would consequently help Moodle's developers to enhance the system for educational purposes based on users'

recommendations. Also, the results showed that Moodle is not regarded as a collaboration medium between professors and students. This result questions the constructivist and collaborative approaches that are mostly needed in the engineering education. In these approaches, professors are supposed to be facilitators of knowledge and assist students as they seek new information and work with others to solve problems. If the CMS, Moodle, is to be used from a constructivist perspective, it should provide opportunities for engineering students to interact with professors and fellow students, allowing them to share ideas and reflect on experiences while constructing knowledge. Therefore, new educational methodologies should be implemented in the engineering courses in order to take advantage from all the benefits provided by the Moodle system rather than merely using the system for simple purposes such as organizing teaching/learning materials and communication.

Finally, further studies are needed to investigate the generic spread of FOSS and Moodle in particular in the Middle East region.

References

1. Dougmias, M., and P. Taylor. (2003). "Moodle: Using Learning Communities to Create an Open Source Course Management System." In *the 15th World Conference on Educational Multimedia and Hypermedia and World Conference on Educational Telecommunications*, edited by AACE, 171-78. Norfolk, VA: ED-MEDIA2003.
2. Bremer, D., and R. Bryant. (2005). "A Comparison of Two Learning Management Systems: Moodle Vs Blackboard." In *18th Annual Conference of the National Advisory Committee on Computing Qualifications*, 135–1390 Tauranga, New Zealand.
3. Wang, Hao-Chuan, Tsai-Yen Li, and Chun-Yen Chang. (2006). "A Web-Based Tutoring System with Styles-Matching Strategy for Spatial Geometric Transformation." *Interacting with Computers*, Vol. 18, pp. 331-55.
4. Kennedy, D. M. (2005). "Challenges in Evaluating Hong Kong Students' Perceptions of Moodle." In *22nd Annual Conference of ASCILITE*, 327-36. Brisbane.
5. Machado, Michael, and Eric Tao. (2007). "Blackboard Vs. Moodle: Comparing User Experience of Learning Management Systems." In *the 37th ASEE/IEEE Frontiers in Education Conference*. Milwaukee, WI.
6. Carvalho, Anna, Nelaon Areal, and Joaquim Silva. (2010). "Students' Perceptions of Blackboard and Moodle in a Portuguese University." *British Journal of Educational Technology*, Vol., pp. 1-18.
7. Venkatesh, V., M.G. Morris, G.B. Davis, and F.D. Davis. (2003). "User Acceptance of Information Technology: Toward a Unified View." *MIS Quarterly*, Vol., pp. 425-78.
8. Marchewka, J.T., C. Liu, and K. Kostiwa. (2007). "An Application of the Utaut Model for Understanding Student Perceptions Using Course Management Software." *Communications of the IIMA*, Vol. 7, pp. 93-104.
9. Chiu, C.M., and E.T.G. Wang. (2008). "Understanding Web-Based Learning Continuance Intention: The Role of Subjective Task Value." *Information & Management*, Vol. 45, pp. 194-201.
10. Liaw, S. S. (2008). "Investigating Students' Percieved Satisfaction, Behavioral Intention, and Effectiveness of E-Learning: A Case Study of the Balckboard System." *Computers & Education*, Vol. 51, pp. 864-73.
11. Marques, B. P., J. E. Villate, and C. V. Carvalho. (2011). "Applying the Utaut Model in Engineering Higher Education: Teacher's Technology Adoption." In *6th Iberian Conference on Information Systems and Technologies (CISTI)*, 1-6: IEEE.
12. Sumak, B., G. Polancic, and M. Hericko. (2010). "An Empirical Study of Virual Learning Environemnt Adoption Using Utaut." In *Second International Conference on Mobile, Hybrid, and On-line Learning*, 17-22.

13. Field, A.P. (2005). *Discovering Statistics Using Spss*. NY: Sage Publications Inc.
14. Ho, R. . (2006). *Handbook of Univariate and Multivariate Data Analysis and Interpretation with Spss*. NY: Chapman & Hall.
15. Kaiser, H. F. (1970). "A Second Generation Little Jiffy." *Psychometrika*, Vol. 35, no. 4, pp. 401-15.
16. Rogers, E. (2003). *Diffusion of Innovations*. New York: Free Press.