

MOODLE AS A LEARNING MANAGEMENT SYSTEM: PERCEIVED EFFICACY AND ACTUAL USE

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ABSTRACT

Smart learning means to create an enriched interactive environment that enables learners and educators to access their learning resources at the right time and place in an effective, efficient, and engaging manner. The effectiveness and efficacy of the Learning Management System (LMS) represents a crucial component in such an environment. In light of the Unified Theory of Acceptance and Use of Technology (UTAUT), Technology Acceptance Model (TAM), and the Diffusion of Innovation Model (DOI), this study aimed to scrutinize the perceived efficacy of Moodle as a learning management system as seen by instructors. It further aimed to reveal the degree to which instructors were actually using Moodle in the educational process in Jordan. A descriptive survey methodology was used for data collection purposes and statistical analysis revealed that performance expectancy, effort expectancy, and social influence have significant impacts on the perceived efficacy of Moodle. Moreover, the results revealed that the actual use was highly driven by perceived efficacy, whereas it was moderately influenced by facilitating conditions. The effect of instructors' gender, experience, and field of study, as moderating factors, were also investigated.

Keywords: Learning Management System (LMS), educational process management, technology acceptance in education, Moodle platform, elearning

INTRODUCTION

Digital technology has been a powerful driving force in today's society. It has opened up broad horizons in the teaching and learning process through the use internet and the world wide web. This has resulted in a substantial change in the forms of teaching, learning methods, and delivery means (Deaconu et al., 2018). With an increasing demand on higher education, institutions have sought to develop the teaching and learning processes and to shift towards providing interactive learning environments through elearning. Thus, elearning is used to overcome the problem of limited resources and to provide education focused on cognitive learning and thinking in all ways possible (Brown et al., 2015; Jantasin & Suppasetsee, 2017).

Perhaps, the most important aspect of elearning is that this type of education transcends geographical, cultural, and temporal boundaries between learners and educators (Traxler, 2018). If fact, elearning can be the only viable method of learning in catastrophic and pandemic circumstances

(Ovetz, 2020). As such, one of the goals of elearning is to create an interactive environment with enriched tools and the means to enable learners to access their learning resources at the right time and place. Such an environment provides learners with learning material that is carefully designed to suit the learner's needs. This content should be enriched with explanatory notes and scenarios, best practices, and exercises. Interaction between the learners and their educator is a vital component. Individual-, group-, and comprehensive-level interactions are key issues for the success of the process. Following up on students' progress, administering exams, and managing learning are among the important pillars of the education process in this model of learning. Educators have to employ all possible tools to achieve these goals from using discussion forums to smart classes and interactive videos (Arnold & Sangrà, 2018; Bates & Sangra, 2011; Carnell & Fung, 2017; Ramachandiran, 2011; Rhode et al., 2017).

One of the most important requirements for elearning is the Learning Management System

(LMS). Such a system is required to communicate between the educator and students and deliver the educational content in a synchronous and asynchronous manner (Rhode et al., 2017). The LMS is responsible for maintaining a reliable, robust, and secure test center that is flexible enough to accommodate different styles of examination questions. Also, the LMS should allow users to access calendars, post announcements, and schedule events and tasks. It should also permit registrars to enroll and de-enroll students (Carnell & Fung, 2017). In short, the LMS is supposed to automate all activities and actions required in the education process. Further to that, it ought to include any extra services that could enhance the teaching and learning process, including but not limited to mobile learning, blended learning, and integration with social media networks to share specific content or practices. Thus, learning management systems represent learner-centered platforms from which all the learning activities are launched (Lopes, 2014).

In recent years, several LMSs have been developed and used in higher education institutions worldwide. These systems have been successfully tailored and integrated along with a traditional classroom setup to provide more flexible learning and support social constructivist approaches (Al-azawei et al., 2017; Baris, 2015; Cabero-Almenara et al., 2019). These systems are continuously evolving. They enable course management, track student progress, offer self-assessment tests, maintain continuous communication, and support the teaching and learning process (Umek et al., 2015). Popular examples of such systems are Moodle, Blackboard, Looop, TalentLMS, Chamilo, and WebCT.

The choice of an LMS for a university depends on its goals, priorities, and financial resources, and the nature of its students and faculty members. In addition, LMS products are either open source (free or semifree) or commercial products. Open-source products, like Moodle, DOKEOS, and ATutor, are made available almost free of charge for educational purposes. On the other hand, commercial LMS products, like Blackboard and WebCT, require paying for a license (Acosta & Luján-Mora, 2016). There is a difference in the prevalence of the use of LMSs in educational institutions in developed countries compared to developing countries. This is sometimes due to

lack of financial support, low internet bandwidth, poor infrastructure, or, more importantly, a lack of elearning literacy (Al-azawei et al., 2017).

In particular, Yarmouk University, Jordan adopted WebCT in 2001 as a pilot choice for one year. It was incorporated into the teaching process by a number of instructors in an aim to evaluate the system. Although, there was positive feedback from users, the university terminated the system for financial reasons. During the period after, from 2002 to 2010), several open source LMS systems were employed. Basically, the university administration was open to any possibility. Faculty members using these systems gained skills and competences in many related components, like content development, digital repository skills, electronic announcements and students follow up, and short quizzes. More importantly they managed to maintain a continuous communication channel with their students. Up to 2010, LMS usage was not required by the university and instructors electively incorporated the available LMS into their teaching and shared information with their students accordingly. Thus, these systems were not integrated with the university's Student Information System (SIS).

In 2010, Moodle was adopted officially to be the university LMS. This choice was based on the positive feedback the university administration received from the faculties and departments that used it heavily over the previous years, as well as its widespread use in many universities worldwide.

According to (Rogers, 2003), the diffusion of an innovation is influenced by the innovation itself, communication channels, the time necessary for innovations to be adopted, and a social system that combines internal and external influences. In this regard, Moodle as an innovative technology that gained a reputation and increased popularity for some key features. Among the key features were flexibility, ability to adapt and customize, and standard characteristics (Badia et al., 2019; Umek, et al., 2015).

In fact, Moodle works as a group of modules that allows its users to flexibly add and delete components at any stage (Kerimbayev et al., 2017). In addition, its ease of use and enriched communication services provide a platform for discussion and group work (Liao et al., 2011). Furthermore, Moodle is an open-source product, which is an important feature for institutions that have limited

budgets and financial concerns. Also, this feature allows users to seek best practices from counterparts worldwide and obtain online training. Moreover, Moodle is categorized as a user-friendly environment that can be customized to suit any educational environment and can be easily integrated with existing Student Information Systems (Umek et al., 2015). Additionally, it can be hosted locally or in the cloud (Pradeep Kumar, 2019). For this reason, Moodle has gained a good reputation among educational institutions worldwide, and hence best practices have been built up among practitioners. Therefore, one can find a solution to any difficulty that might be encountered.

Since 2010, the Computer and Information Centre at Yarmouk University has installed Moodle locally on a dedicated server. It was tailored to suit the learning environment and integrated smoothly to other working systems, especially the SIS system. Alongside that, Moodle culture has permeated among instructors and students through awareness workshops and regularly offered training courses.

The success of the learning management system as an effective tool is affected by several factors. Chief among these factors is user satisfaction and user acceptance (Horvat et al., 2015). However, determining the level of use is not only a matter of knowing how to interact with the system, but also having a deep understanding of the behavioral factors that influence the extent of the recipient's acceptance of the application and is based on the impact of the acceptability factors. Several theories and prediction models of technology acceptance have been developed in recent years. Among these theories are the Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Task Technology Fit (TTF), Unified Theory of Acceptance and Use of Technology (UTAUT), Technology Acceptance Model (TAM), and Diffusion of Innovation (Abdullah & Ward, 2016).

The TAM model explains the technology adoption behavior of users and computes the level of acceptance (Davis, 1989; Psycharis et al., 2013). It is considered one of the most important models to explain the factors that influence the acceptance of technology. The creator of this model suggested that the acceptance of technology is determined by its perceived usefulness expressed in terms of user perception that the technology system provides an added value as compared to other

available alternatives to perform the intended task. Second determinant is the perceived ease of use of the technology, which is expressed in terms of the degree of user perception that using the system is relatively effortless (Davis, 1989; Liu, 2012; Liu et al., 2009). Those two factors are affected by external variables, so the model is implemented in four consecutive stages, starting with external variables that influence both perceived usefulness and perceived ease of use. Those, in turn, influence the developed attitudes towards the system. Finally, the generated attitudes impact the actual system use (Davis, 1989).

To this end, this study aimed to investigate the perceived efficacy of Moodle and its degree of actual use in the teaching and learning process among Yarmouk University instructors after a decade of implementation. Furthermore, the study aimed to study the impact of Field of Study and Years of Usage as moderating factors on instructors' perceptions.

The implications of the study results are not particular to Yarmouk University or Jordanian universities; these findings can be generalized and used in all similar educational environments globally. Researchers in this field can benefit from these findings and build on them.

RELATED WORK

In recent years, several studies have been conducted that addressed the use of the innovative technology of Moodle as a learning management system in the teaching and learning process in educational institutions. These studies investigated several aspects of Moodle including its acceptance, usage, and other issues. Some of these key studies are presented in this section.

Cabero-Almenara et al. (2019) carried out a study to measure didactic and technological use of Moodle. They aimed to investigate its implications in teaching using a quantitative approach. Data were collected from a sample of 640 instructors via a questionnaire. Along with that, the authors added a few questions related to the purpose of Moodle use such as what strategies, resources, and tools were being used, its contribution to student-centered learning, and other similar questions. The findings confirmed that while Moodle was effectively used as a repository for course material, its pedagogical use was limited. The authors

concluded that, although Moodle confirmed its instrumental and functional capabilities as a learning management system, yet the adoption and integration of technology in the classroom was still debatable and needed further analysis from a systematic perspective and discussions.

Salhab (2019) studied the attitudes of using Moodle among faculty members at Palestine Technical Khadoorie University. The study targeted 41 instructors and data were collected through a questionnaire. The reported results revealed that instructors had positive attitudes towards Moodle use. However, the results showed a significant difference in respondents' attitudes related to training on Moodle usage, which suggested that training was essential.

In another study, Papadakis et al. (2019) investigated students' attitudes towards the use of smartphones to access various activities on Moodle. The study was conducted at a University in Crete, Greece. Data were collected from 122 university students in a course offered by the faculty of Preschool Education through a self-administered questionnaire and follow-up interviews to solicit students' perceptions on mobile access to Moodle and their underlying reasons for using it. The results indicated significant differences in students' usage. Furthermore, the findings indicated that Moodle was merely used as an electronic document repository rather than an effective learning tool. This was due to the limitations of mobile access on usability and reliability.

Yeou (2016) investigated students' acceptance of Moodle in a blended learning environment in a Moroccan university. Forty-seven students were targeted to explore their acceptance of the system. Structural equation modelling was employed with SmartPLS program to explain the students' acceptance of the system. The results showed that the TAM model proved to be a solid theoretical model whose validity could extend to blended learning environments. The findings emphasized the significance of computer self-efficacy and perceived usefulness.

Damnjanovic et al. (2015) studied the factors that influence the effectiveness and use of Moodle from the students' perspective. The study was conducted across higher education institutions in Serbia, Lithuania, and Bosnia and Herzegovina. The authors adopted an extended Seddon model.

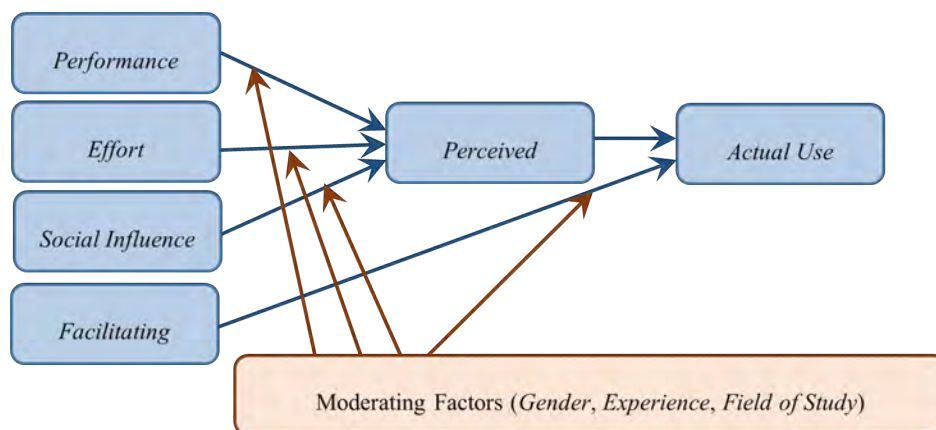
The study hypotheses were empirically validated based on responses from 255 students who were surveyed on elearning usage. The study considered factors related to behavioral intention to use in the future, communicativeness, format, information quality, performance outcome, perceived usefulness, user satisfaction, and system quality. Analysis on the collected data showed that communicativeness had the highest impact on performance outcome, and satisfaction had a significant effect on behavior intention and accounted for 68.4% of the variance in this area. However, the results showed that system and information quality did not influence satisfaction.

These studies and several others reported in the literature emphasized the importance of incorporating technology in the educational process, especially learning management systems. Most of these studies revealed that practitioners, whether students or instructors, developed positive attitudes towards the use of the technology in the educational process. It was important to conduct this study of the perceived efficacy of Moodle and its degree of actual use in the teaching and learning process among Yarmouk University instructors after a decade of implementation.

THEORETICAL FRAMEWORK

Diffusion of Innovation (DOI) Theory, developed by E. M. Rogers in 1962, is one of the oldest social science theories (Rogers, 2003; Sahin, 2006). It originated to explain how, over time, an idea or product gains momentum and diffuses or spreads through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product. The key to adoption is that the person must perceive the idea, behavior, or product as new or innovative. It is through this that diffusion is possible. Several models have been developed in recent years to incorporate the DOI theory in higher education. Among these models was the case study of elearning diffusion as an innovative diffusion model in higher education (Buc & Divjak, 2015). According to this model, six stages lead to the diffusion of innovation in higher education, namely: a) awareness of the need to elearning adoption, b) the feasibility study and proposal to adopt, c) adoption decision, d) adapting the organization to elearning, e) training and user support for

Figure 1. Proposed Research Model



wider use, and f) the suitability of the continuous application. (Buc & Divjak, 2015).

The acceptance of technology and its use has been a very active topic for researchers and practitioners in the last few decades. Several models have been proposed to examine the acceptance and use of technology, including Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Technology Acceptance Model (TAM) (Davis, 1989), and others. These theoretical models offered different explanations of technology acceptance and use from different perspectives taking several factors into account. TAM, as proposed by Davis based on Fishbein and Ajzen's TRA, considered the perceived ease of use and perceived usefulness of technology as predictors of users' attitudes towards using the technology and their behavioral intentions and actual usage. Furthermore, perceived ease of use also influences perceived usefulness of technology (Davis, 1989).

According to TAM, perceived usefulness refers to the degree to which the user believes that using the technology improves their work performance, while perceived ease of use refers to how effortless the user perceives using the technology will be. Both are considered distinct factors influencing the user's attitude towards using the technology, but perceived ease of use is hypothesized to influence perceived usefulness and attitude towards using the technology. Such attitudes towards using the technology determine the behavioral intention to use that technology.

A modification on the TAM model was presented by Venkatesh et al. (2003). In this work, the Unified Theory of Acceptance and Use of

Technology (UTAUT) was proposed. The authors identified the constructs that impact the adoption of technology: performance expectancy, effort expectancy, social influence, and facilitating conditions. While the first three constructs were considered to be direct determinants of behavioral intention, facilitating conditions was considered a direct determinant of user behavior. The authors studied the impact of a number of moderating factors on the aforementioned constructs.

While several studies have addressed the factors impacting the user's acceptance of the LMS and elearning platforms worldwide, little attention has been given to factors that influence instructors' acceptance of Moodle as an open source LMS in Jordanian universities. To this end, this study was conducted to investigate the Perceived Efficacy and Actual Use of Moodle by instructors in Yarmouk University as a learning management system in the light of UTAUT and TAM. Figure 1 shows the proposed model for the study.

According to Figure 1, Perceived Efficacy is driven by Performance Expectancy, Effort Expectancy, and Social Influence, while Actual Use is driven by Perceived Efficacy and Facilitating Conditions. Performance Expectancy refers to the instructor's estimate for the potential usefulness of using Moodle as a technology. This may be interpreted as perceived usefulness of the technology and extrinsic motivation of using Moodle. Effort Expectancy refers to perceived ease of use. Ease of use is the degree to which using a technology is perceived as being difficult. Perceived ease of use aims to examine the extent of extra effort an instructor thinks they need to put into using

Moodle. Henceforth, Effort Expectancy plays a significant role in first-time usage whether mandatory or voluntary. Social Influence describes whether the instructor's decision to use Moodle depends on others influence. In this regard, "others" refers to the whole university society and their social situation. Lastly, Facilitating Conditions refers to the organizational role and the technological infrastructure that assists the adoption of Moodle. On the other hand, Actual Use refers to the degree of Moodle usage in the educational process management by university instructors. Actual Use is driven by Perceived Efficacy and Facilitating Conditions. Finally, the study investigated the impact of three moderating factors on the perceptions of instructors: Gender, Experience, and Field of Study.

PURPOSE OF THE STUDY

In the light of the proposed model, the study aimed to address the following:

1. The degree of Perceived Efficacy of Moodle as a learning management system as seen by the instructors in Yarmouk University

To achieve this goal, the following null hypotheses were developed:

H_{01} : There is no significant relationship between Performance Expectancy and Perceived Efficacy of Moodle as a learning management system.

H_{02} : There is no significant relationship between Effort Expectancy and Perceived Efficacy of Moodle as a learning management system.

H_{03} : There is no significant relationship between Social Influence and Perceived Efficacy of Moodle as a learning management system.

2. The significance of statistical differences in instructors' estimates of Perceived Efficacy related to Gender, Experience, and Field of Study

To achieve this goal, the following null hypotheses were developed:

H_{04} : There is no significant difference in Perceived Efficacy of Moodle as a learning management system related to instructors' Gender.

H_{05} : There is no significant difference in Perceived Efficacy of Moodle as a

learning management system related to instructors' Experience.

H_{06} : There is no significant difference in Perceived Efficacy of Moodle as a learning management system related to instructors' Field of Study.

3. The degree of Actual Use of Moodle as a learning management system by the instructors in Yarmouk University

To achieve this goal, the following null hypotheses were developed:

H_{07} : There is no significant relationship between Perceived Efficacy and Actual Use of Moodle as a learning management system.

H_{08} : There is no significant relationship between Facilitating Conditions and Actual Use of Moodle as a learning management system.

4. The significance of statistical differences in instructors' estimates of Actual Use related to Gender, Experience, and Field of Study

To achieve this goal, the following null hypotheses were developed:

H_{09} : There is no significant difference in Actual Use of Moodle as a learning management system related to instructors' Gender.

H_{10} : There is no significant difference in Actual Use of Moodle as a learning management system related to instructors' Experience.

H_{11} : There is no significant difference in Actual Use of Moodle as a learning management system related to instructors' Field of Study.

METHODOLOGY

Approach

To achieve the goals of the study, the descriptive survey approach was utilized.

Study Population

The study population consisted of all instructors in Yarmouk University, Irbid, Jordan. According to the Human Resources Department, there were 1,082 instructors in the university in the academic year 2019/2020.

Study Sample

A representing random sample, consisting of 285 instructors, was targeted for data collection purposes, which represented 26.3% of the population. Table 1 shows the demographic distribution of sample members according to moderating factors.

Table 1. Demographic Distribution of Study Sample

Factor	Categories/Levels	Frequency	Percentage
Gender	Male	145	50.88%
	Female	140	49.12%
Experience	Fewer Than 2 Years	185	64.91%
	2 or More Years	100	35.09%
Major	Scientific	120	42.11%
	Humanities & Social Sciences	165	57.89%

Data Collection

To collect data from targeted instructors, a 5-point Likert scale questionnaire was designed that comprised two parts. The first part, which consisted of 12 paragraphs, aimed at revealing instructor estimates of Perceived Efficacy and was divided into three groups. These groups aimed to reveal estimates regarding Performance Expectancy, Effort Expectancy and Social Influence. While the second part, which consisted of 13 paragraphs, aimed at revealing information regarding Actual Use. This part was divided into two groups pertaining to Facilitating Conditions and practical uses resulting from Perceived Efficacy.

To verify the content validity, the questionnaire was presented in its initial form to a group of eight experts and specialists in the field. Their opinions on the clarity of questionnaire paragraphs and their suitability to the study objectives were carefully considered. The questionnaire was revised accordingly to its final form.

To verify the reliability of the questionnaire and its internal consistency, it was given to a pilot sample of 15 instructors who differed from the study sample. Cronbach's α analysis was performed on the pilot data. The test results showed that the overall Cronbach's α coefficient was 0.84, which indicated that the questionnaire paragraphs were internally consistent and suitable (Odeh, 2010).

Data Analysis

The Statistical Package for Social Sciences (SPSS) software was used to analyze the data and reveal results. Statistical means and standard deviations of instructors' estimates were computed. Linear regression analysis as well as ANOVA analysis were performed to examine the developed hypotheses. To establish judgements on the estimates, and based on the 5-point Likert scale used, the range was divided into three sub-ranges or degrees: (*High*) for estimates above 3.66, (*Moderate*) for estimates between 2.34 and 3.66 (exclusive), and (*Low*) for estimates below 2.34 (Odeh, 2010).

Results

The questionnaire was distributed electronically among targeted instructors with directions explaining the purpose of the study, the way to participate and respond, and deadlines for submitting responses. A total of 300 instructors confirmedly received the tool, out of which 285 complete responses were secured.

The first goal of the study was related to Perceived Efficacy of Moodle as a learning management system as seen by the instructors, thus the statistical means and standard deviations of the instructors' estimates were calculated per paragraph as well as for the overall domain. The obtained results are shown in Table 2 (An illustration of the histograms of those estimates are provided in Figure 2 in the Appendix).

According to the results reported in Table 2, the overall instructors' perception of Moodle efficacy among instructors was *High*. According to the instructors, Performance Expectancy was the highest factor affecting their judgment, followed by Effort Expectancy and lastly the Social Influence factor, which they believed was moderately affecting their judgment.

To examine the significance of these factors, and hence to examine the first three study hypotheses (H_{01} - H_{03}), linear regression techniques and ANOVA analysis were used.

As for the first hypothesis, which stated:

H_{01} : There is no significant relationship between Performance Expectancy and Perceived Efficacy of Moodle as a learning management system.

Table 2. Statistical Means (M) and Standard Deviations (SD) for Instructors' Estimates of Perceived Efficacy

Paragraph	M	SD	Degree
Performance Expectancy			
Moodle improves your chances of success in preparing for the courses you teach	3.8737	0.988	High
Moodle improves your chances of success in delivering the courses you teach	4.0246	0.828	High
Moodle improves your chances of success in communicating with your students	3.9719	0.822	High
Moodle improves your chances of success in following up on your students' progress	3.8877	0.848	High
Moodle quiz capabilities are appropriate for the courses you teach	3.8351	0.895	High
Moodle provides all capabilities that you think are essential for a successful delivery of the courses you teach	3.6667	0.937	High
Overall (Performance Expectancy)	3.8766	0.698	High
Effort Expectancy			
It is easy to navigate on Moodle	3.6351	0.923	Moderate
It doesn't take you much time to familiarize with Moodle	3.7088	0.886	High
You find it easy for your students to interact with you on Moodle	3.5404	0.913	Moderate
Overall (Effort Expectancy)	3.6281	0.640	Moderate
Social Influence			
You would use Moodle even if it was not required	3.5088	0.879	Moderate
You recommend other instructors elsewhere to use Moodle	3.6000	0.861	Moderate
Other colleagues encouraged you to use Moodle	3.4526	0.857	Moderate
Overall (Social Influence)	3.5205	0.643	Moderate
Overall (Perceived Efficacy)	3.7254	0.510	High

Table 3. The Impact of Performance Expectancy on Perceived Efficacy

R	R ²	Adjusted R ²	Std. Error of the Estimate	Change Statistics				
				R ² Change	F Change	df1	df2	Sig. F Change
0.907	0.823	0.822	0.21511	0.823	1313.106	1	283	0.000
Results of ANOVA Analysis								
Sum of Squares			df	Mean Squares	F	Sig.		
Regression			1	60.761	1313.106	0.000		
Residual			283	0.046				
Total			284					

The results were as shown in Table 3.

As can be seen from Table 3, the value of (R^2) was (0.823), which means that about (82%) of the Perceived Efficacy was driven by Performance Expectancy. Furthermore, ANOVA analysis showed that the value of the significance was (0.000), which means that the hypothesis was rejected at significance level of ($\alpha = 0.05$), i.e., there was a significant relationship between Perceived Efficacy and Performance Expectancy. This result

emphasized the result reported in Table 2, which indicated the impact of Performance Expectancy on the Perceived Efficacy was *High*.

Similarly, the same analysis was performed to examine the validity second hypothesis, which stated:

H_{02} : There is no significant relationship between Effort Expectancy and Perceived Efficacy of Moodle as a learning management system.

The results are shown in Table 4.

Table 4. The Impact of Effort Expectancy on Perceived Efficacy

R	R ²	Adjusted R ²	Std. Error of the Estimate	Change Statistics				
				R ² Change	F Change	df1	df2	Sig. F Change
0.795	0.633	0.631	0.30965	0.633	487.259	1	283	0.000
Results of ANOVA Analysis								
	Sum of Squares	df	Mean Squares	F	Sig.			
Regression	46.721	1	46.721	487.259	0.000			
Residual	27.135	283	.096					
Total	73.856	284						

As can be seen from Table 4, the value of (R^2) was 0.633, which means that 63% of the Perceived Efficacy was driven by Effort Expectancy. Furthermore, ANOVA analysis showed that the value of the significance was (0.000), which means that the hypothesis was rejected at significance level of ($\alpha = 0.05$). Thus, there was a significant relationship between Perceived Efficacy and Effort Expectancy. This result revealed that the result reported in Table 2 indicated the impact of Effort Expectancy on the Perceived Efficacy was *Moderate*, yet this relationship was significant.

To examine the validity of the third hypothesis, which stated:

H_{03} : *There is no significant relationship between Social Influence and Perceived Efficacy of Moodle as a learning management system.*

Again, linear regression and ANOVA analysis were performed, and the results are shown in Table 5.

As can be seen from Table 5, the value of (R^2) was 0.169, which means that only 16.9% of the Perceived Efficacy was driven by Social Influence. Yet, ANOVA analysis showed that the value of the significance was (0.000), which means that the hypothesis was rejected at significance level of ($\alpha = 0.05$), which means there was a significant relationship between Perceived Efficacy and Social Influence. This finding revealed that the results reported in Table 2 indicated the impact of Social Influence on the Perceived Efficacy was *Moderate*, nevertheless this relationship was significant.

For the second goal of the study and to understand further the results in the light of moderating factors (Gender, Experience, and Field of Study), the statistical means and standard deviations of the estimates were calculated based on these factors. The results based on these factors are shown in Table 6.

As can be denoted from the Table 6, there

Table 5. The Impact of Social Influence on Perceived Efficacy

R	R ²	Adjusted R ²	Std. Error of the Estimate	Change Statistics				
				R ² Change	F Change	df1	df2	Sig. F Change
0.411	0.169	0.166	0.46576	0.169	57.459	1	283	0.000
Results of ANOVA Analysis								
	Sum of Squares	df	Mean Squares	F	Sig.			
Regression	12.465	1	12.465	57.459	0.000			
Residual	61.391	283	0.217					
Total	73.856	284						

Table 6. Perceived Efficacy According to Moderating Factors

Moderating Factor			Performance Expectancy	Effort Expectancy	Social Influence	Perceived Efficacy
Gender	Male (N=145)	Mean	3.9000	3.6046	3.5356	3.7351
		Std. Dev	.75727	.67699	.62026	.55361
	Female (N=140)	Mean	3.8524	3.6524	3.5048	3.7155
		Std. Dev	.63286	.60092	.66845	.46220
Experience	Less Than 2 Years (N=185)	Mean	3.8856	3.5874	3.4775	3.7090
		Std. Dev	.66256	.62144	.63102	.47683
	2 or More Years (N=100)	Mean	3.8600	3.7033	3.6000	3.7558
		Std. Dev	.76274	.66985	.66160	.56746
Field of Study	Scientific (N=120)	Mean	3.9736	3.7556	3.5000	3.8007
		Std. Dev	.75252	.69644	.66526	.54814
	Humanities & Social (N=165)	Mean	3.8061	3.5354	3.5354	3.6707
		Std. Dev	.64898	.58051	.62869	.47452

were apparent differences in instructors' estimates related to the studied moderating factors.

To investigate the significance of these apparent differences, and hence to examine hypotheses (H_{04} - H_{06}), Three-Way ANOVA analysis without interaction was conducted at a significance level of ($\alpha = 0.05$). The test results are presented in Table 7.

It is evident from the results in Table 7 that there were no significant statistical differences at ($\alpha = 0.05$) between the means of the estimates of Perceived Efficacy or its drivers that could be related to Gender or Experience. This means that hypothesis H_{04} , which stated:

H_{04} : *There is no significant difference in Perceived Efficacy of Moodle as a learning management system related instructors' Gender.*

and hypothesis H_{05} , which stated:

H_{05} : *There is no significant difference in Perceived Efficacy of Moodle as a learning management system related to instructors' Experience.*

were both accepted. Instructors, regardless of their gender, established the same behavioral intentions towards the use of a specific technology, and hence their expectations of improving performance and ease of use proved to be the same. The way they influence others or the way they get influenced towards the use of an adopted technology proved

to be the same. These results sound logical as they primarily perform the same duties in the teaching and learning process regardless of gender. On the other hand, when Experience was investigated, the results indicated that although there were apparent differences in the estimates' statistical means and in favor of experienced instructors (2 or more years), yet ANOVA test results indicated that those differences were not genuine. This probably indicates that Moodle is a friendly platform that does not require a long time or creative effort to become familiar with it. Reasonable training as well as continuous technical support from IT personnel should improve the competencies of users to master it.

Nevertheless, the results reported in Table 7 indicated that there were significant statistical differences at ($\alpha = 0.05$) in estimating Perceived Efficacy related to instructors' Field of Study. These differences were in favor of instructors in scientific fields, as can be seen from Table 6. Investigating deeply the results, one can notice that those significant differences were related to Performance Expectancy and Effort Expectancy. As a result, hypothesis H_{06} , which stated:

H_{06} : *There is no significant difference in Perceived Efficacy of Moodle as a learning management system related to instructors' Field of Study.*

was rejected.

Table 7. Results of 3-Way ANOVA Analysis Showing the Significance of Differences in Estimating Perceived Efficacy According to Moderating Factors

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	Performance Expectancy	.134	1	.134	.280	.597
	Effort Expectancy	.002	1	.002	.004	.948
	Social Influence	.384	1	.384	.937	.334
	Perceived Efficacy	.121	1	.121	.478	.490
Experience	Performance Expectancy	.131	1	.131	.273	.602
	Effort Expectancy	.268	1	.268	.687	.408
	Social Influence	.919	1	.919	2.245	.135
	Perceived Efficacy	.036	1	.036	.140	.709
Field of Study	Performance Expectancy	2.817	1	2.817	5.888	.016
	Effort Expectancy	4.367	1	4.367	11.167	.001
	Social Influence	.001	1	.001	.003	.957
	Perceived Efficacy	1.831	1	1.831	7.216	.008
Error	Performance Expectancy	132.538	277	.478		
	Effort Expectancy	108.331	277	.391		
	Social Influence	113.378	277	.409		
	Perceived Efficacy	70.269	277	.254		
Total	Performance Expectancy	4421.417	285			
	Effort Expectancy	3867.778	285			
	Social Influence	3649.778	285			
	Perceived Efficacy	4029.340	285			

The third goal of the study was pertaining to the degree of actual use of Moodle by instructors. According to the study model, the actual use is driven by two factors. The first factor is Perceived Efficacy resulting in actual use practices. The second factor is the Facilitating Conditions pertaining to the learning environment in the university and the support instructors receive. The statistical means and standard deviations of the estimates were calculated per paragraph as well as for the overall domain. The obtained results are shown in Table 8 (An illustration of the histograms of those estimates are provided in Figure 3 in the Appendix).

It is obvious from Table 8 that the overall degree of Actual Use of Moodle as a learning management system was *High*. Furthermore, it can be seen from the tabulated results that the developed intentions of the efficacy of use (Perceived Efficacy) resulted in a *High* degree of usage, whereas Facilitating

Conditions moderately affected instructors' Actual Use of the technology.

To examine the validity of hypotheses H07–H08) linear regression and ANOVA analysis were performed. These hypotheses stated that:

H_{07} : *There is no significant relationship between Perceived Efficacy and Actual Use of Moodle as a learning management system.*

H_{08} : *There is no significant relationship between Facilitating Conditions and Actual Use of Moodle as a learning management system.*

The results of the linear regression and ANOVA analysis for the relationship between Perceived Efficacy and Actual Use are shown in Table 9.

Table 8. Statistical Means and Standard Deviations of Instructors' Estimates Pertaining to Actual Use

Paragraph	M	SD	Degree
Facilitating Conditions			
The university ICT infrastructure supports using Moodle	3.3263	.88145	Moderate
The university conducts training courses to help you familiarize with Moodle	3.1228	.92444	Moderate
The university provides prompt technical support and help while using Moodle	2.9474	.92731	Moderate
Overall (Facilitating Conditions)	3.1322	.70605	Moderate
Use Practices			
You provide teaching material on Moodle for the courses you teach	3.2596	1.21723	Moderate
You use Moodle to upload assignments and homework for your students	4.2632	.89061	High
You request your students to deliver their assignments and homework using Moodle	3.9368	.78915	High
You use Moodle to conduct and administer exams for the courses you teach	3.9474	.77870	High
You use Moodle to follow up on students' access and learning progress	3.9825	.74331	High
You communicate and interact with your students through Moodle	3.8807	.82211	High
You provide different forms of teaching material to enrich the learning experience of your students on Moodle	3.8842	.85411	High
You initiate off-class Moodle group discussions	3.8211	.80464	High
You launch subgroups on Moodle to enrich the learning experience of students	3.7474	.80011	High
You mediate and oversee student-student interactions on Moodle	3.6175	.79015	Moderate
Overall (Use Practices)	3.8340	.45121	High
Overall (Actual Use)	3.6721	.41322	High

Table 9. The Impact of Perceived Efficacy on Actual Use

R	R ²	Adjusted R ²	Std. Error of the Estimate	Change Statistics				
				R ² Change	F Change	df1	df2	Sig. F Change
0.923	0.851	0.851	0.17426	0.851	1621.005	1	283	0.000
Results of ANOVA Analysis								
	Sum of Squares	Df	Mean Squares	F	Sig.			
Regression	49.226	1	49.226	1621.005	0.000			
Residual	8.594	283	0.030					
Total	57.820	284						

It can be seen from Table 9 that the value of (R^2) was (0.851), which means that about 85% of the Actual Use was driven by Perceived Efficacy. In addition, ANOVA analysis showed that the value of the significance was (0.000), which means that the hypothesis was rejected at significance level of ($\alpha = 0.05$). There was a significant relationship

between Actual Use and Perceived Efficacy. This result emphasized the result reported in Table 8, which indicated the Actual Use is highly influenced by the Perceived Efficacy.

The same analysis was performed to examine the validity of hypothesis (H_{08}). The results are shown in Table 10.

Table 10. The Impact of Facilitating Conditions on Actual Use

R	R ²	Adjusted R ²	Std. Error of the Estimate	Change Statistics				
				R ² Change	F Change	df1	df2	Sig. F Change
0.571	0.326	0.323	0.58088	0.326	136.592	1	283	0.000
Results of ANOVA Analysis								
	Sum of Squares		df	Mean Squares	F	Sig.		
Regression	46.088		1	46.088	136.592	0.000		
Residual	95.489		283	0.337				
Total	141.577		284					

It can be seen from Table 10 that the value of (R^2) was (0.326), which means that about 32% of the Actual Use was driven by Facilitating Conditions. In addition, ANOVA analysis showed that the value of the significance was (0.000), which means that the hypothesis was rejected at significance level of ($\alpha = 0.05$). There was a significant relationship between Actual Use and Facilitating Conditions. This result emphasized the result reported in Table 8, which indicated the Actual Use is influenced by the Facilitating Conditions.

The fourth research goal was related to effect of moderating factors (Gender, Experience, and Field of Study) on instructors' estimates on Actual

Use. To investigate the effect of these factors on the Actual Use, and hence examine the validity of hypotheses (H_{09} — H_{11}), the statistical means and standard deviations of the estimates were calculated. The results are portrayed in Table 11.

It can be seen from Table 11 that there are apparent differences in the means of estimates with respect to Gender, Experience, and Field of Study and in favor of males, experienced, and in Humanities and Social Sciences fields, respectively. To examine the significance of these differences at the significance level of ($\alpha = 0.05$), 3-Way ANOVA analysis without interaction was performed. The results are shown Table 12.

Table 11. Actual Use According to Mediating Factors

Moderating Factor			Facilitating Conditions	Use Practices	Actual Use
Gender	Male (N=145)	Mean	3.1402	3.8600	3.6939
		Std. Dev	.66628	.42121	.38026
	Female (N=140)	Mean	3.1238	3.8071	3.6495
		Std. Dev	.74733	.48035	.44504
Experience	Less Than 2 Years (N=185)	Mean	3.0811	3.8124	3.6437
		Std. Dev	.73477	.43677	.39546
	2 or More Years (N=100)	Mean	3.2267	3.8740	3.7246
		Std. Dev	.64246	.47644	.44144
Field of Study	Scientific (N=120)	Mean	3.1444	3.8300	3.6718
		Std. Dev	.72276	.44582	.41916
	Humanities & Social Sciences (N=165)	Mean	3.1232	3.8370	3.6723
		Std. Dev	.69573	.45642	.41012

Table 12. Results of 3-Way ANOVA Analysis Showing the Significance of Differences in Estimating Actual Use According to Moderating Factors

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	Facilitating Conditions	0.041	1	0.041	.083	.773
	Use Practices	0.165	1	0.165	.803	.371
	Actual Use	0.129	1	0.129	.752	.387
Experience	Facilitating Conditions	1.819	1	1.819	3.683	.056
	Use Practices	0.213	1	0.213	1.037	.309
	Actual Use	0.444	1	0.444	2.586	.109
Field of Study	Facilitating Conditions	0.013	1	0.013	.026	.871
	Use Practices	0.006	1	0.006	.027	.870
	Actual Use	0.001	1	0.001	.006	.941
Error	Facilitating Conditions	136.817	277	0.494		
	Use Practices	56.912	277	0.205		
	Actual Use	47.548	277	0.172		
Total	Facilitating Conditions	2937.556	285			
	Use Practices	4247.270	285			
	Actual Use	3891.450	285			
Corrected Total	Facilitating Conditions	141.577	284			
	Use Practices	57.820	284			
	Actual Use	48.493	284			

It is evident from the results in Table 12 that the apparent differences in the means of the estimates were not significant. That is hypotheses ($H_{09}-H_{11}$) stating:

H_{09} : *There is no significant difference in Actual Use of Moodle as a learning management system related instructors' Gender.*

H_{10} : *There is no significant difference in Actual Use of Moodle as a learning management system related to instructors' Experience.*

H_{11} : *There is no significant difference in Actual Use of Moodle as a learning management system related to instructors' Field of Study.*

were all accepted. This means that instructors, regardless of their gender, experience, or field of study, use Moodle to a *High* degree. This use was significantly driven by the Perceived Efficacy and the Facilitating Conditions.

DISCUSSION

Overall, the reported results indicated agreement with the developed study model and the theoretical framework presented. For the first goal of the study, which was related to the degree of Perceived Efficacy of Moodle as a learning management system, the reported results in Tables 2–5 showed that instructors have developed high behavioral intentions toward using the adopted technology. The major factor for this was their trust that this technology enhances the teaching and learning process. As for the expected effort using this technology, the overall judgment was moderate and close to the high border, yet linear regression analysis showed that the relationship was still significant. The ease of use of a technology can always be polished by continuous training and specialized workshops. Therefore, if efficacy was to be perceived better, the university administration must revise its faculty training programs in terms of content, frequency, and duration. To this end, these findings agreed with the UTAUT theory (Venkatesh

et al., 2003) and TAM model (Davis, 1989).

On the other hand, these results indicated that Social Influence was also moderate and overall lower than the effect of the other two factors, yet it played a significant driving role towards Perceived Efficacy. This result could be understood from that fact that this technology has been adopted and in use for about 10 years, which means Social Influence could be more decisive in the early stages of adopting a new technology. With time, people get used to the adopted technology, and it becomes part of their culture and a person builds their own judgment based on their own conviction.

As for the second goal of the study, which was related to the significance of statistical differences in instructors' estimates of Perceived Efficacy related to moderating factors, the results reported in Tables 6 and 7 indicated that there were no significant statistical differences between estimates related to Gender or Experience. Instructors, regardless of their gender, established the same behavioral intentions towards the use of a specific technology, and hence their expectations of improving performance and ease of use proved to be the same. The way they influence others or the way they get influenced towards the use of an adopted technology proved to be the same. These results sound logical as they primarily perform the same duties in the teaching and learning process regardless of gender. Similarly, when Experience was investigated, the results indicated that although there were apparent differences in the estimates' statistical, those differences were not genuine. This probably indicates that Moodle is a friendly platform that does not require long time or creative effort to become familiar with it. Reasonable training as well as continuous technical support from IT personnel could improve the competencies of users to master it.

Nevertheless, the results reported in Table 7 indicated that there were significant statistical differences in estimating Perceived Efficacy related to instructors' Field of Study. These differences were in favor of instructors in scientific fields, as can be seen from Table 6. Investigating deeply the results, those significant differences were related to Performance Expectancy and Effort Expectancy.

To this end, these results agreed with the theoretical framework and with the proposed model. The results, as well, aligned with (Davis, 1989) and

(Venkatesh et al., 2003). Moreover, these results agree with results reported in Cabero-Almenara et al. (2019), which concluded that Moodle confirmed its instrumental and functional capabilities as a learning management system. However, the obtained results disagreed with results reported in Salhab (2019) that revealed the high need for intensive training to master Moodle.

The third goal was related to the degree of Actual Use of Moodle. The obtained results as reported in Tables 8–10 agreed with the theoretical framework and proposed model. UTAUT indicated that the use behavior is affected by behavioral intentions developed as a result of Performance Expectancy, Effort Expectancy, and Social Influence. In addition, the use behavior is affected by the Facilitating Conditions. The respondents indicated that their Actual Use of Moodle was highly affected by the developed Perceived Efficacy resulting from Performance Expectancy, Effort Expectancy, and Social Influence and it was affected by Facilitating Conditions.

Moreover, the obtained results agreed with the results reported in Cabero-Almenara, et al. (2019), which indicated the effectiveness of employing Moodle in the educational process. The results further agreed with Damjanovic et al. (2015) and Salhab (2019), who expressed that instructors used Moodle because they developed positive intentions towards its use due to its powerfulness and ease of use in communicating with students. On the other hand, the results disagreed with the results reported in Papadakis et al. (2019), who indicated that Moodle was only used as an electronic repository.

Finally, the fourth goal was related to the effect of moderating factors (Gender and Field of Study) on instructors' estimates on Actual Use. The results presented in Tables 11 and 12 showed that there were no significant statistical differences in instructors' estimates related to any of the moderating factors. This means that instructors regardless of their gender, experience, or field of study, use Moodle to a *High* degree. This use was significantly driven by the Perceived Efficacy and the Facilitating Conditions. The official adoption of Moodle by the university administration and its implementation for 10 years, together with the support instructor receive at all levels, was a fruitful experience among all instructors. This

indicates that a diffusion of the innovation was accomplished.

It is important to mention here that the limitations of the study were that it was conducted on the first semester of the academic year of 2019/2020 in Yarmouk University, Jordan. The results were based on the assumption of the objectivity of the respondents. The study sample consisted of 285 instructors out of about 1,100 faculty members in the university. Furthermore, the data were collected under the assumption of the suitability, validity, and reliability of the designed questionnaire as described in the methodology section. Therefore, the obtained results are constrained by these limitations.

These findings represent solid evidence to administrators of higher education institutions globally to encourage and convince instructors and students on how easy it is to use a new technology like Moodle and how useful this technology is for them. This should encourage a diffusion of this innovative technology in their teaching and learning processes in a fast-changing world particularly due to growth in remote learning due to the COVID-19 pandemic. Finally, the findings can be beneficial to researchers in this field where they can utilize build on it. Finally, similar studies should be conducted that take into account the student's perspective of Moodle use and addresses the challenges and obstacles facing the diffusion of technology in higher and general education. In addition, the perceived efficacy of technology in face-to-face, remote, and blended learning should also be studied.

CONCLUSIONS

In light of the results of the study, the adoption of Moodle as a learning management system in Yarmouk University was a successful experience. The technology proved to be highly employed by instructors to enrich the teaching and learning process. The employment of Moodle was driven by a high belief among instructors of the efficacy of the technology. Under the conditions of the COVID-19 pandemic, universities all around the world had to rely on technology to ensure that the educational process continues without critical interruptions. Learning management systems, together with other supporting technologies, have proven efficacy among educators as well as learners in this

pandemic. This implies that educational institutions worldwide need not ignore the importance of coping with the advances in technology to maintain state-of-the-art learning environments that are equipped with latest technologies and infrastructure and providing prompt support to teachers and learners around the clock. Finally, universities should conduct continuous awareness workshops, seminars, and training and get engaged with the private technology sector to keep students and instructors updated on technology use and its best practices.

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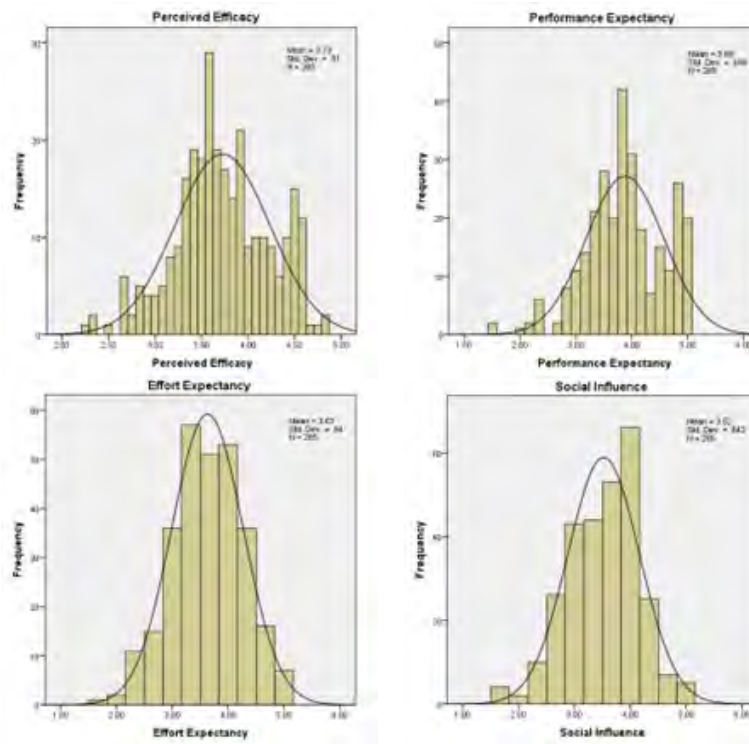
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APPENDIX

The histograms of the instructors' estimates pertaining to *Perceived Efficacy* are shown in Figure 2.

Figure 2. Histograms of Instructors' Estimates Pertaining to Perceived Efficacy



The histograms of the instructors' estimates pertaining to Actual Use are shown in Figure 3.

Figure 3. Histograms of Instructors' Estimates Pertaining to Actual Use

