

# Evaluating the Use of Moodle to Achieve Effective and Interactive Learning: A Case Study at the German Jordanian University

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**Abstract**—Moodle is among the most widely used open-source Learning Management Systems in the educational sector. It provides several functionalities that are crucial to support interactive and effective learning. This paper contributes to the ongoing efforts to expand the use of open-source e-learning tools in higher education institutes. In particular, a questionnaire-based study is conducted on forty six engineering students to evaluate the effectiveness of the Moodle-based e-learning system of the German Jordanian University, Jordan. The questionnaire is designed to quantify the students' familiarity with Information and Communication Technology. Moreover, the questionnaire characterizes the students' enrolment in the various tools and functionalities of Moodle as well as their perspective towards expanding the integration of Moodle in the learning process. The study results indicate that Moodle is mainly used as an online repository to access course materials. However, the interactive learning tools of Moodle are not effectively utilized. The students demonstrated a positive perspective towards expanding the use of Moodle in the learning process. These results suggest expanding the use of Moodle in the educational process, particularly by employing its interactive learning tools to achieve an effective and interactive learning environment.

**Keywords**—Moodle, open-source software tools, e-learning, interactive learning, and learning management systems.

## I. INTRODUCTION

Information and Communication Technology (ICT) has been increasingly used in education. In fact, ICT is extensively applied in many countries with advanced educational systems. Moreover, various initiatives have been proposed to impose ICT in countries with developing educational systems. One of the most widely used ICT-based educational tools is the modular object-oriented dynamic learning environment (Moodle) [1]. Moodle is an open-source Learning Management System (LMS) that supports an extensive set of educational features, such as interaction, feedback, conversation, and networking. In fact, these features are crucial to support the successfulness of the educational process. Moodle contains advanced methods of teaching and learning which have been implemented and used in several higher education institutions across the globe. Examples of these methods include the creation, organization, announcement, communication, collaboration, and assessment of learning and educational activities.

The transition from commercial LMS to open-source systems, such as Moodle, is a growing trend. Moodle platform developers continue to interact with the end users, *i.e.* instructors and students, to achieve a successful development process. Several debates and forums are created for this purpose [2]. Instructors can also contribute to the development of Moodle by encouraging students to actively use the e-learning platforms enabled by Moodle and report constructive feedbacks about the limitations and potential expansions.

In this paper, we present an evaluation study of the Moodle-based e-learning system of the German Jordanian University (GJU), Amman, Jordan. The university was established in 2005 as a leading, public higher education institute. GJU offers more than 20 graduate and undergraduate programs that are mainly focused on applied sciences. Our study aims to quantify how GJU students employ and perceive Moodle in their learning. To achieve this goal, a questionnaire has been developed and distributed to 46 students that are enrolled in various undergraduate engineering programs. The data provided by the students were analyzed to quantify the integration of the Moodle in the educational process at GJU and evaluate the perspective of the students towards the application of advanced ICT tools in their learning.

The remainder of the paper is organized as follows. Section II provides a description of the Learning Management Systems (LMS) and summarizes the main characteristics of Moodle. The questionnaire methodology employed in this study is presented in Section III. The results and discussions are provided in Sections IV and V, respectively. Section VI presents the conclusion and future directions.

## II. LEARNING MANAGEMENT SYSTEMS

Learning Management Systems (LMS), also known as Course Management Systems (CMS) or Virtual Learning Environment (VLE), is a set of software tools that are specifically designed to support the educational process [3-4]. The development of LMS started in the 1990s and grew up since then [5]. Through time, an increasing number of universities across the globe have integrated LMS in their educational systems to improve the effectiveness, accessibility, and flexibility of the learning process.

The integration of LMS in the learning process of educational institutions is usually referred to as learning platform, course management system, content management system, e-learning portal, or instructional management system. Such integration enables the course instructor to incorporate the course learning material with LMS to achieve an effective and interactive online learning environment [5-6]. Students can then access the course content in different formats, such as text, image, sound, as well as interact with the instructor and other students via message boards, forums, chats, video-conferences, and other types of communication tools [7]. Moreover, LMS supports effective management, monitoring, and evaluation of the learning process to achieve a group of preset learning outcomes. In fact, the study of Piotrowski [3] suggested that the use of e-learning platforms at the university assists the creation, organization, delivery, communication, collaboration and assessment of the learning process.

LMS has been adopted by a vast number of universities across the globe. For example, in Australia, studies have reported extensive incorporation of online technologies in various university programs [8]. In 2002, a survey conducted on 39 universities in Australia found that the WebCT [9] and Blackboard [10] LMSs are being used by three quarters of the universities included in the survey [5]. In the United States, several major universities were found to use open source LMS tools rather than commercial systems.

#### A. Reasons of adopting LMS by universities

The incorporation of LMS in university systems seems to fulfill some needs and expectations of instructors, students, and university managers. For the instructor, LMSs support their work towards developing and enriching their online materials through the inclusion of web pages, digital resources, assessment tasks, and online discussion [5]. This feature encourages course instructors to use LMS and enrich their studying materials with virtual content. This in turn encourages the universities to adopt LMSs, despite some probable inconveniences like the costs, complexities, quality and risks involved [11].

For the universities, LMS can increase the competitiveness of the university through increasing its efficiency of teaching. Using LMS, universities can develop large-scale e-learning systems to ensure the flexibility and quality of course delivery, enable efficient accessibility of the educational resources, and achieve advanced learning activities and collaborative work between students [12]. Also, LMS enables university students to easily access the course content and allow them to interact with diverse, dynamic, and associative educational networks. Moreover, the increasing demand for greater access to higher education makes university managers face the problem of expanding the university physical infrastructure. Virtual classes using LMS can be a solution to overcome this limitation [5].

For the student body, which mainly includes young learners, LMS provides a high involvement level of advanced technologies in the learning process [5], which meets the general expectation of new student generations. Motivated by nature of nowadays students along with the competition environment of the educational sector, universities are working to increasingly adopt LMS in their pedagogic systems.

As LMS is becoming an essential part of the university educational structure, it is important to examine how students adopt the e-learning activities as part of their fundamental learning process. It is also important that institutions adopt LMS in a smooth and open way to positively affect the education process. The incorporation of LMS into high education institutions is a complex process. Indeed, university leaders are required to investigate several plans and parameters to insure the successful adoption of LMS. In fact, leaders can establish several LMS adoption plans by promoting research and encouraging practices towards understanding the educational role of LMS in higher education in general [5]. Then leaders can support the best plan to incorporate LMS into the university environment [13].

#### B. The Moodle e-learning platform

Several studies revealed the benefits of using e-learning platforms [14-15]. A study conducted on 51 higher education institutes from 19 different countries found that 14 out of the 51 institutes use multiple LMS tools [16]. Some studies identify Moodle as the easiest and most-widely used platform in higher education [4,17]. Other studies suggested that Moodle is the second most-widely used LMS after Blackboard [16]. In fact, studies have indicated that LMSs are mainly used as a repository for course materials. Students, however, are often aware of the importance of the other features and functions of these e-learning platforms for the success of the learning process [18].

Moodle is an effective open-source LMS platform. It aims to create e-learning websites that can be accessed only by enrolled students [19]. It also allows synchronous, such as chats, and asynchronous, such as forums, exchange of information among users. In a functional perspective, Moodle has features which can be set up to form course assessment material, such as quizzes and online tests [14,20-21].

Several studies classified Moodle from several perspectives. The study by Blin and Munro [22] indicated that Moodle supports two different sets of functionalities. The first functionality is resources, which includes the digital materials created by other software tools and uploaded to the e-learning platform, such as Power Point lecture notes, Word documents, Flash animations, and video files. The second functionality is modules, which represent the material created using the Moodle platform. Modules mainly include interaction tools between users (usually students and teachers), such as lessons, homework, workshops, chats, discussion forums, news, wikis, quizzes, and surveys [1].

Costa *et al.* [18] classifies the functionalities of Moodle into two groups: configured modules and external tools. The configured modules, which include assignments, workshops, chats, forums, news, quizzes, and surveys, are set up from the Moodle platform and support information exchange between students and teachers. The external tools include blogs, questionnaires, and wikis.

### III. QUESTIONNAIRE METHODOLOGY

The e-learning services at GJU provided through the Moodle platform were evaluated using a paper-based questionnaire. Forty six undergraduate students who were

attending a Programming Methodology course were asked to complete the questionnaire. The questionnaire was composed of three sections. In the first section, the participants were asked to provide information related to their gender, age, study program, and preferred devices used to access the Internet. Moreover, the participants were asked questions about their general use of computing technology and Internet services.

The second section was focused on evaluating the use of GJU e-learning services by the participants. In particular, the participants provided information related to the frequency of using the e-learning services and the commonly used components of the Moodle platform. In the last section of the questionnaire, the participants provided information related to their opinion about the impacts of expanding the use of e-learning services during course lectures.

#### IV. QUESTIONNAIRE RESULTS

##### A. General characteristics of the participants

A total of forty six students participated in the survey. Among these students, 63% were females and 37% were males. The mean  $\pm$  standard deviation age of the students was  $19.9 \pm 1.3$  years. All students were enrolled in engineering undergraduate programs. The distribution of the study programs of the participants is presented in Table I.

All students indicated that they employ computing technology and Internet services in their daily activities inside and outside the university. Figure 1 provides the distribution of the students' experience of using computing technology and Internet services. Regarding the devices employed to access Internet, 15% of the participants indicated that they mainly use personal computers and 35% said that they use smartphones. Moreover, half of the participants reported that they use both personal computers and smartphones to access the Internet.

The students have also been asked to indicate the main purposes of using computing technology and Internet services. Table II provides a summary of the students' response to this question. 85% of the students said that they participate in online chatting on daily basis. Moreover, the majority of students use the Internet on daily or weekly basis to access education-related services, such as dictionary and encyclopedia websites, surfing other educational resources, participating in online educational courses and quizzes, and joining online discussion groups and forums.

The participants have been requested to report the number of hours per day in which they use the Internet to carry out any activities related to their study program. The participants' responses are summarized in Fig. 2. Around 70% of the participants spend more than 2 hours per day on online activities related to their learning.

##### B. Participants' enrolment in the Moodle platform at GJU

The participation of the students in GJU Moodle platform has been evaluated in terms of the frequency and purpose of

using the platform as well as identifying the most commonly used components of the platform. Figure 3 shows the distribution of the number of times per week in which the students access GJU Moodle platform. Around half the students use the platform between 0 and 20 times per week. Moreover, more than 35% of the students use the platform between 21 and 40 times per week. The rest of students use the platform between 41 and 60 times per week.

The frequency of using the different components of GJU Moodle platform is presented in Fig. 4. Around 96% of the participants use Moodle to download course lectures and slides. Moreover, 54% of the students use Moodle to download course assignments. Around one third of the participants use Moodle to do course quizzes and read course news. The other components of Moodle, including chats, wikis, feedbacks, forums, questionnaires, and surveys, are not commonly used by the participants.

TABLE I. DISTRIBUTION OF THE PARTICIPANTS IN THE FIVE STUDY PROGRAMS INCLUDED IN THE SURVEY.

Specialization	Number of Students
Applied Technical Sciences (Mechanical Engineering, Industrial Engineering, and Mechatronics Engineering)	8
Natural Resources Engineering and Management (Civil and Environmental Engineering and Energy Engineering)	18
Applied Medical Sciences (Pharmaceutical and Chemical Engineering and Biomedical Engineering)	16
Electrical Engineering and Information Technology (Computer Engineering, Computer Science, and Electrical Engineering)	4

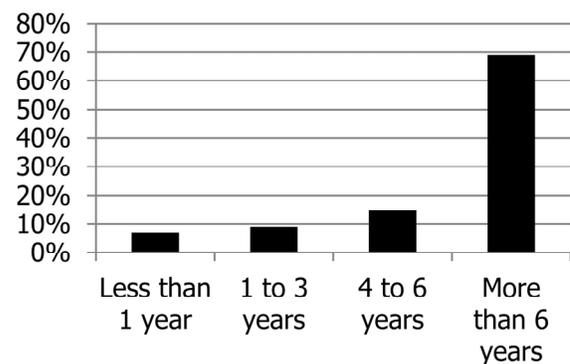


Fig. 1. Distribution of the experience levels of the participants in using computing technology and Internet services.

TABLE II. DISTRIBUTION OF THE NUMBER OF TIMES THE PARTICIPANTS USE THE INTERNET TO PERFORM ONLINE ACTIVITIES.

	Never	Several times a month	Weekly	Daily
Sending and reading emails	0%	33%	30%	37%
Chatting online (e.g. Facebook and WhatsApp)	0%	4%	11%	85%
Reading or watching news	2%	17%	43%	37%
Surfing dictionary and encyclopedia websites (e.g. Wikipedia)	0%	33%	28%	39%
Searching the internet for other educational resources and information	0%	33%	41%	26%
Participating in online educational courses and quizzes	7%	43%	33%	17%
Participating in group discussions and forums	33%	28%	28%	11%
Playing online games	20%	20%	30%	30%

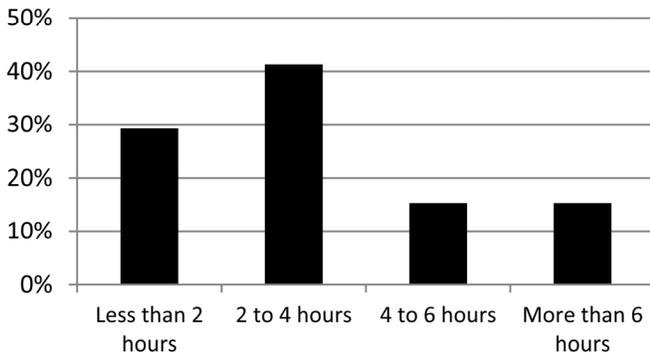


Fig. 2. Distribution of the number of hours per day in which the participants use the Internet to carry out activities related to their study program.

### C. Characterizing the participants' perspective towards e-learning services

The last section of the survey was focused on evaluating the students' perspective towards e-learning services. The students were asked about their opinion about the potential positive impacts of using e-learning services during lessons. Figure 5 presents the responses of students. The majority of students indicated that the integration of e-learning services in class lessons would have a positive impact on their concentration, learning activities, feeling of independence, ease of understanding, memorization of the course material, co-working with other students, and improving the class atmosphere.

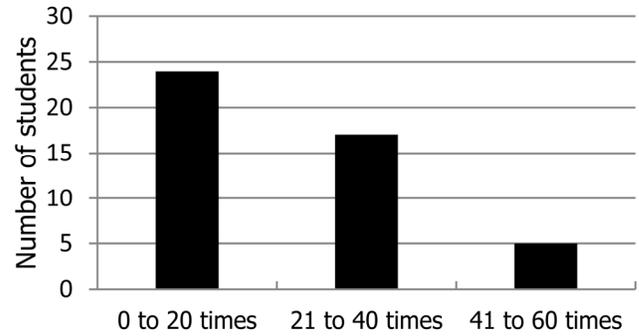


Fig. 3. Number of times per week the students use GJU Moodle platform.

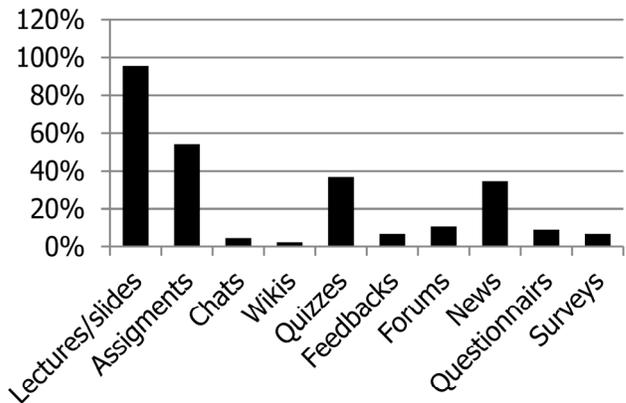


Fig. 4. The frequency of using the different components of GJU Moodle platform.

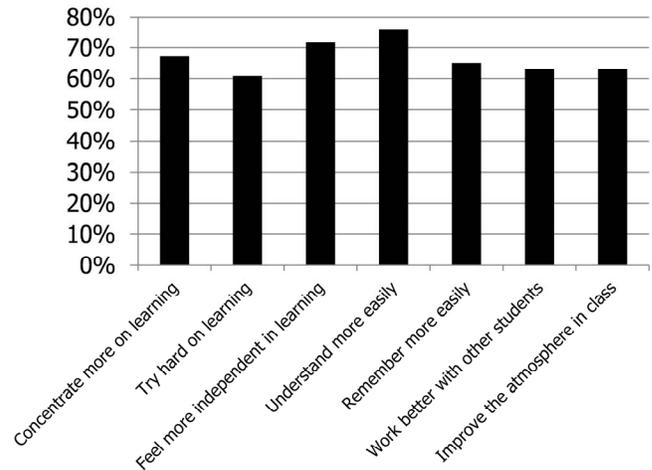


Fig. 5. Students' perspective about the potential positive impacts of accessing elearning services during lessons.

## V. DISCUSSION

The results presented in Fig. 1 and Table II demonstrate that the majority of students have long experience of using computing technology and Internet services. For example 85%

of the students do chatting on a daily basis and 60% of them play online games on daily or weekly bases. Moreover, Fig. 2 indicates that most students spend more than 2 hours per day on online activities related to their learning. However, as shown in Fig. 4, the Moodle-based e-learning system at GJU is mainly used to access course materials, including lecture slides, assignments, quizzes, and news. Such course materials are essentially prepared using other software tools, such as Microsoft Office, and uploaded to the e-learning system. Also, Fig. 4 indicates that the interactive learning tools of Moodle, including chats, wikis, feedbacks, forums, questionnaires, and surveys, are underutilized. In fact, the interactive tools are usually prepared using the module functionalities of Moodle. These results suggest that Moodle is mainly used as a repository platform for exchanging course materials, but its interactive learning tools are not effectively utilized.

One important finding of our study is that students in general have a positive perspective towards expanding the use of e-learning tools in lessons, as indicated in Fig. 5. This might be attributed to the fact that most students have long experience with computing technology and Internet services. The results of our study suggest expanding the use of Moodle in the learning process, with particular focus on integrating the interactive learning tools of Moodle to achieve an interactive and effective learning environment.

## VI. CONCLUSION

In this paper, a questionnaire-based study is conducted to evaluate the use of the Moodle-based e-learning platform of the German Jordanian University, Jordan. Forty six engineering students participated in the study. The responses of the students indicate that they have a long-term experience with computing technology and Internet services. Moreover, the study indicates that Moodle is mainly used as a repository to exchange course materials. However, the interactive learning tools of Moodle are not effectively utilized. The students demonstrated a positive perspective towards expanding the use of e-learning tools in the educational process. The results of our study suggest that university leaders and instructors are encouraged to expand the use of Moodle in the educational process, with particular focus on employing the interactive learning tools of Moodle to achieve an effective and interactive learning environment.

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