
Evaluating the usefulness of e-learning management system delivery in higher education

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Abstract: Learning management systems (LMSs), such as Moodle, has been used by many academic institutions to improve teaching and student learning experience. This paper examines the use of LMS as a course delivery system and an electronic assessment (e-assessment) tool for improving the learning process. This study analyses educators' perspective on the use of Moodle based on effectiveness, helpfulness, user-friendly interface design, and flexibility in delivering online courses. Quantitative and qualitative data were collected using a survey questionnaire from 81 instructors from five colleges of Al Ain University of Science and Technology (AAU) who have been involved in using LMS for the delivery of courses. The respondents agreed, in general and independent of their college affiliation, that the functionality of the LMS is effective; reliable, usable, maintainable and efficient. In addition, respondents showed a positive attitude toward using the LMS and dedicating specialised trainers according to users' needs.

Keywords: learning management system; LMS; Moodle; e-learning; e-assessment; higher education; e-learning management system usefulness.

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1 Introduction

In the education sector, the only capital that institutions consider a sustainable competitive advantage is intellectual capital (Butler and Dunne, 2004). This intellectual capital within institutions is demonstrated by the capabilities, knowledge, and competencies of instructors. The ability of instructors to learn, improve, and share their learning is at the heart of the sustainability of the competitive advantage and the success of the institution or the organisation (Butler and Dunne, 2004). The learning management system (LMS) is the educational platform within institutions that offer an integrated platform to post, collaborate, and share teaching materials among teachers, learners, and the management of institutions (Achchuthan et al., 2014). The adoption of LMSs has become a requirement because LMSs are the current facilitators and leading drivers of blended learning and class-based traditional learning (Achchuthan et al., 2014). However, the abundance of a plethora of LMSs has resulted in lower satisfaction regarding user experience. Almost 50% of surveyed decision makers at education institutions reported their intention to change or upgrade their LMSs (Pappas and Zaharias, 2016). Therefore, the development of a new user experience oriented LMSs has become a necessity. Such a system must incorporate a pragmatic quality, user and administrator engagement and motivation as well as offering authentic learning (Pappas and Zaharias, 2016).

1.1 Study objective

The main objectives in this research are:

- Examining the usefulness of LMS as a course delivery tool and e-assessment for improving the learning process.
- Analysing instructors' perspectives of using LMS for the delivery of courses.
- Comparing between e-assessment and paper-based assessment courses.
- Evaluating the five aspects of LMS usefulness from instructors' perspective.

For the evaluation of the LMS usefulness, the authors have followed the aspects shown in Figure 1.

Figure 1 LMS usefulness evaluation aspects (see online version for colours)

In this research authors tries to answer the following interesting questions:

- Is there any association between instructors' length of LMS usage and the number of LMS activities that are used by instructors?
- What are the instructors' perceptions of LMS usage (i.e., effectiveness, helpfulness, friendly interface design, and flexibility) related to their college affiliation?
- What are the instructors' perceptions of LMS online examinations (preparing, applying, and grading) compared to paper-based examinations?
- What are the instructors' perceptions of LMS availability (accessibility) and security, and the university IT technical support?

Many universities have adopted an LMS for improving their teaching and learning processes. Hence, authors believe that evaluating the usefulness of LMS for the university instructors seems to be important. Because Al Ain University of Science and Technology (AAU) have adopted Moodle system as an LMS, authors have chosen it to be the study case of this research. The following sections present the literature review and describe the research methodology, including data analysis and results, followed by discussion and recommendations.

2 Literature review

The use of Moodle is one of the approaches to improve the quality of teaching. The adoption of Moodle as a solution to resolve the problems of educational institutions has become frequent (Ali and Mbabazi, 2016). The results of the gradual implementation of the Moodle shifted the level of support compared to the previous versions and upgrades. Universities consider the knowledge as a source rather than focusing on learning as a human continuous and complicated process, which explains the considerable number of failures in the adoption of LMSs (Pappas and Zaharias, 2016). Recently, many organisations have shifted from the use of traditional LMSs to the use of user experience

oriented: users' oriented blended learning systems, and management approach to teaching (Pappas and Zaharias, 2016). Practitioners and professionals emphasise that the delineation of a new LMS's role must be consistent with the education and learning theories, which implies the creation of learning authentic LMSs. Moodle is one of the vastly adopted LMSs (Pappas and Zaharias, 2016). The TAM remains as one of the vastly used approaches to evaluate the usefulness and effectiveness of Moodle and LMSs as well as the satisfaction and perception of users (AlQudah, 2014). Although different universities worldwide have adopted Moodle as their educational, technological platform, the TAM shows that the main barrier towards the adoption of Moodle is the perception of ease of use by the instructors, which might be attributed to the familiarity and comfort with the use of computers and computerised systems. For instance, AlQudah (2014) stated that only 18.8% of surveyed Jordanian university teachers who upload material for their students on Moodle said claimed that Moodle is easy to use while 27.5% stated that Moodle is not easy and 27.5% were neutral.

Arsenovski et al. (2008) investigated and evaluated the usability and instructor experience of the different standard modules of the Moodle. They found that instructors agreed, on average, that the Moodle is very useful at helping instructors in different activities (lessons, quizzes, HTML pages, quizzes, database, choices, announcements, assignments, workshops, discussion chat and forums, and glossary). In general, Moodle modules are memorable and satisfying (Arsenovski et al., 2008). The high instructor satisfaction in the educational context has an impact on the academic outcome of the class (Hölbl et al., 2009). Filippidi et al. (2010) studied the impact of the use of Moodle in blended learning classes (classes using online and physical classes). The authors found that the utilisation of Moodle in blended learning contexts explains 20.2% of the variability in the academic performance at the University of Patras in Greece.

Security and reliability are other important aspects when evaluating Moodle (Chavez and Hernandez, 2008). Chavez and Hernandez (2008) found that the services and options offered by Moodle are reliable. However, the documentation received by the developers of Moodle is poor, which makes the training on the use and development of the system longer and more complicated (Chavez et al., 2008). The authors found that Moodle's security services are not adequately documented, which makes the software vulnerable to different types of attacks. Moodle's server is also vulnerable to various attacks such as the session hijacking, prediction of passwords and usernames, using brute force (trial and error method), and the session fixation. Moreover, Dutta and Kumar (2011) state that Moodle is a platform for the virtual learning environment (discussions and interactions between students and teachers on Moodle. Moodle is vulnerable software in terms of the authentication such as the brute force attacks. The software is also vulnerable to availability, integrity attacks, and confidentiality (Dutta and Kumar, 2011). Moodle is designed and developed by the open source model, which allows a fast response to the security bugs and defections within the LMS system. However, Moodle's ability of reacting to bugs and vulnerability depend greatly on the security measures placed on the server of universities (Đanić et al., 2008).

Moodle is a useful tool for the exam and quiz preparation for students. It is also useful to instructors at universities regarding the exams and quizzes. García et al. (2008) found that Moodle helped instructors at the University of Cordoba to have full reports and analyses of students' individual performance and their answers in the cases of online quizzes and exams. Therefore, instructors were able to discuss different issues with

students, which consequently helped students to improve their performances (García et al., 2008).

Moodle and other LMSs are not the only sources of computerised resources used to improve the learning process within classic classrooms and blended learning programs (Achchuthan et al., 2014). The use of the open/alternative educational resources (OAERs) has become frequent among instructors to enhance the flexibility of the class material (Adhikari et al., 2016). The OAERs are means to make the content and material taught in class more flexible. However, continuation of the use of OAERs also depends on the technological platform adopted by the institution (Adhikari et al., 2016). The usability allows institutions and educational professionals to assess the usefulness and easiness of the technological platform in serving learners.

Despite the usefulness of the LMSs for students, researchers have found that the current LMSs used in developing countries, such as Sri Lanka, still have limitations in uploading (online submissions features) (Achchuthanhan et al., 2014). Achchuthan et al. (2014) stated that Sri Lankan teachers reported a lack of clear user guidelines and suggested that every update made to Moodle be reviewed by an expert before it is implemented. The good function of Moodle and LMSs, in general, is crucial for the success of traditional learning as well as contemporaneous forms of learning such as the blended learning, which has gained ground among education professionals both in developed and developing countries. However, the survival of Moodle and other LMSs depends on the perceptions of instructors using Moodle to upload the material for their students. Among 258 surveyed teachers in Tanzanian institutions, 53% of them had positive attitudes toward Moodle and LMSs in contrast to 47% who showed negative attitudes. The exposure to the computer has a statistically significant correlation with the attitude of Tanzanian high education teachers toward LMSs (Kisanga, 2016).

On the other hand, Chang and Hsu (2013) argued that instructors' perceptions about the use of Moodle and LMSs remain of significant importance. The usefulness of Moodle is the primary facilitator of students' access to the learning resources (Adhikari et al., 2016). Students and instructors from the Kansas State University were surveyed to investigate the usefulness of the LMSs posted on Moodle. The instructors surveyed also indicated that they would continue to use the LMSs in their courses because of the various benefits offered by these systems (Adhikari et al., 2016).

Perceptions of instructors about the ease, accessibility, and usefulness of LMSs and Moodle are critical factors in the success of the adoption and implementation of the blended learning system. Chang and Hsu (2013) investigated the perception of the convenience and the usefulness of Moodle for their learning activities. The results of the survey showed that instructors' perception about the convenience of use has a direct impact on their perception about the usefulness of Moodle for their studies. The perception of students about the ease of use and the perception of convenience and usefulness had a statistically positive and significant association with the attitude toward the use of Moodle. Interestingly, the exposure to a computer was not a factor that impacted the attitude toward the use of Moodle.

The perception of users depends on the ease of use of Moodle and LMSs (Ali and Mbabazi, 2016). However, the lack of training, adequate equipment, fast connection, and technical support hinder the satisfaction of the users of the system and their perception of the adoption of Moodle (Ali and Mbabazi, 2016). The benefits of Moodle depend largely on the satisfaction of instructors in traditional and blended learning. Instructors' satisfaction about the LMSs depends on computer anxiety (familiarity with computers),

personal innovativeness, the quality of information offered, the quality of the system, the availability of training and technical support, the support from the management, and the policy incentives given by institutions to instructors to continue adopting the LMS (Ali and Mbabazi, 2016).

3 Research methodology

The present study was based on quantitative and qualitative data collected from a sample of AAU instructors using a survey questionnaire. Stratified sampling technique was used. This technique is the most suitable sampling technique for this study as the population distribution of the study is known. A sample of 56 out of 81 (i.e., 69%) instructors from five different colleges (i.e., business, engineering, pharmacy, communication and media, education, humanities and social science) at AAU, Al Ain Campus, were included in the study. Four incomplete questionnaires were excluded from the analysis. The distribution of the sample per colleges vs. the population distribution is shown in Table 1.

Table 1 Population distribution vs. sample distribution

<i>College</i>	<i>Population distribution</i>		<i>Sample distribution</i>	
	<i>Instructor no.</i>	<i>%</i>	<i>Frequency</i>	<i>%</i>
Business	21	25.9	13	25.0
Engineering	15	18.5	11	21.2
Pharmacy	18	22.2	12	23.1
Communication and media	4	04.9	3	5.8
Education, humanities and social science	23	28.4	13	25.0
Total	81	100.0	52	100.0

4 Findings and interpretation

4.1 Length of Moodle usage by instructors

Three instructors (5%) of the sample had never used LMS. They were mainly from the College of Education, Humanities and Social Science. A quarter (25%) of the sample had been using LMS for more than three years and 29% of them had been using LMS for around two years. The rest of instructors varied between around one year (23%) and around three years (18%) of usage as shown in Figure 2.

4.2 Evaluation of LMS activities usage

The maximum and minimum quantities of activities that have been used by an instructor are seven and two different activities, respectively. Activities vary in number of users as shown in Table 2, which shows that the majority of instructors used uploading teaching materials, announcements, and assignments, whereas less than 5% of the sample used chatting and/or Wiki. Only 51% of the instructors used online exams and only 15% of them used learning outcome assessment activities regardless of the importance of these

two different components of LMS. Since Turnitin assignment was activated recently by the university, only 17% of the instructors have used it. They are primarily from the College of Business. None of the instructors sample specified any other activity that they could have been using.

Figure 2 Instructors distribution according to length of Moodle usage (see online version for colours)

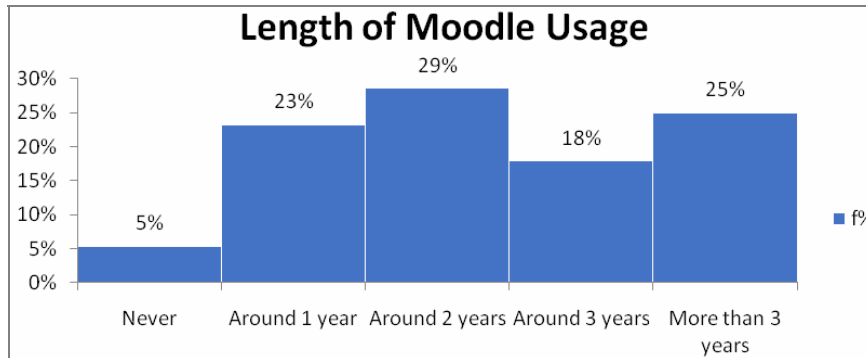


Table 2 Distribution of users (percentage) on Moodle activities in descending order

Moodle activity	Users %	Moodle activity	Users %
Uploading teaching materials	98	Turnitin assignment	17
Announcements	74	Forum	17
Assignments/projects	70	Learning outcome assessment	15
Online exam (quizzes)	51	Attendance	11
Grade checking	36	Chatting	4
Feedback	19	Wiki	2

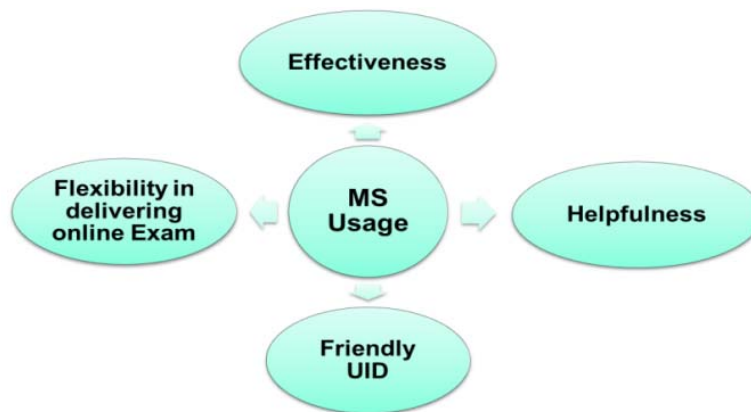
From the results in Table 2, the authors were interested in finding out about the association between the LMS length of usage by the instructor and the number of activities used.

By studying the relationship between the length of Moodle usage and the number of Moodle activities used by instructors, the authors found that there is a relatively weak positive linear relationship between the number of years of LMS usage and the number of LMS activities used. Only 22.51% (the value of the coefficient of determination; R^2) of the variation in the number of LMS activities used is explained by the variation in the number of years of LMS usage. However, by testing the significance of the coefficient of determination R^2 at $\alpha = .05$ and $d_1 = 1$ and $d_2 = 45$ degrees of freedom (df), the authors found that $(F = 6.9752) > [F_{(\alpha, d_1, d_2)} = 4.02]$; hence, there is not enough evidence to accept the null hypothesis (H_0 : the independent variable does not explain a significant portion of the variation in the dependent variable). Therefore, the authors accept that the number of years of usage explains a significant portion of the variation in the number of LMS activities used.

4.3 Evaluation of LMS usage

The authors evaluated the usage of LMS on four related aspects: effectiveness, helpfulness, user-friendly interface design, and flexibility (see Figure 3) in delivering online exams from instructors' perspectives. Moreover, the authors tested whether instructors from different colleges differed significantly in their perception of LMS usage levels. In other words, the authors tested whether there were relationships (dependencies) between instructors' perceptions of LMS effectiveness, helpfulness, user-friendly interface design, and flexibility in delivering online exams and instructors' college affiliation. To perform the test, the authors used a chi-square (χ^2) test for independence at significance level $\alpha = 0.05$ and degree of freedom $df = (5 - 1) * (5 - 1) = 16$.

Figure 3 LMS usage evaluation aspects (see online version for colours)



4.3.1 LMS effectiveness

Our analysis of the level of LMS effectiveness from instructors' perspectives, as shown in Figure 4, indicates that 77.36% of the sample believed that LMS is either extremely effective or very effective, 18.87% believed that LMS is moderately effective, whereas only 1.18% believed that LMS is slightly effective or not at all effective. Moreover, by testing the significance at $\alpha = 0.05$ and $df = 16$, the differences in instructors' perceptions of LMS effectiveness according to their college affiliation, the authors found that there is not enough evidence to support the claim that instructors' perceptions of the level of LMS effectiveness are dependent on the instructors' college affiliation. Hence, the instructors' perceptions of the level of LMS effectiveness are independent of their college affiliation.

4.3.2 LMS helpfulness

As shown in Figure 5, 57.69% of the sample believed that LMS is either quite or extremely helpful, whereas 38.46% believed that it is moderately helpful. Zero percent indicated that LMS is slightly helpful, whereas only 3.85% believed that LMS is not helpful at all. By applying the chi-squared (χ^2) test for independence at $\alpha = 0.05$ and $df = 16$, the authors found that there are statistically significant differences between

instructors' perceptions of the level of helpfulness according to college affiliation. Hence, instructors from different colleges differ significantly in their perceptions of the level of LMS helpfulness.

Figure 4 Effectiveness of Moodle system in delivering course teaching materials (see online version for colours)

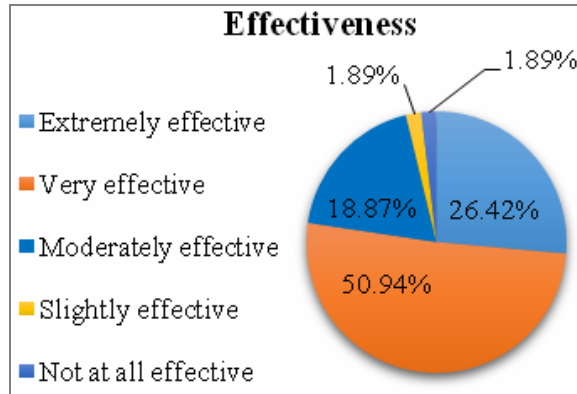
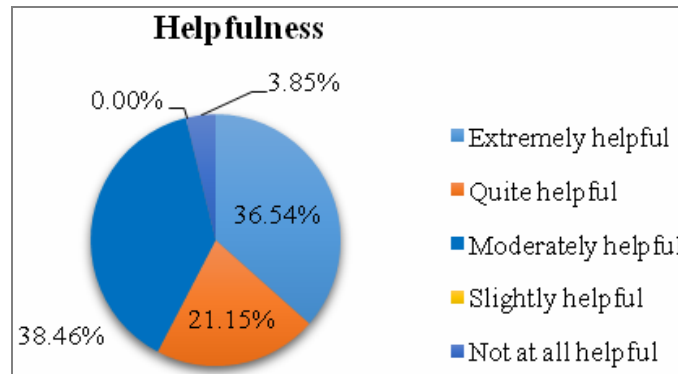


Figure 5 Level of LMS helpfulness in delivering course teaching materials (see online version for colours)

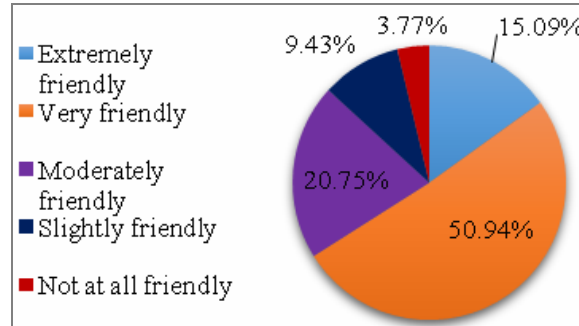
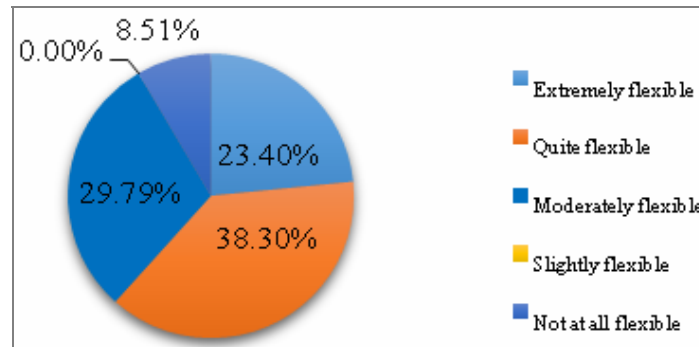


4.3.3 LMS ease of use (user-friendly) interface design

Figure 6 illustrates that 66.03% of the sample believed that LMS has very or extremely user-friendly (easy-to-use) interface design and 20.75% believed that it is moderately friendly, whereas only 13.2% indicated that LMS is either slightly or not at all has a user-friendly interface. By testing for independency, the analysis showed that there is no significant evidence that instructors differed in their perceptions of the level of LMS ease of use (user-friendly) interface design according to their related college affiliation.

4.3.4 LMS flexibility in delivering online exams

Figure 7 indicates that 61.70% of the sample found LMS is quite or extremely flexible in delivering online exams. About 29.79% believed that LMS is moderately flexible.

Figure 6 Level of LMS user-friendly interface design (see online version for colours)**Figure 7** Level of LMS flexibility in delivering online exams (see online version for colours)

Zero percent believed that LMS is slightly flexible, whereas 8.51% believed that LMS is not at all flexible in delivering exams. Moreover, the authors investigated the reasons behind the lack of LMS flexibility in delivering online exam (i.e., 8.51%). As shown in Table 3, more than half (i.e., 54.55%) of the number of instructors who believed that LMS is slightly flexible (i.e., 8.51%) thought that the lack of LMS flexibility comes from the complication of LMS tools and procedures. About 18.18% attributed the reason to their lack of experience, which is not surprising as 23% of the total sample had been using LMS for less than a year.

Table 3 Reasons behind the lack of flexibility of online exam in Moodle systems

<i>Reasons</i>	<i>Percentage</i>
Complication of Moodle tools and procedures	54.55%
Lack of experience	18.18%
Lack of technical support	18.18%
Lack of internet accessibility	9.09%
Lack of Moodle guidance and instructions	0.00%

On the other hand, 18.18% attributed the reason to the lack of technical support whereas only 9.09% indicated the reason to the lack of internet accessibility. Finally, 0% claimed that the reason was the lack of Moodle guidance and instructions.

Again, when the authors tested for independencies, the authors found that there is no significant evidence that instructors differed in their perceptions of the level of LMS flexibility in delivering online exams according to their related college affiliation.

4.4 Evaluation of ease of LMS online exam vs. paper-based exam

The authors compared and evaluated the ease of exams for both online and paper-based types of exam. The authors divided the exam process into three main steps: preparing, applying (managing), and grading the exam. The analysis (as illustrated in Figure 8) indicated that 36% of the sample believed that preparing for an online exam is easier than preparation for a paper-based exam, whereas 41% believed that preparing for an online exam is more difficult that preparation for a paper-based exam. However, 23% of the sample believed that both activities are the same in the level of easiness of preparation.

Figure 8 Ease of preparing an online exam compared to a paper-based exam (see online version for colours)

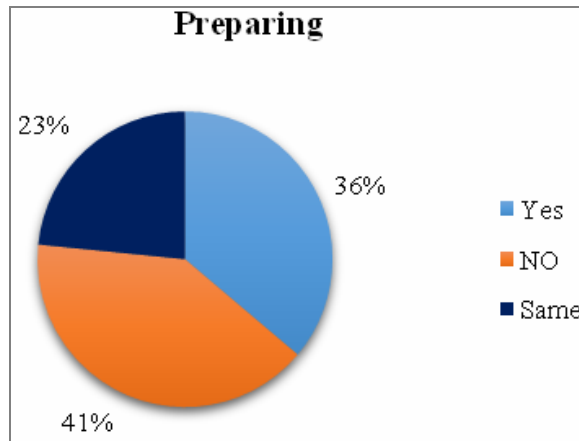
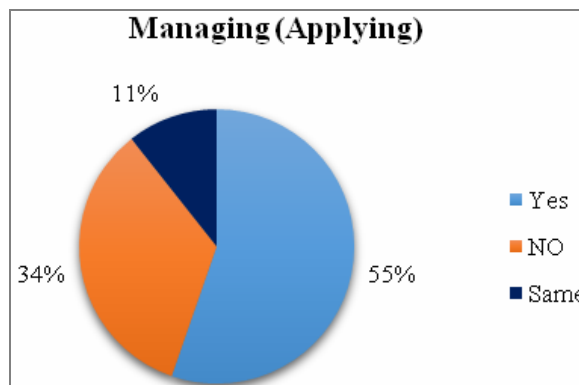


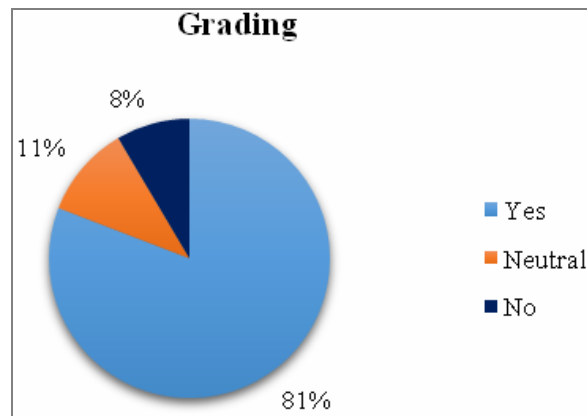
Figure 9 Ease of managing (applying) an online exam compared to paper-based exam (see online version for colours)



On the other hand, Figure 9 shows that 55%, 34%, and 11% of the sample believed that managing the online exam is easier than, not easier than, and the same as for a paper-based exam, respectively.

Figure 10, however, illustrates that 81% of the sample believed that online exams are easier to grade, 11% believed it is not easier, and 8% believed they are equally easy.

Figure 10 Ease of grading an online exam compared to paper-based exam (see online version for colours)



The authors also tested whether instructors differed significantly in their perceptions of the ease of each of the steps of the process of an online exam compared to paper-based exams at $\alpha = 0.05$ and $df = 16$. The authors found that there is no significant evidence that instructors differ in their perceptions of the ease of preparing and grading online exams, compared to paper-based exams, according to the participants' college affiliation. There is enough evidence, however, to support the claim that instructors' perceptions of the ease of managing the online exam compared to paper-based exam, is related to (dependent on) instructors' college affiliations.

Figure 11 Sample distributions of perceptions of that favour online exams (see online version for colours)

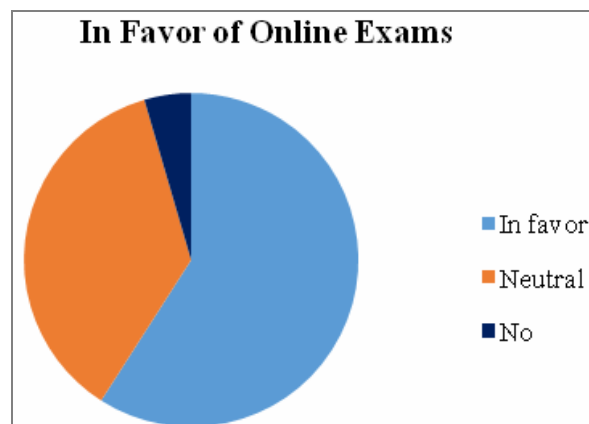
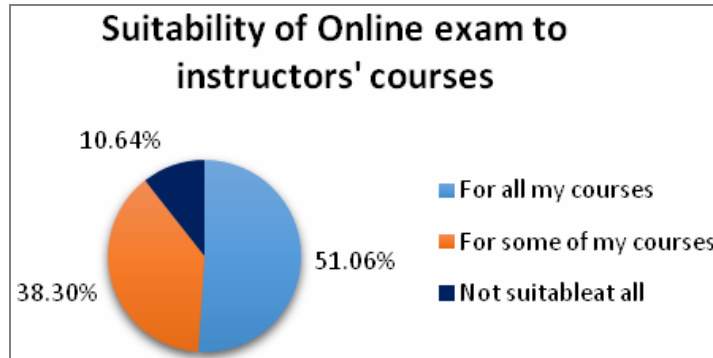


Figure 12 Sample distribution of instructors' who favour online exams (see online version for colours)

The authors were also interested in determining whether or instructors in general are in favour of online exams. Our data analysis indicates that 59.09% are in favour of online exam, whereas 4.55% of the sample was not in favour of online exam. However, 36.36% of them were neutral (see Figure 11).

Moreover, as illustrated in Figure 12, 51.06% of the sample indicated that online exams are suitable for all of their courses, 38.30% of them believed that online exams are suitable for only some of their courses, and 10.64% of instructors surveyed believed that online exams are not suitable at all for any of their courses.

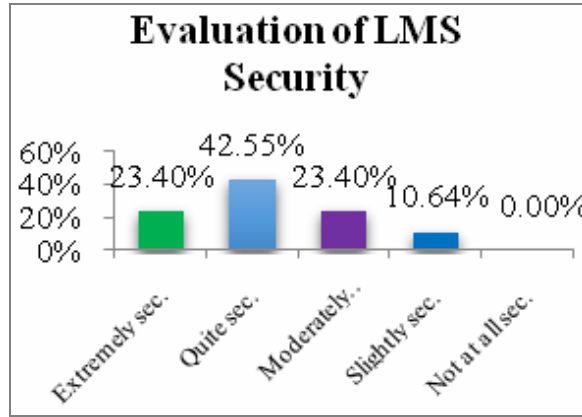
To learn more about the suitability of online exams for courses from instructors' point of view, the authors were interested to investigate the reasons behind the unsuitability of online exams for courses indicated by instructors who believed that online exams are not suitable for all or some of their courses. Hence, by analysing the reasons behind instructors' beliefs/viewpoints about unsuitability of online exams for some or all of their courses (i.e., 48.94% of the sample), the authors found that:

- The majority of participants thought that online exams require multiple choice questions or true or false types of questions.
- Some participants believed that online exams are not suitable for graphics and drawing diagrams.
- Some believed that LMS is not suitable for mathematical formulas and calculations.

Clearly, there is a lack of knowledge among instructors about the various features and exam question types that can be provided by LMS. LMSs indeed provide users with some impeded features and 11 types of exam questions, plus a description type, to support and enhance exam questions and process.

Again, this raises a question: do instructors differ in their opinion according to their college affiliation? Using χ^2 test for independence at $\alpha = 0.05$ and $df = 16$, the authors found that the instructors from different colleges did not differ significantly in their perceptions of the suitability of online exams to their courses based on their college affiliation.

Figure 13 Sample distribution according to instructors’ perceptions of MS security (see online version for colours)



4.5 Evaluation of LMS security and the university’s IT support

The present study evaluated LMS security and IT support at AAU from the instructors’ point of view but not from a technical point of view. From instructors’ perceptions of LMS security (as illustrated in Figure 13) the study indicated that 23.40% of the sample believed that LMS is extremely secure, 42.55% believed that LMS is quite secure, and 34.04% believed that LMS is moderately or slightly secure. However, 0% of respondents believed that LMS is not secure at all. Moreover, tests for independency indicated that there is no significant evidence that instructors differ in their perceptions of the level of MS security according to their related college affiliation.

Figure 14 illustrates that 75% of the sample believed that university IT support is quite or extremely sufficient, whereas 23.07% believed that it is moderately or slightly sufficient. Only 1.92% believed it is not at all sufficient.

Figure 14 Sample distribution of instructors’ perceptions of sufficiency of AAU it support (see online version for colours)

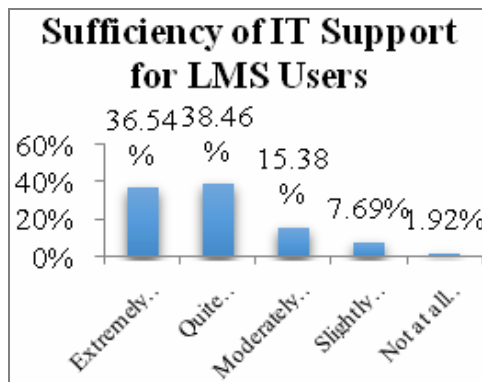
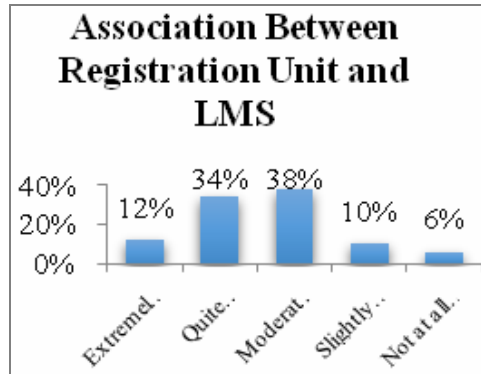


Figure 15 Efficiency and accuracy of the relationship between the registration unit and Moodle system from instructors' perspective (see online version for colours)



The authors were also interested in investigating the efficiency and accuracy of the association and interaction between the LMS and registration unit in the university from instructors' point of view. The analysis, as illustrated in Figure 15, shows that 46% believed that the association is extremely or quite efficient and accurate, 48% believed that it is moderately or slightly efficient and accurate, and 6% believed that the association is not at all efficient or accurate. Moreover, the authors found that there is not enough evidence to support the claim that instructors' perceptions of the level of efficiency and accuracy of the association (interaction) between the LMS and the registration unit in the university are dependent on their college affiliation.

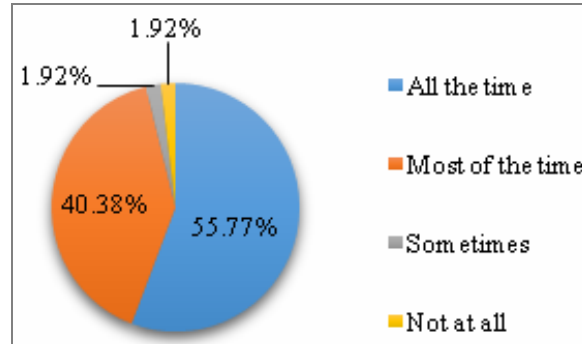
4.6 Evaluation of LMS availability and accessibility

The authors evaluated LMS availability and accessibility from instructors' point of view. The authors investigated instructors' opinions of LMS availability for 24 hours a day and seven days a week, LMS sufficiency of available uploading space of files, and LMS compatibility with common browsers on common hardware.

4.6.1 Availability of LMS services 24 hours a day and seven days a week

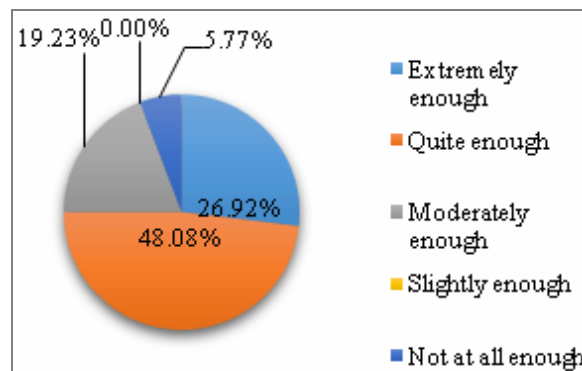
As shown in Figure 16, 55.77% of instructors believed that LMS system is available all the time, 40.38% believed that it is available most of the time, and only 3.84% of them believed that it is sometimes or not at all available.

The authors also tested whether instructors differ significantly in their perceptions of the system availability at $\alpha = 0.05$ and $df = 12$. The authors found that there is not enough evidence to support the claim that instructors' opinions are dependent on instructors' college affiliations. In other words, the instructors in the sample did not differ significantly in their perceptions of the LMS availability for 24 hours and seven days a week depending on their college affiliation.

Figure 16 Instructors' perceptions of LMS availability (24/7) (see online version for colours)

4.6.2 LMS sufficiency of available uploading space of files

Figure 17 illustrates that 26.92% of instructors believed that the available uploading space for files is extremely adequate, 48.08% believed that it is quite adequate, and 19.23% believed that it is moderately adequate. Only 5.77% believed that LMS available file uploading space is not adequate. Moreover, 0% believed it is slightly adequate. Tests for independency indicated that instructors in the sample did not differ significantly in their perceptions of the LMS sufficiency of the available files' uploading space depending on the college affiliation.

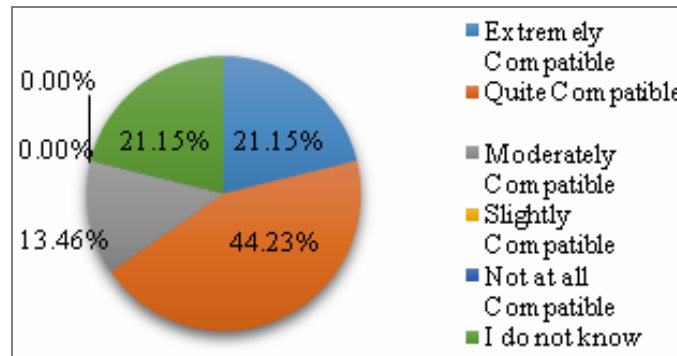
Figure 17 Instructors' perceptions of LMS available uploading space (see online version for colours)

4.6.3 LMS compatibility with common browsers on common hardware

As illustrated in Figure 18, 21.15% of respondents believed that LMS is extremely compatible with common browsers on common hardware, 44.23% believed it is quite compatible, and 13.46% believed that it is moderately compatible. Moreover, 0% believed it is either slightly or not at all compatible; however, 21.15% indicated that they

do not know whether or not it is compatible. Again, the authors learned (by testing for independency) that there is not enough evidence to support the claim that opinions are dependent on instructors' college affiliations. That is, instructors from different colleges in our sample did not differ significantly in their perceptions of the LMS compatibility with common browsers on common hardware.

Figure 18 Instructors' perceptions of LMS compatibility with common browsers on common hardware (see online version for colours)



4.7 Professional improvement of instructors in using LMS

The authors investigated how many of the offered LMS training sessions by AAU were attended by the instructors. Figure 19 shows that the majority of instructors were more interested in learning how to use the system as 51.92% of them attended some of the offered sessions, whereas 38.46% attended all of the offered sessions. Moreover, only 9.62% did not attend any sessions. Clearly, the statistics show the considerable interests of instructors in using and learning more about LMS to enhance their teaching processes.

As illustrated by Figure 20, 75% of instructors in the sample indicated their needs for more LMS training sessions. Only 13.46% believed that they did not need to attend any more training sessions and 11.54% were neutral.

Figure 19 Instructors' distribution on offered LMS training sessions offered by AAU (see online version for colours)

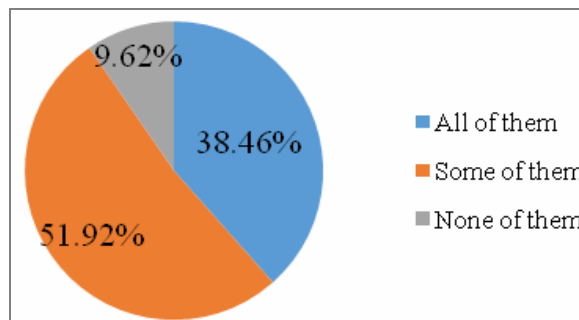
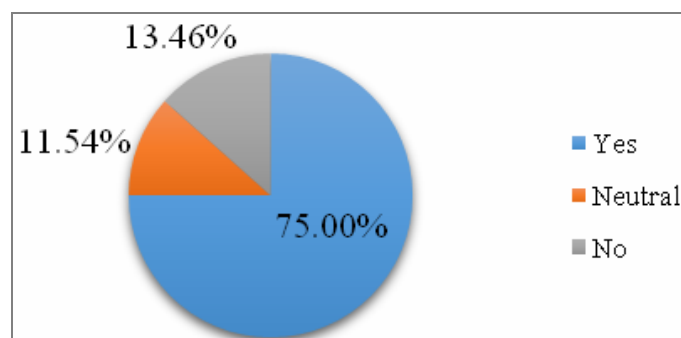


Figure 20 Instructors' distribution on perceived need for more LMS training (see online version for colours)



For more clarifications and understanding of instructors' opinions, the authors sought comments of instructors in the sample. Most of the participants emphasised the importance of enhancing the integration between the LMS used and the registration system at the university. The rest of the comments were centred on the following points: developing policy and procedures for privacy and security purposes, enabling online registration within the LMS, and offering LMS usage workshops on regular basis. On the other hand, some instructors suggested the use of Blackboard as an alternative LMS to Moodle.

5 Conclusions and recommendations

This study concentrated mainly on evaluation of the usefulness of LMS from users' (i.e., instructors) perspectives. Five main aspects were used to evaluate LMS usefulness: online exam vs. paper-based exam, system security, system availability and accessibility, and system technical support. Moreover, to evaluate LMS usage, four evaluation aspects were used: effectiveness, helpfulness, easy (friendly) user interface design, and flexibility in delivering online exams. The study showed that instructors are, to some extent, at ease with using Moodle as an LMS and that it does not present any significant difficulty for them. Instructors' perceptions are an important factor for the success of the use of the system; however, not all instructors perceive it as user-friendly.

The study indicates that the number of years of LMS usage by instructors explains a significant portion of the variation in the number of activities used. Furthermore, and despite the fact that more than half of the sample attended some of the offered training sessions in LMS and 38.46% attended all, the study indicates that the majority of instructors in the sample were using only three activities out of the 12 that are provided by the LMS used by the university (i.e., Moodle). Indeed, this study found that the humble usage of LMS activities and online exams by some instructors can be attributed to their lack of understanding of Moodle varies features and capabilities.

Likewise, tests for independency between instructors' perceptions and their college affiliation indicated that instructors from different colleges in the study sample did not differ significantly in their perception of the level of LMS effectiveness, user-friendly interface design, online exam flexibility/ease of preparing and grading online exam, suitability of online exam to their taught courses, security, IT support, and system

availability. However, instructors' perceptions of the ease of managing (applying) the online exam and LMS helpfulness differ significantly according to their college affiliation.

Having analysed the factors related to LMS usefulness at AAU and identifying the significance of its successful application, the authors conclude that focus should be placed on the human factor. It was evident from the findings that the university should set strategies for motivating instructors to adopt a more positive attitude toward LMS usage in more of their teaching-related activities. Hence, it is recommended that the university should dedicate specialised LMS trainers according to user's needs in each college. In addition, LMS training should emphasise on content delivery aspects so that instructors could attain better system usage benefits. Moreover, to use the features of LMS during lectures, the university should provide Internet access and PCs in all classrooms.

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