Promoting Comprehensive E-Learning For Higher Education Through The Comprehensive Use Of Moodle-Based Learning Management System

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Abstract. The rapid change of policy regarding the pandemic required various academic parties to make a rapid decision in response. Various learning design was proposed in the hope to facilitate an effective learning environment for students including the choice to use a specific Learning Management System (LMS). One of the most popular LMS used in this period is Moodle-based LMS. This study aims to investigate the use of Moodle-based LMS for higher education that was arranged comprehensively to support digital learning. Started from the learning environment arrangement in the LMS that was designed such that to facilitate students to learn comprehensively including the development of necessary media. The effectiveness of such design was investigated to promote comprehensive e-learning for higher education through data collection qualitative and quantitatively. The data shows that a well-arranged LMS could promote a better learning environment which gave a better impact on student's achievement.

Keywords: e-Learning, Higher Education, Moodle, Learning Management System.

1 Introduction

Covid-19 crisis has changed the education and learning paradigm in Indonesia. The pandemic has impacted every sector in human life ever since its spreading in 2019. Education is included as one of the affected sectors [1], [2]. Various countries have decided to conduct online learning including Indonesia. Currently, the Indonesian government has conducted the learning process through limited face-to-face meetings [3]. Commonly, it is conducted using the hybrid learning method by considering the health procedures [4], [5]. Through the policies of social distancing and physical distancing, interactions are limited [6], [7]. Hence, teachers as learning designers should design learning activities that optimize non-physical interaction but the learning process is still optimal.

One adaptive learning method in such a situation is online learning since it could be conducted remotely involving either the teachers or the students. Online learning is one of the learning methods conducted using information technology as the main tools in the middle of the pandemic [8]–[11]. The effectiveness of such a learning method relies mainly on the availability of supporting telecommunication networks along with the teacher's capability and skill in designing learning activities [12]. In online learning, students are given the freedom to determine the time and the place to study. Students could interact with the teacher using various

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applications including learning management systems, web conference platforms, and assessment applications [13], [14].

Currently, we have come to a digital era where information technology and science have been developed massively. It also gives an impact on the education sector, especially regarding learning media. In a learning activity, media could be defined as any form of communication instrument including software and hardware that is needed to be developed based on the necessity. It should be developed, used, and managed based on learning requirements to conduct an effective and efficient learning environment. Comprehensively, media is not only an assisting tool but is more like a connector to deliver messages between the educator and the students [15]–[18].

Currently, the popular way to convey messages, knowledge, and information in a learning environment is by using e-learning. E-learning is a term that could be defined as a learning system that uses the electronic instrument as the learning media. Furthermore, e-learning is not only expected to be powerful in replacing conventional learning but also enhanced with a relatively new method and strategy in the learning process. With the use of e-learning, it is expected that students interaction activity could be improved hence effective in enhancing the quality of graduates and the capacity of education institutions. Students are expected to form a learning community that interacts and shares information so there are multiple information sources [19]–[22].

Unfortunately, there are some constraints related to the use of online learning. Internet access interruption has become a huge challenge in Indonesia since network development is not evenly distributed [23]. Hence, the implementation of online learning for students in rural areas is still challenging since the signal is unstable [24]. One solution expected to overcome the limitation of internet connection is by using a proper Learning Management System (LMS).

The quality of online learning is determined mainly by the model of the LMS used in the learning activity since e-learning is the delivery of content via all electronic media, including the internet, intranet, extranets, satellite broadcast, audio/videotape, interactive tv, and CD-ROM. LMS in ICT (Information and Communication Technology)-based learning activity is defined as an instrument of technology product feasible to be used in the learning activity, as a part of learning material as the content of learning activity, and assisting instrument to conduct effective and efficient learning.

There are various LMS commonly used in Indonesia including *Moodle*-based LMS that can be customized as needed; *Quipper* that aims to be the Distributors of Wisdom; *Edmodo* which is popular in Indonesia since it provides various language features hence easier to be understood; *Schoology* with the tagline „it all started in the classroom“ provides various experiences for the students who use the platform, and *Geschool* that uniquely provides blog so students could share personal experiences along with news from all over the world hence students can learn, share, and inspire each other [15], [25]–[28].

With the feature of *Moodle*-based LMS, it has become one of the most used platforms in higher education. Moodle is a free LMS that enables the user to create powerful, flexible, and engaging online learning experiences. It enables the student to browse several web pages in any order through embedding in the LMS, live chats feature is available to be used among students and teachers, forums that can be used to rate messages or discuss problems, online workshops that enable students to collaborate and evaluate each other's work, impromptu polls that let the teacher assess and evaluate course's progress, and directories to store files [29].

All of these Moodle's features could create an active learning environment that promotes interactions among students and student-to-teacher interaction. These features are advantageous for Moodle-based learning compared to other LMS. Hence, this study aims to investigate the

effectiveness of the *Moodle*-based learning management system in promoting comprehensive e-learning for higher education and students‘ responses towards e-learning.

2 Research Methods

Communication has played a crucial role in education, especially since the COVID-19 pandemic has started. However, in higher education, communication should focus on the transmission of information in both ways either in lecturer-to-student or student-to-student interaction. The use of communication media become more crucial. The choice of platforms should consider the analytical reasoning and judgment based on the actual situation. In higher education, the learning environment should be able to create interactive communication that promotes students‘ problem-solving skills, communication skills, and creative thinking. Even in the pandemic, educators should be able to determine which applications could provide interactive features that allow students to gain more information with immediate feedback that could be given by their peers or lecturers. Hence, one of the most popular platforms commonly used currently in higher education especially in Indonesia is the *Moodle*-based platform.

Moodle-based LMS facilitates students with a discussion forum that aims to remove communication barriers by providing a user-friendly interface. The interaction without involving face-to-face encounters allows students to express their argumentations and opinions more openly. Moreover, the discussion forum can also be used without time limitation so it can be used either synchronously or asynchronously. Hence, students have time flexibility whenever they want to respond or state their opinions when ideas come up to their minds. Moreover, for synchronous purposes, educators could facilitate live discussion using the *Chat* feature where educators could come up with problems and students could use the feature to discuss together synchronously using the real-time chat at the same time.

If necessary, *Moodle*-based LMS could also be enhanced using another real-time feature called web meetings. Currently, in our institution account, we are facilitated with the *Big Blue Button* feature but not necessarily limited to the application. We could also embed other web meeting applications to the LMS. The web meeting could be used anytime if content reinforcement is highly necessary since it requires more resources for students to access the application. For assessment purposes, *Moodle*-based LMS provides various kinds of questions such as multiple-choice, true/false, matching, short answers, even essays. These facilities could be used based on the purpose of the assessment designed to be conducted. However, we could also embed links to other assessment platforms so the assessment tools are not limited to the ones provided by the standard *Moodle* platform.

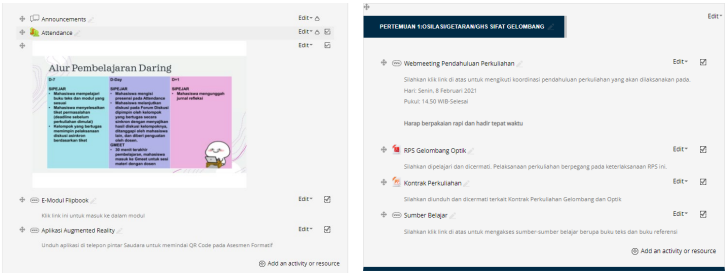
Moodle-based LMS could also be used as storage of resources including e-books, video, audio, or applications. This study explores all the facilities provided by the *Moodle*-based LMS including the discussion forum, resources storage, assignment, and quiz. All these features are also enhanced by the development of an e-module flipbook linked to an external website where students could read the outlines of wave and optics courses. Students are also expected to install an *Android* application that supports the formative assessment provided at the end of every chapter which is enhanced with the use of *Augmented Reality* (AR) experience.

By the facilitation of *Moodle*-based features as mentioned in the course of concern, this study aims to explore the effectiveness of *Moodle*-based LMS and students‘ responses towards such a learning environment. It involved control and experimental groups consisting of 31 students in each group enrolled in Wave and Optics course. Both were treated using the problem-solving

approach in LMS. The control group was facilitated using the standard *Moodle*-based LMS while the experimental group was treated using similar features enhanced with the use of flipbook and AR-based *Android* application developed previously by the research team. Test and 4-scaled questionnaires were used as the source of quantitative data. Previously, the test questions‘ validity and reliability had been tested. 20 HOTS questions were covering the Wave and Optics topic and 11 items of the questionnaire covered various aspects of the LMS and learning activities conducted.

3 Results and Discussions

The *Moodle*-based LMS for the course conducted in the pandemic era begins with the explanation of how the course will be conducted, the resources available, and the lesson plan as shown in Fig. 1. For the experimental group, students are given a flipbook-based e-module and an application to be used together. Next to each meeting, students conduct online learning as the design is shown in Fig. 2.



(a) (b)

Fig.1. The learning design at the start of the LMS course is (a) the flow design of the course along with the applications for the experimental group, and (b) the lesson plan and learning resources for both groups.

However, the experimental group was also treated with the use of an e-module flipbook as shown in Fig.3. It facilitates students with learning material, conceptual questions, formative assessment, and instruction related to the discussion activity in the LMS. Hence, the activity in the experimental groups was more comprehensive compared to the control group.

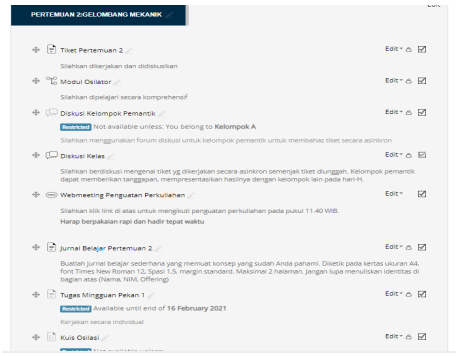


Fig.2. General description of students‘ activities in each meeting.

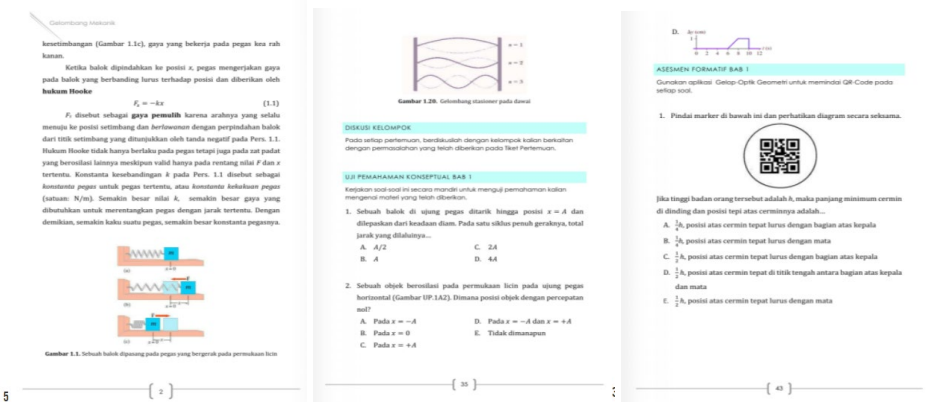


Fig.3. Sample of e-module flipbook for experimental group activity.

To investigate the effectiveness of *Moodle*-based LMS, a statistical test was conducted including normality and homogeneity test. The normality test shows that both groups are normally distributed and homogenous. A pretest and a post-test were conducted for both of the groups to identify the different results related to the facilitation of the e-module flipbook and application in the LMS.

Table 1. The mean scores of control and experimental groups

Category	Control Group	Experimental Group
Pretest	57.43	60.23
Posttest	72.37	74.57

Based on Table 1, the mean scores of both the groups in the pre-test and post-test were quite similar. The post-test score for the experimental group is slightly larger than the control group. Moreover, a questionnaire was given to the students to find out their opinion and perspectives related to the use of *Moodle*-based LMS.

All of the students agreed that their skill in using ICT helps them to be able to learn in the LMS and the lecturer's IT proficiency enabled them to follow the learning flow easily. 90.5% of students agreed that the use of *Moodle*-based LMS in pandemic era helps the learning process to become more effective since it is very comprehensive and integrative. Most of the students (90.4%) in the experimental group agreed that the use of other applications linked in the LMS enrich their learning experience. Comprehensive learning using *Moodle*-based LMS enables students to interact more in discussion related to the problem-solving approach and boost students' self-confidence. Hence, the comprehensive learning activities using *Moodle*-based LMS succeeded in improving students' conceptual understanding, especially in the pandemic era.

4 Conclusions

Based on the conducted study, it could be concluded that *Moodle*-based LMS could effectively promote comprehensive e-learning activity for higher education especially when it is connected to other supportive applications since it is one of the advantages of *Moodle*-based

LMS being capable to be collaborated with other platforms or application either by embedding or hyperlinking. Moreover, students' responses towards the use of *Moodle*-based LMS were very positive since it can boost their self-confidence in interacting with one another. Students could also improve their conceptual understanding of the course since *Moodle*-based LMS enriches their learning experience.

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