Designing Moodle features as e-learning for learning mathematics in COVID-19 pandemic

I Lisnani1,2, R I I Putri1, Zulkardi1 and Somakim1

1Department of Mathematics Education, Universitas Sriwijaya, Jl. Srijaya Negara, Palembang 30128, Indonesia
2Primary Teacher Education, Universitas Katolik Musi Charitas, Jl. Bangau No.60, Palembang 30114, Indonesia

Email: ratuilma@unsri.ac.id

Abstract. Technology plays a significant role in the process of teaching and learning mathematics in the COVID-19 pandemic. Moodle is software with an open-source system e-learning platform designed to help educators to create quality for resources and communication tools online courses in learning mathematics. The objects of the research are to know the teachers' need analysis about e-learning like Moodle, the framework features of the Moodle as e-learning learning for learning mathematics in the COVID-19 pandemic and get the best features of the Moodle. The research methodology used a qualitative descriptive approach. The collecting data used questionnaires for the mathematics teachers in one of the schools. The research subjects were fourth-grade teachers consist of eight teachers as mathematics teachers from three private schools in Indonesia. The result of this research was the teachers need e-learning like Moodle in teaching and learning mathematics, the features of Moodle for learning mathematics was different with another Moodle, and the teachers believed the Moodle could facilitate them in teaching and learning mathematics in COVID-19 pandemic.

1. Introduction

World Health Organization (WHO) has notified pneumonia cases caused by the virus in Wuhan City, Hubei Province, China on December 31, 2019 [1, 2]. The growth of the case was very rapidly [3], until January 7, 2020. The Chinese government named the pneumonia cases was coronavirus or COVID-19 [4]. COVID-19 (Corona Virus Disease 2019) is a pandemic disease in every country in the world. The COVID-19 is affecting 213 countries and territories around the world and 2 international conveyances with the total cases 7,121,779 until on June 9, 2020 [5, 6]. Especially in Indonesia, it has been reported two cases on March 2, 2020, the growth in Indonesia was very fast until June 9, 2020, the total cases 35,295 [7].

The pandemic has many effects for many sectors not only economics but also education sectors in all countries in the world. However, the Minister of Education and Culture of Indonesia in March 2020 established a role to learn from home for many students by using online learning through the Minister
of Education and Culture Circular Letter No 15/2020. As the result, the government of Indonesia through the Minister of Education and Culture of Indonesia recommended many e-learning platforms and online learning applications recommended to facilitate teaching and learning from homes such as Rumah Belajar, SPADA, MejaKita, ICANDO, Ganeca Digital, Kelas Pintar, Quipper School, Ruang Guru, Sekolahmu, Zenius, Cisco Webex, and Pahamify [8]. Some of them are a partnership with the Ministry of Education and Culture of Indonesia and one of them developed by the Indonesia Ministry of Education and Culture.

Based on the explanation above, technology provides broad, fast, effective, and efficient information to many people in the world, especially in the learning process. The widespread use of the web and other Internet technologies in post-secondary education has exploded in the COVID-19 pandemic. Therefore, the teachers and students supposed to be able to use technology in the learning process. They must know how to operate ICT to get knowledge in learning mathematics. It was necessary to develop web learning media and in line with this, the National Council of Teachers of Mathematics (NCTM) has stated, "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" [9]. E-learning has many advantages, it is cheaper than the conventional learning process [10]. E-learning or web-based learning is a distance learning system used in a process of education through an internet network or the intranet with the use of a management system for education [11, 12]. Innovations of technological innovations change the tools of media in learning mathematics to help the students in the real world and mathematics abstraction [13].

Extensively, e-learning has two approaches, they were: 1) Asynchronous e-learning generally facilitated by media, for instance, e-mail and discussion boards support for learners and with tutors, although when the learner could not be online together. It makes learners spend more time to log on to an e-learning environment at any time and download documents or send messages to tutors or peers; 2) Synchronous e-learning, generally supported by media such as video conferencing and chat, has the potential to support learners in the development of learning communities. Learners and tutors experience synchronous e-learning regarding with asking and answering questions in real-time. Synchronous sessions help learners feel like participants rather than isolates. E-learning can create a learning system for students especially in getting material from the internet even from where the students are located without having to meet face to face with the teachers if they’re not in the classroom. E-learning is web-based learning like e-learning systems sometimes also called Learning Management Systems (LMS) or Virtual Learning Environments (VLE).

When online learning began to be implemented, students and teachers discovered several obstacles like, firstly the limited use of digital platforms only in certain access areas. Secondly, the limited ability of both teachers, students, and parents in using digital platforms during the learning process. Thirdly, signal limitations when teaching and learning activities are carried out. Finally, students tend to leave class because there is no face to face teaching and learning activities. However, many studies investigate the barriers of e-learning [14] and online learning in normal conditions [15] but some studies investigate online learning for pandemic COVID-19 focused on mathematics [8]. Accordingly, researchers are interested in designing web-based learning features using Moodle (Modular Object-Oriented Dynamic Learning Environment). Many e-learning could use in teaching and learning. The architecture for adaptive e-learning is Moodle (Modular Object-Oriented Dynamic Learning Environment). Moodle is a Course Management System (CMS) - a software package designed to help educators to create quality online courses an open Source e-learning platform [16, 12] which presents an excellent platform for resources and communication tools. As usual, the features of CMS are file uploads, discussion forums, assignment submission functions, calendar entries, grading options, and feedback, quiz, and workshop modules [17, 18]. CMS is the one commonality shared organizing in a course-based mode and linked with course enrollment. The features of Moodle are designed by researchers with new features to facilitate not only teachers and students but also parents. It purposes to help all subjects to control teaching and learning mathematics. The research problems of the research are: The first, how about the teachers' need analysis the Moodle in teaching and learning mathematics during the COVID-19
pandemic. The second, how to design framework features of the Moodle as e-learning for learning mathematics in the COVID-19 pandemic. Third, how about the responses and comments about the framework features of the Moodle as e-learning in teaching and learning mathematics in the COVID-19 pandemic. The topic in learning mathematics was plane figure and number of operations for fourth graders student.

Generally, most researchers used Moodle for learning science [19], language [20], and computer. Moodle often used in learning mathematics [21]. Moodle visions for curriculum management and the incorporation of a reflective process to help managers to interrogate their past and present to generate new strategies to improve future management knowledge/skills [22]. Using platform Moodle in learning can facilitate students to increase self-directed learning. Moodle is a free learning platform software having some features that can be used in learning Moodle is a learning means that could facilitate students to improve their knowledge as a result of active and collaborative activities during learning processes [23, 21]. Learning by utilizing Moodle has a significant effect on increasing students’ motivation and learning outcomes of the students [24]. Learning by utilizing Moodle, the teachers could create an e-learning environment [25], a virtual learning environment [26], and a constructivist learning environment [27]. On the other hand, the teachers could use Moodle to assess their students by employing web tools for example e-assessments, deals with the effective use of technology to assess them in teaching and learning mathematics [26].

That is why researchers selected Moodle to be used by the participants (the managers) for this study. Besides, we selected reflection as a tool, as it is a powerful resource that supports managers to transform and understand how they should adapt according to their strengths and weaknesses. In other words, reflection processes may help managers, teachers, and learners to learn by interrogating their past and present experiences to make decisions regarding their future. The current study aims to design features of Moodle as web-based learning for learning mathematics in the COVID-19 Pandemic.

2. Method

The methodology of the research was qualitative descriptive research. The stages of the research as follow in Figure 1.

![Diagram](image)

**Figure 1.** The stages of the research

Figure 1 explained the stages of the research, they were: In the first stage, the researchers prepared the teachers' need analysis through questionnaires for the participant. The questionnaires aimed to know the teachers' need analysis about the Moodle for teaching and learning mathematics. In the second phase, the researchers designed the Moodle feature as e-learning. The objectives of the phases described the features of Moodle, the guide book of Moodle, and the content of Moodle. In the last stage, the researchers gave questionnaires to participants and the interview sheet purposed the responses and comments of the framework Moodle e features from participants.

The participants of the research were fourth-grade teachers consist of eighth teachers from three private schools at one of three private schools in Palembang, Indonesia. The researchers analyzed data was descriptive qualitative of the interview sheets and questionnaires. The researchers got the data for the COVID-19 pandemic through a google form.
3. Result and Discussion

3.1. The Teachers’ Need Analysis

The results of the teachers' need analysis the Moodle in teaching and learning mathematics by using questionnaires through Google form. The total item of questionnaires was 10 items. It was shown in Table 1.

| Question                                                                 | Yes | No |
|-------------------------------------------------------------------------|-----|----|
| Did you experience any difficulties in teaching and learning mathematics during the COVID-19 pandemic? | 7   | 1  |
| Do you need e-learning applications such as Moodle in learning?          | 8   | 0  |
| Do you need a complete e-learning application?                          | 8   | 0  |
| Are teacher features needed in e-learning applications?                | 8   | 0  |
| Are student features needed in e-learning applications?                | 8   | 0  |
| Are parental features needed in e-learning applications?               | 8   | 0  |
| Have you ever used an e-learning application in the teaching-learning process? | 2   | 6  |
| Are assessment features needed in e-learning applications?             | 8   | 0  |
| Are question and answer features needed in e-learning applications?    | 8   | 0  |
| Is the video conference feature needed in e-learning applications?      | 8   | 0  |

Table 1 explained the teachers' need to analyze the Moodle in teaching and learning mathematics. From the questionnaires, the researchers got the results that consist of: Firstly, the teachers have difficulties in teaching and learning mathematics through e-learning during the COVID-19 pandemic (87.50%). It means seven teachers from eight teachers have difficulties by using e-learning in teaching and learning mathematics. Secondly, all participants need e-learning in teaching and learning mathematics during the pandemic (100.00%). Thirdly, all participants need to complete e-learning to facilitate them in teaching and learning (100.00%). Fourthly, all teachers need teachers' features needed in e-learning applications (100.00%) to communicate with students and parents about the topics. Fifthly, all participants need students' features in e-learning applications like Moodle (100.00%). Sixthly, all teachers need parents' features needed in e-learning applications (100.00%). Seventhly, the teachers ever used an e-learning application in the teaching-learning process (25.00%), it means two teachers from eight teachers ever used an e-learning application but they never use Moodle, they used zoom cloud meeting in teaching and learning mathematics. Eighthly, all teachers need assessment features needed in e-learning applications (100.00%). Ninthly, all teachers need questions and answers features needed in e-learning applications (100.00%). Tenthly, all teachers need video conference features needed in e-learning applications like Moodle (100.00%). The researchers believed the complete features of Moodle could help the teachers and the students in teaching and learning mathematics especially in e-assessment and interaction between teachers, students, and parents [26]. On the other hand, the teacher would create a virtual learning environment through user-friendly Moodle features [25].
3.2. The Design of Moodle Features as E-Learning

The researchers designed the framework of Moodle features as e-learning for teaching and learning mathematics described in Figure 2.

Figure 2 described frameworks of the Moodle features that have four main features, they were: Firstly, admin/researchers' features consist of expert reviews or comments and techniques of collecting data. Besides, it could be the maintenance of the access of Moodle for example login and log off the Moodle. Secondly, parents' features purposes to facilitate parents to discuss with teachers through discussion features. They could discuss the conditions of their children. The features consist of students' scores, students' exams, and students' reports, to control their children’s academics increasing.

Third, teachers' features have many features, they were: 1) topics: materials about plane figure and number of operations, tasks (exercises), questions and answers (Q & A), tests, assessments, and video conference. In this feature, the teachers could attach attachments file, upload and download link documentation about the topics in teaching and learning mathematics; 2) group: teachers’ groups and students’ groups: add groups and discussion between students and students or with the teachers; 3) presence: present, absent, permit, late, and excused; 4) stamps for appreciate student achievement; 5) scorebook: score of quizzes or test. Fourth, the students' features, this features the same with teachers’ features but students only could upload or send the answer to their task or examples. They could not upload the material or input the presence or score in the scorebook. The students could discuss the discussion of the topics with their teachers. The most important thing in the Moodle was they could access user books for admin, teachers, students, and parents would be read the user book to operate it.

Parents' features especially feature in the Moodle was designed by researchers. It was different with another Moodle designed by previous researchers [17, 18]. The Moodle is learning management systems, On the other hand, the Moodle has the same features with previous researchers are file uploads,
discussion forums, assignment submission functions, calendar entries, grading options, and feedback, quiz, and workshop modules [17, 18].

3.3. The Responses and Comments in the Framework of the Moodle Features as E-Learning

The results of the responses and comment in the framework of the Moodle features in teaching and learning mathematics by using interview sheet through Google form, they were: 1) The participants give comments about the Moodle features must have complete the features for the teachers, the students, and the parents; 2) Most of the teachers said that the Moodle features are complete for them but it will be better if the Moodle could be used in offline and online; 3) The most important thing in the Moodle is the guide book to use it; 4) The participants expect that the researchers could train them how to use the Moodle for three days until one week. Then, they could understand how to use and operate it in teaching and learning mathematics; 5) All teachers believe the Moodle would help them in the learning process because they do not have LMS like Moodle in their school.

4. Conclusion

In the COVID-19 pandemic, teaching and learning using technology were very important for teachers. It means they need Moodle as e-learning in teaching and learning mathematics. Moodle is one of application to facilitate them in teaching and learning mathematics but the Moodle as LMS must have complete features for the users. That is the researchers' reason designed Moodle as e-learning in the COVID-19 pandemic. The difference between the Moodle with another Moodle designed by previous researchers is parents' features.

The teachers need complete features in e-learning like Moodle in teaching and learning mathematics. Although, not all teachers ever used e-learning likes Moodle. It means Moodle is a very new application for them. Something, especially in the Moodle, is parents' features to facilitate them to control their children in teaching and learning mathematics in the COVID-19 pandemic. It is not only used in online learning but also offline learning. The Moodle facilitates with video conference in teaching and learning mathematics, students could search the materials is uploaded by the teachers. The limitations of the study are the participants only eight teachers in three schools and the Moodle made by researchers and it only comes to the framework of the design features before to the final design of the application Moodle.

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