Biology teachers used Learning Management System (LMS) for collaborative learning

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Abstract. Learning Management System (LMS) provides a new perspective in the education system in the 2nd century. The use of LMS by biology teachers is dominated by developing countries, as many as 67% of teachers have implemented LMS in biology learning. LMS can be used by biology teachers to conduct collaborative and conceptual learning through existing media in online-based learning management system. Moodle is a Learning Management System (LMS) with the most popular and most used system in the world, because of its flexibility, open-source capabilities, and a learning management system that is a free download, and can load 1000 subjects in this system. This literature study aims to illustrate the use of LMS to support collaborative learning in biology and science subjects. This research methodology using review and meta-analysis, there are interactive features that can support collaboration between students and teachers or between students.

1. Introduction

Fulfilment of additional learning lessons for students in order to support the objectives of the 2013 curriculum, it is necessary to have learning management that is packaged into a system called a learning management system [1]. The development of information and communication technology has changed the learning techniques that were previously teacher-centered, to student centered (student centered learning) [2]. Students can find out their own information or knowledge through the internet, the teacher’s role as a facilitator who does not dominate the class must still supervise because most of the teachers master the big picture of students search maps related to the subject matter [3].

Utilization of collaborative learning models will help students in the speed and depth of the process of acquiring the desired knowledge [4]. Basically collaborative is a necessity of learning in the digital age [5]. However, with LMS collaborative learning can be developed because it contains content that involves many people, such as a discussion forum [6]. In a study conducted by Wentworth & Middleton in 2014 in several schools, collaborative learning with technology was able to increase focus between 73% and 83% of students. This shows that there is a positive influence on the impact of collaborative learning using technology. In the future, collaborative learning with technology will become an increasingly needed activity. On the other hand, the content that has been compiled is very possible to be connected with a book or e-book publisher [7].

Supporting increasingly advanced technology, LMS has been changed into an online system so that for administrative purposes, documentation, reports of an activity, teaching and learning activities have
been carried out online [8]. Through LMS the teacher can manage the class and exchange information with students and access to subject matter within a predetermined period of time can also be determined [9]. Based on the statistical center body, the percentage of computers connected to the internet network in secondary schools is equal to 83.34% while the percentage of teachers who have the ability to qualify in ICT in the secondary school level in Indonesia is 14.43%. This is not comparable to the facilities provided by schools for teachers. Therefore teachers must have the knowledge and ability to support learning activities in the current era, especially in the use of LMS [10].

LMS has many types, one of which is Moodle which stands for Modular Object-Oriented Dynamic Learning Environment [11]. Moodle is an LMS that is open source 80% more effective than other LMS providers and can accommodate 1000 lessons in it [12]. Moodle is a system that is ready to use and has very broad benefits as a social network between teachers and students [13]. Moreover, it is supported by various advanced features that make the teaching and learning process more effective, efficient, and organized, such as quizzes, files and links, Free Online Resources, Workshop Features, polls, assignments, chat, surveys, and discussion forums [14].

The teacher has a significant role in considering the position and role of students in the learning process at school [15], so educators are required to be more sensitive to the factors that influence the low quality of education in learning biology in the field of students still stuttering lessons which is not interesting and difficult to understand [16]. Data from the 2019 Puspendik, the results of the 2019 biology high school National Exams showed an average of 50.03 in the poor category. Therefore, efforts are needed to improve learning through LMS in order to encourage interactive and collaborative learning by exchanging information through the internet.

LMS can be utilized by biology teachers to distribute teaching materials in LMS in the form of links, the number of links that can be utilized is infinite because of the amount of biological information that is easily accessed via internet. Website that contains information about biology as much as 1.430.000.000 so that LMS can be used as a good source of biology learning [17]. Biology learning is often confronted with abstract material and is outside the daily experience of students, so the material becomes difficult to teach by teachers and difficult for students to understand [18]. There are also many materials on Biology learning that cannot be visualized directly and thus require certain media [19]. Visualization through learning media is one way that can be used to make the material seem real [20]. Biology learning aims to develop the ability of scientific processes and develop positive attitudes towards science [21]. The subject of biology is conceptual in the sense of learning everything that exists in everyday life. Biological material that is very suitable to be packaged in ICT content is complex material that involves the process of a system [22].

The following research questions are addressed in this review:
1. What type of LMS is used in learning biology?
2. What is the form of LMS implementation in learning biology?
3. What is the learning model that uses LMS?

2. Research Method
This systematic review was completed in accordance with the guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyze. This study uses the meta-analysis method, which adopts the literature review method carried out by Baki & Birgoren (2018) [23], with the following steps;

2.1. Determine the area to be discussed and search literature
The first step that research can do is determine the research objectives and keyword search articles. Keywords used by researchers, namely: the use of LMS in learning biology, collaborative learning, and the use of LMS biology/science in collaborative learning. Keyword searches are performed in ERIC, Pro Quest, the Directory of Open Access Journal (DOAJ), Science Direct, Google Scholar, Semantic Scholar. All article findings obtained are then considered with several criteria.
2.2 Consider the criteria
Criteria that are met for an article to be reviewed, these criteria include: (a) scientific articles that discuss the use of LMS in collaborative learning, (b) scientific articles have been published in 2014-2019, (c) articles come from proceedings and indexed international journals Scopus, (d) the article uses experimental research methods, surveys, and development, (e) the fields of study used are biology and science / science at secondary and tertiary education levels. Based on predetermined criteria, 20 articles were found that discussed the use of LMS to improve Scopus Indexed collaborative learning.

3. Result and Discussion
The use of LMS in schools by biology teachers in Indonesia is still very rare. This is due to a lack of knowledge of LMS and the use of technology and internet devices. LMS should be used by teachers to manage the learning process effectively and efficiently because it is not obstructed by time and space. However, the most important thing when using LMS in the learning process is the availability of ICT devices and an internet connection. The use of LMS in developed countries has grown very rapidly and various types of LMS have been used in the learning process. LMS is not only used as a medium for distributing subject matter, but has made LMS a forum for online discussion.

Based on research, the use of LMS is widely used by developed countries with a percentage of 66.67% while developing countries is 33.33%. This is because the knowledge of LMS by teachers in developing countries is low so that teachers cannot utilize LMS in learning. Besides that, internet network access in developing countries is still small and uneven in each region.

Figure 1. The spread of the use of LMS throughout in the world

The use of LMS must have the function of uploading and sharing materials, forums and chats, quizzes and surveys, assessments, recording grade. Moodle is a software package that is used to develop systems and learning processes using computer devices (laptops) and other cell phones. The results of this Moodle development can then be accessed by students by utilizing the internet network. The learning system and process by utilizing this application is called the Learning Management System (LMS). Data on the results of research on the response of student attitudes towards the use of Moodle LMS shows the average results of student responses is 95.52% with a very positive category. Data from research on student activities in using Moodle shows that the most activities accessed by students are downloading teaching material, which is 12 students, uploading assignments for 11 students and doing quizzes for 11 students and filling in questionnaires for 11 students.
Table 1. Data types of LMS that are often used

| No. | Type of LMS                  | Total | Percentage |
|-----|-----------------------------|-------|------------|
| 1.  | Moodle                      | 11    | 55%        |
| 2.  | Blackboard                  | 1     | 5%         |
| 3.  | CKBiology                   | 1     | 5%         |
| 4.  | NeuroK                      | 1     | 5%         |
| 5.  | MOOC                        | 2     | 10%        |
| 6.  | Rubric                      | 1     | 5%         |
| 7.  | Google Classroom            | 1     | 5%         |
| 8.  | Edmodo                      | 1     | 5%         |
| 9.  | Learning Path type MGL (Mayer Guidelines) | 1 | 5% |
|     | **Total**                   | **20**| **100%**   |

Based on Table 1 of the 20 articles found 9 types of LMS used by biology/science teachers, Moodle is a type of Moodle that is often used by teachers and students with a percentage of 55%. This is because Moodle is one of the LMS that is open source, and can accommodate 1000 subjects in it [24]. Moodle is a learning system that provides a set of student-centered tools and a collaborative learning environment that empowers teaching with features that are easy to use, therefore the number of Moodle worldwide reaches 90 million users with usage at the academic level making Moodle the most LMS type widely used throughout the world [25]. Forms of implementation of the use of Moodle in learning biology vary, namely discussion, independent training, group assignments, distribution of subject material in the form of video or images [26].

In addition, teachers can track the progress and completion of tasks or activities during learning, the presence of peer and self-assessment features that can make it easier for students or teachers to see and assess the work of each member of their own group [27]. The development of Moodle is now focused on version 3.3 with the advantage of new features, one of which is word list entry, forum posts and book chapters can be tagged for easier searching. Moodle is flexible to meet various needs but still simple enough for teachers to start utilizing the internet and build collaborative learning communities with students [28].

Table 2. Using LMS in biology learning

| No. | Use of LMS in biology learning             | Total | Percentage |
|-----|-------------------------------------------|-------|------------|
| 1.  | Exercise, independent task                 | 11    | 23.91%     |
| 2.  | Distribution of teaching material          | 11    | 23.91%     |
| 3.  | Group task                                 | 7     | 15.21%     |
| 4.  | Submitting a concept map                   | 1     | 2.17%      |
| 5.  | Download videos, animations, images, schematics | 3 | 6.52%   |
| 6.  | Discussion                                 | 13    | 28.26%     |
|     | **Total**                                   | **46**| **100%**   |

Table 2 shows that the form of the use of Moodle in learning biology as a forum for discussion by students and teachers or as a discussion forum for groups of students with a percentage of 28.26%, this discussion forum feature can be used by students collaborating with other students sharing information to add insight into biology lessons or deepening biology through Moodle. The teacher as a facilitator and confirmer of the information obtained by students. In addition, Moodle is also used by teachers to give assignments or exercises independently to students with a percentage of 23.91%. Moodle can be used by teachers to distribute biology teaching materials in the form of soft files and students can directly download the file easily and efficiently.
Table 3. Learning models used LMS

| No. | Learning Model                                      | Total | Percentage |
|-----|-----------------------------------------------------|-------|------------|
| 1.  | Collaborative                                      | 8     | 50%        |
| 2.  | Blended learning                                   | 1     | 6.25%      |
| 3.  | Computer-Supported Collaborative Learning          | 4     | 25%        |
| 4.  | Flipped Classroom                                  | 1     | 6.25%      |
| 5.  | Active Learning                                    | 1     | 6.25%      |
| 6.  | Flipped-problem based learning                     | 1     | 6.25%      |
|     | **Total**                                           | 16    | 100%       |

Based on a journal review of 20 articles, there are 4 articles that do not have a learning model. Based on table 3 of the 16 articles found 6 types of learning models that can be integrated in the use of LMS, the cooperative learning model has the highest percentage, which is 50%. Collaborative learning involves students who work together in small groups to achieve shared goals. Each group consists of different characteristics so that more students participate in lessons [29]. During group work, although some students have difficulty understanding subjects, students will help each other in groups to solve problems[30].

4. Conclusion

Moodle's presence in learning is a choice of learning forms for teachers online but there is still a collaborative interaction with students. Moodle is one type of LMS that is often used and popular throughout the world. Moodle can be used by teachers for collaborative learning with the interaction between the teacher and students through the system on Moodle. Forms of learning biology using Moodle, namely quizzes, exercises, group discussions, distribution of teaching material so that there is a collaborative interaction between teachers and students or collaboration fellow students.

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