OLMs Development to Improve Students' Ability to Produce Learning Media

https://doi.org/10.3991/ijet.v18i05.28437

Intan Safiah(✉), Muhammad Yunus, Ahadin, Mislinawati, Yusrijal Abdar
Syiah Kuala University, Banda Aceh, Indonesia
Intan.afia@usk.ac.id

Abstract—This research aims to develop e-learning-based Online Learning Modules (OLMs) for prospective teachers. The development integrates the project learning model with LMS-based e-learning, as an innovative module for assisting teachers. Furthermore, it employs the ADDIE model's method and design. Based on the results of expert validation, it was found that the developed OLMs was suitable for use in learning as teaching materials to produce learning media by students. The results showed that students' response to the module was very good. Prospective teacher's ability to produce learning media is 34%, 60%, and 6% in the exemplary, partially professional, and professional categories. In conclusion, OLMs can be used in learning activities to increase students' ability to produce learning media.

Keywords—development OLMs, project-based learning, learning media production skills

1 Introduction

Technology and information development continue to increase and are influenced by changes in the learning process caused by the COVID-19 pandemic. Therefore, there are significant changes in the interaction process between teachers and students. Previously, face-to-face learning activities have been replaced by online methods. Supporting facilities are needed to achieve this objective, particularly in learning media and Information Literacy courses.

The objective of the course is that prospective teacher can produce learning media. This is an urgent course in the faculty of training and education (FKIP), hence, additional resources are needed to assist the independent learning process. The development of online learning models and online learning modules (OLMs) built on project-based learning (PjBL) is essential. OLMs are online modules designed to actively involve students in seeking and sharing knowledge, ideas, and learning resources. They may read the text and view an animation closely resembling the actual procedure, making it easier to grasp the concept. Students may read the text and view an animation closely resembling the actual procedure, making it easier to grasp the concept. OLMs can improve students' understanding [1], [2], [3], [4]. and problem-solving ability [5]. Therefore, it is easier for students to comprehend abstract material when translated into

tangible information. OLMs also can assist schools in realizing quality learning and provide better-planned activities.

The learning is only in the form of ordinary teaching materials used offline. PjBL is rooted in the idea that problems or questions drive learning activities in developing artifacts [6]. PjBL integrated with e-learning is effective in equipping students in independent learning activities [7]. Moreover, it allows them to expand their knowledge and develop skills through problem-solving [8].

Based on the background that has been described previously, the main problem is that there are no OLMs that can facilitate the online learning process. They are planned to be a learning problem-solving solution combined with LMS-based e-learning. Furthermore, LMS is a system with a pattern of interaction between teacher and students using various mobile application features (Moodle LMS) [9]. In e-learning, student needs are not yet available because it provides features as a medium of access to learning. Therefore, these features need to be packaged into an e-module that can support an active learning process.

2 Relevant literature

2.1 Online learning modules (e-Module)

E-module is a collection of digital and non-printed learning media systematically arranged and used for independent research purposes. In addition, it requires students to learn and solve problems in their way [10] [11]. The module is one of the teaching materials used to help the learning process [12]. The use of teaching materials aids in the smooth running of educational activities. It is also the materials used to assist teachers/instructors in teaching and learning activities. A module is a form of teaching material packaged entirely and systematically, containing a set of learning experiences planned and designed to help students master particular objectives.

Modules are a way of organizing subject matter, while the method of organizing learning content is referred to by Reigeluth, Bunderson, and Merrill (1977) as a structural strategy. This is a way to sequence and synthesizes related facts, concepts, procedures, or principles. Sequencing refers to making the order in which the research content is presented. Synthesizing refers to efforts to show the learner the interrelationships between the contents of the field of research. Therefore, the organizing strategy refers to sequencing and synthesizing the research content.

The five categories of abilities in designing teaching materials are verbal information, intellectual skills, cognitive strategies, attitudes, and motor skills [13]. The strategy for organizing teaching materials consists of three stages of the thinking process, namely concept formation, interpretation, and application of principles. This strategy is essential in designing learning, and its usefulness can make students more interested in learning.

Several studies on the development of learning modules include the research conducted by Lamb & Annetta. They developed three simulations (modules) containing selected laboratory topics and related external web searches for laboratory simulations [3].

Linda et al. developed an interactive e-module called Chemistry Magazine, which has two editions of ionic equilibrium and buffer solution pH and solubility equilibrium [14]. Furthermore, Hill developed an OLMs for sports learning [2]. In this research, the development of OLMs is more directed at developing LMS-based e-module focused on increasing students' abilities in producing learning media during the COVID-19 era.

2.2 Model project based online learning

Project learning has spread in the world in various disciplines at all levels of education [15]. In contrast to traditional lecture-based learning, it uses problem-based, independent, and small group learning. It produces practical information, from passively receiving knowledge to actively seeking, and establishing personal understanding. Project learning aims to equip students with integrated knowledge, skills, and attitudes to become independent problem-solvers, better knowledge seekers, influential team players, and lifelong learners. In addition, it is considered one of the most innovative pedagogies in history and may have proliferated widely but not perfectly. The original McMaster project learning model has been repeatedly tested and modified. For example, from the Howard Barrows project learning to the Maastricht, Singapore, or the Aalborg model [16].

PjBL is a teaching approach in which students respond to real-world questions or challenges through an extended inquiry process [17]. It organizes learning around projects and engages students in authentic situations where they can explore and apply subject matter to complex problems relevant to the professional practice [18]. The characteristics are developing students' thinking skills to be creative and have direct access to information. Furthermore, it requires students to participate voluntarily in the proposed meaningful learning activities, mostly teamwork [18]. In a PjBL environment, they learn primarily by constructing knowledge and making meaning through an iterative process of questioning, active learning, sharing, and reflection. This service-learning emphasizes educational opportunities that are interdisciplinary, student-centered, collaborative, and integrated with real-world problems and practices [19].

Jalinus developed a seven-step PjBL model, namely (1) formulating expected learning outcomes, (2) understanding the concept of teaching materials, (3) skills training, (4) designing project themes, (5) making project proposals, (6) implementing assignments project, and (7) presentation of project reports [20]. The seven steps need to be adjusted to the characteristics of the project to be produced. Based on the needs analysis, the development of OLMs refers to the PjBL steps developed by Jalinus.

The results indicate that the PjBL approach is widely used in various classroom settings [21]. Research showed that PjBL is an efficient teaching strategy to increase student motivation and help them engage in learning activities. Some showed that students' independent learning could be stimulated in PjBL activities. This is because PjBL has the potential to improve student learning outcomes in the affective domain, including attitudes and beliefs of self-efficacy[22]. Student motivation is stimulated in various ways in a PjBL environment, such as formal and informal group discussions, regular supervisor meetings, and leadership. In summary, the evidence for the potential

of the PjBL approach, particularly to facilitate student achievement and motivation, is well documented in previous studies. Based on the development of science and technology, the approach needs to be integrated into the online learning model.

In this research, the model is integrated with the LMS to produce e-module that could guide the learning process independently or in groups. This e-module directs student activities to online collaboration for project completion. PjBL implementation activities in e-module include material concepts, project planning, project implementation, and evaluation of results.

3 Method

3.1 Research design

Research and development (R&D) was used to develop project-based OLMs. This model improves skills in producing learning media to support learning activities in the COVID-19 era. Research and development is "a process used to develop and validate educational products" [23]. The procedure developed by Borg and Gall consists of two main objectives: (1) developing a product and (2) testing the effectiveness in achieving its objectives. Therefore, the development research is intended as a development effort to conduct expert validation tests, project-based OLMs, and product field trials.

3.2 Procedure

The research development procedure is the analysis, design, development, implementation, and evaluation (ADDIE) model. This model has five stages (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Figure 1). The ADDIE model has a focus on literacy and reflection. Therefore, improvement can be made continuously based on the feedback provided by the experts.

The module development stage procedure is carried out in five stages, (1) analysis, which aims to identify the need to improve learning outcomes. (2) Design, this stage aims to design the product that will be developed. It consists of learning objectives, materials, and strategies or learning models. (3) The development stage is making e-module, instrument validation, and tests to determine the feasibility. This e-module is developed using an LMS, easily accessible by students with various android devices and laptops. (4) The implementation is the testing stage of the products in learning activities. It determines the extent to which learning objectives can be achieved. (5) The evaluation stage evaluates the teaching materials that have been made and implemented.

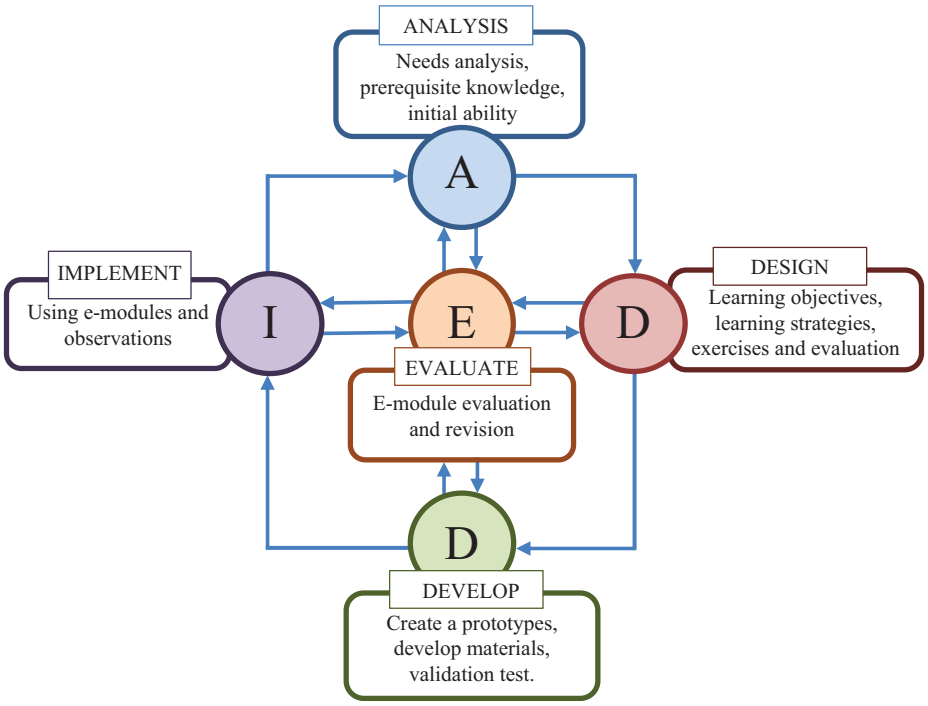

Fig. 1. ADDIE Model OLMs development procedure (Morison adaptation and modification, 2013) [24]

3.3 Design validity

The data collection instruments used were a questionnaire and an assessment rubric. The questionnaire for expert validation used an instrument adapted from Jalinus [20]. The student response questionnaire instrument is developed based on 3 aspects, appearance, material presentation, and benefits. There are two types of statements in this questionnaire, namely closed and open. Closed statements use a scale of 4, which is very good, good, less, and less good, while open statements are used to ask for advice from experts and students. Meanwhile, the assessment of learning media projects uses the assessment rubric developed by Vandervelde [25]. It is grouped into 4 categories: exemplary, partially professional, professional, and incomplete. The instrument grid for expert validation is presented in the following Table 1.

Table 1. Expert validation instruments

No	Assessment Aspect	Indicator
1	Formulation of Learning Objectives	Learning objectives are presented Directs discussion of real-world problems It contains the ability to solve problems
2	Understanding the concept of teaching materials	The material is appropriate to the learning objectives Steps to study the material Easy to understand language
3	Identification of problems	Relevant to the field of science troubleshooting steps Concepts for problem-solving
4	Designing Project tasks	Project procedure Directing the process of designing the project Models used
5	Project proposal creation	Steps for preparing a project proposal Material identification strategy
6	Carry out project tasks	Steps to prepare ingredients Systematics of work Time Teamwork
7	Project report generation	Project report procedure Communicative and clear language

3.4 Data analysis

Expert validation data analysis used Aiken's V formula [26] to calculate the coefficient of content validity based on the results of assessments.

$$V = \sum s/[n(C - 1)]$$

$$S = r - lo$$

Description:
Lo = lowest rating score
C = highest rating score
R = number given by rateri

4 Result

4.1 Pre analysis results

Development research using the ADDIE produces OLMs with an LMS-based project model. The initial stage is to analyze students, subject matter, and the condition of the learning environment. Furthermore, the results show that primary teacher education students known as PGSD can operate all types of technological devices, both laptops,

and androids. They have private facilities that are used in learning using e-module. The subjects are the Learning Media and Information Literacy course, the subject of expertise in the PGSD study program. It is carried out in the third semester with a weight of 100 minutes per meeting, and it is focused on skills in developing learning media. The initial analysis also shows that students have wifi facilities to support online learning in primary school education study programs.

4.2 Design of OLMs

OLMs products are e-module used for LMS-based online learning. This model divides the designed material into 16 meetings and two categories of concept and application material. Students study the material independently, then proceed with class meetings and do assignments. Implementation material is a guideline for conducting group discussions through forums. In this forum, students discuss learning media's planning, design, production, and implementation. The following OLMs design is developed.

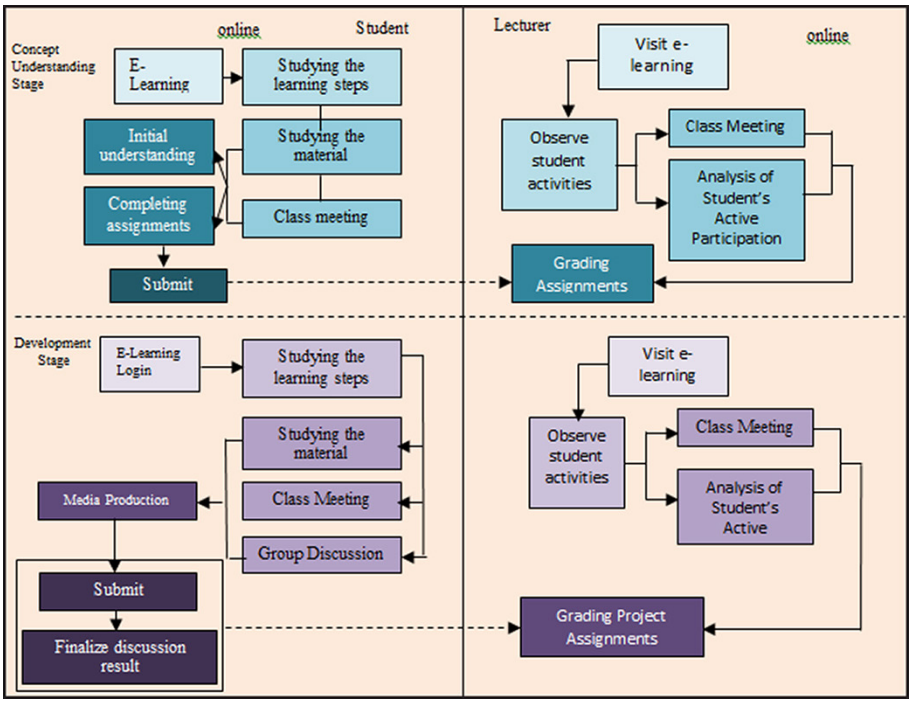

Fig. 2. Design of LMS-based OLMs

4.3 Development of OLMs products

OLMs homepage display is presented in the following figure.

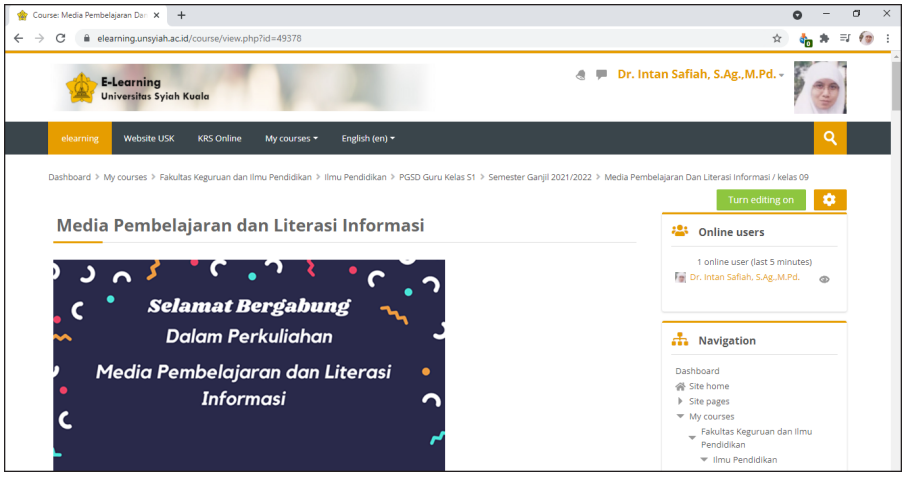

Fig. 3. OLMs homepage

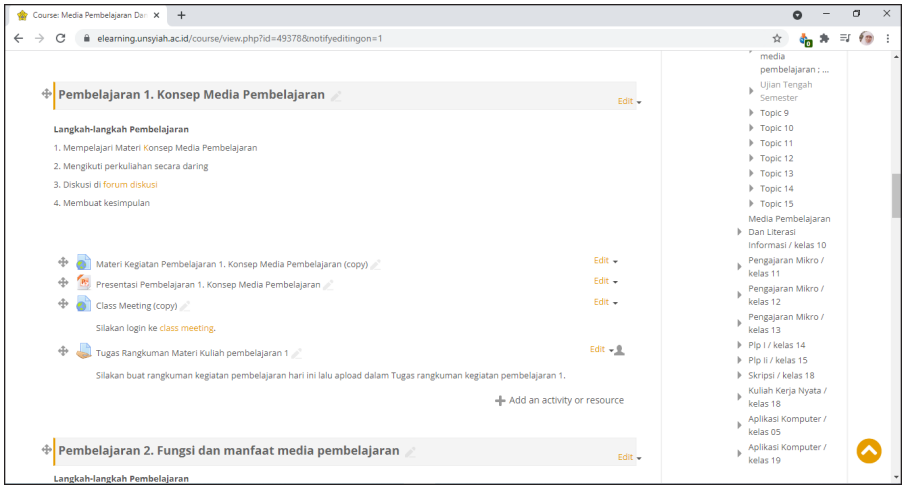

Fig. 4. Activities in OLMs

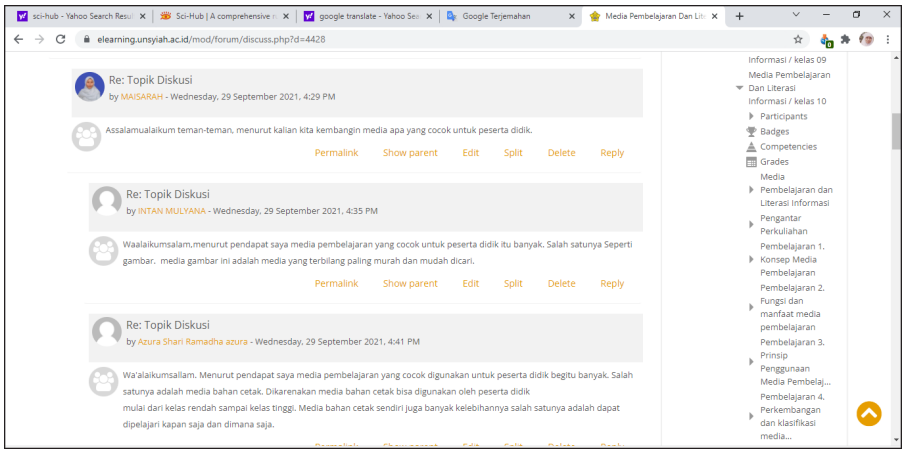

Fig. 5. Student activity in the material discussion forum for the development of learning media: the planning stage

In this section, students conduct discussions to agree on planning a media project to be developed. This discussion is for up to 4 meetings at the planning, designing, development, and implementation stage. This section strongly supports learning activities to produce online media.

4.4 Product validation

The next stage is OLMs validation using a questionnaire containing 22 questions given to 7 validators. The results are considered adequate content validity when Aiken's V coefficient value ranges from 0 to 1. The following (Table 2) are the results of the OLMs product validation analysis.

Table 2. Results of expert assessment

Item	Coefficients	Item	Coefficients	Item	Coefficients	Item	Coefficients
1	0.905	7	0.905	13	0.857	18	0.905
2	0.857	8	0.905	14	0.905	19	0.905
3	0.952	9	0.905	15	0.952	20	0.952
4	0.905	10	0.905	16	0.857	21	0.905
5	0.905	11	0.905	17	0.857	22	0.905
6	0.905	12	0.905				

Based on the results of the validation analysis above, the highest and lowest significant coefficient value of the 22 items is 0.952 and 0.857. Therefore, it can be concluded that all statement items range from 0 to 1. This means the questionnaire statement items have adequate content validity.

After the validation process, the next step is to conduct field trials. In this process, data collection of students' perceptions was conducted. This is focused on 3 aspects: appearance, presentation of material, and benefits. Based on the questionnaire, the results of the percentage analysis are as follows.

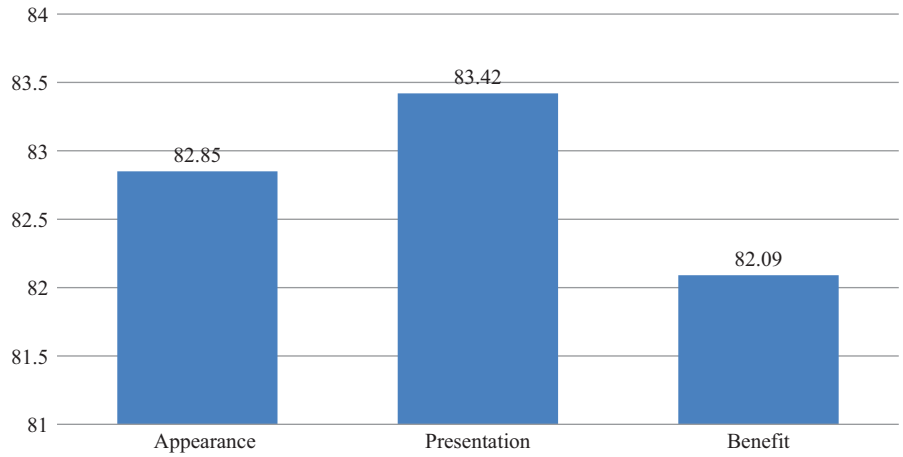

Fig. 6. Students' perceptions of OLMs

The graph above concluded that students' perception of OLMs from the appearance, presentation and benefit aspects are 82.85%, 83.42%, and 82.09%. Therefore, OLMs based on perceptions is in the very good category. The skills of prospective teacher students to produce learning media can be seen in the following figure.

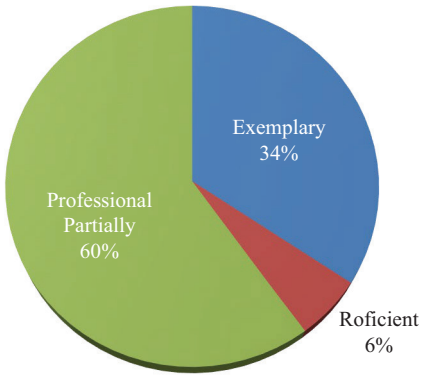

Fig. 7. Learning outcomes of learning media production skills

The product trials showed that student learning outcomes in producing learning media are 34%, 60%, and 6% in the exemplary, partially professional, and advanced categories. Therefore, it can be concluded that OLMs can improve learning outcomes by producing learning media for prospective elementary school teacher students.

5 Discussions

The OLMs development process is conducted in five stages: analysis, design, development, implementation, and evaluation. These can be adequately and effectively conducted because of the support from various available hardware and software facilities. The results prove that expert assessments and student responses are positive towards OLMs as learning solutions in the current digital era. Students assume that project-based OLMs are one of the learning modules that can help them participate in online learning. Moreover, OLMs help students collaborate in learning activities. They can take advantage of the features provided, such as discussion forums and class meetings. The features are used as communication in designing and producing learning media.

Previous research supported these results, which concluded that project-based online collaborative learning could guarantee student competence in developing teaching materials [27]. Moreover, it positively affects students' problem-solving abilities [28] [29]. They collaborate to complete projects in the form of learning media production. In project learning, there can also be stronger interactions [29]. Online discussion forums can guarantee conceptual understanding as well as promote student activity and social interaction [30].

Other research concluded that students' online presence significantly influences their learning performance [31]. Discussions and working collaboratively using online communication tools are rated the most useful engagement strategies [32]. This proves that students studying, discussing, and collaborating online can learn in modules, including OLMs. One of the main supporters that can be considered good is the learning environment. Students are expected to prepare using adequate information technology tools facilitated by educational institutions and private facilities. In addition, learning environments that support different information technologies affect students' productivity and creativity [33].

Several factors make these OLMs suitable for use in educational activities. The development leads to the learning outcomes achievement of understanding and skills in developing learning media, online collaborative learning models, features used to trigger student activity, integration e-learning, and class meeting through zoom. Their attention level is a positive thing for the success of producing learning media, which is in line with the previous research. Furthermore, representative OLMs can improve students' conceptual understanding [2].

The development of these OLMs uses Moodle, which has advantages such as 1) MOODLE LMS providing exclusive features for learning activities. This includes communication (Forum, messaging, and chatting), administration of learning materials, and progress assessment with an easy-to-understand user interface. 2) Easy to use, almost all components in the MOODLE LMS are arranged flexibly according to learning process needs [34]. The advantages of Moodle can be accessed through various devices, one of which is a smartphone [35].

The learning system emphasizes the active learning process. This is because students do not only act as passive recipients but will construct knowledge in their way [36]. All activities are directed to seek and find the answer to something in question, which

can foster self-belief. This developing process of intellectual abilities and mastery of higher competencies is part of the mental process. Therefore, the learning system can minimize the possibility of adverse events.

6 Conclusion

OLMs are designed by combining project learning models with LMS, and the features such as File, Chat, Forum, and BigBlueButtonBN support PjBL activities. Based on the validation test, all indicators such as PjBL materials and models are considered feasible and meet the requirements of a learning module. Meanwhile, the aspects of appearance, presentation, and benefits are in the very good category. Similar to the trial results, OLMs can improve the skills of prospective teachers in producing learning media.

7 Acknowledgement

This research was supported by the research and community service institute of the University of Syiah Kuala.

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9 Authors

Intan Safiah is a lecturer in the Department of Elementary School Teacher Education at Syiah Kuala University, Banda Aceh, Indonesia. His research interests include instructional media and learning strategies.

Muhammad Yunus is a lecturer in the Department of Citizenship Education at Syiah Kuala University, Banda Aceh, Indonesia. His research interests include instructional media and learning strategies.

Ahadin is a lecturer in the Department of Elementary School Teacher Education at Syiah Kuala University, Banda Aceh, Indonesia. His research interests include sports education.

Mislinawati is a lecturer in the Department of Elementary School Teacher Education at Syiah Kuala University, Banda Aceh, Indonesia. His research interests include instructional media and learning strategies.

Yusrijal Abdar is a lecturer in the Department of Citizenship Education at Syiah Kuala University, Banda Aceh, Indonesia. His research interests include citizenship education.

Article submitted 2021-11-29. Resubmitted 2022-10-19. Final acceptance 2023-01-18. Final version published as submitted by the authors.