Learning Management System with Moodle to Enhance Creativity of Candidate Physics Teacher

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Abstract. Creativity is one of the main goals of education. Debriefing creativity is essential to win in global competition. Practicing creativity can be done by utilizing the development of information and communication technology, including learning physics for candidate teachers. One innovation that can be done to improve the quality of creativity-oriented learning is to develop a learning management system (LMS) with Moodle. The aim of this research is to produce a learning management system with Moodle that can enhance the creativity of candidate physics teachers. However, the focus of this article is to explain the results of trials of the effectiveness of products that have been developed to increase the creativity of candidate physics teachers. This research is a research development that adopts ADDIE research design (analysis, design, develop, implementation, and evaluate). The research instrument used to measure candidate physics teacher creativity is a creativity test consisting of 80 questions and consists of various types of tests both multiple-choice, short answers, and essays, which have been developed according to creativity indicators. To find out the increase in student creativity, data were analysed using the n-gain test. The results of the study show that the model develops successfully trained the creativity of candidate teachers, including verbal, figural, numerical, and procedural aspects. This model allows lecturers to manage learning and exchange information with students quickly and flexibly.

1. Introduction

The development of information and communication technology is getting faster, and this has an impact on the changing perspective of education. The change in perspective does not only occur in the concept of education, but also in the mechanism of education itself. According to Susanti [1], the need for information technology-based learning mechanisms becomes necessary. Technology in learning is a tool used in formal education practices to disseminate, illustrate, communicate, or maintain students and teachers in activities designed intentionally to sustain learning [2]. Application of technology in learning is expected to increase the effectiveness of learning.

Learning relates to the application of technology in it. Learning can be said to be effective if it utilizes information and communication technology optimally as a tool [3]. One use of information and communication technology in learning is to use computers. Form of computer utilization can be in the form of integration of LMS (Learning Management System) software. LMS provides features that support learning activities such as discussions, practice questions, final exams, etc., online and offline.

Herayanti et al. [4] stated that learning management systems are effective digital learning environments and are designed for learning that continues to develop. An effective digital-based learning environment will help students improve their knowledge through activities that encourage critical thinking, communication, collaboration, and creativity.

Development of LMS requires good planning that is organized so that development is able to convey learning objectives thoroughly. LMS is available in a variety of options, including online tutors, interactive blackboards, online classes, Moodle, and others. Moodle is a free open source software [5]. Moodle is a learning platform designed to be used by educators, administrators, and students as a reliable and secure integrated system so that it becomes a learning environment suitable for each user [6]. Moodle is used by teachers to convey information, give and listen to assignments, deliver electronic journals, and other learning resources.

In addition, student creativity can be enhanced by providing learning that supports the creation of an active learning environment. One of the active learning environments is to apply computer-based or digital-based learning. Computer-based learning requires students to be active in every stage of learning. Moodle-based e-learning also includes digital-based learning. This based learning has proven to be very supportive in developing students' creative abilities [7].

Moodle is electronic-based learning. Electronic-based learning has more roles and benefits compared to traditional learning. The benefits of electronic learning according to Sims [8] and Seok [9] are (1) increasing levels of learning interactions between students and teachers, (2) enabling learning interactions to occur from anywhere and at any time, (3) reaching students in a broad scope, and (4) facilitate the improvement and storage of learning materials. The main advantage of electronic-based learning is the opportunity for students to interact electronically with each other and their teachers during the forum, on the discussion board, via email and in the chat room [5].

Moodle (Modular Object-Oriented Dynamic Learning Environment) which means a dynamic learning place by using an object-oriented model or a dynamic web-based educational environment package. Moodle is open-source software that supports the implementation of learning management systems with an integrated paradigm with various learning support features that can be accommodated in an e-learning portal. According to Sampurno et al. [10], Moodle functions as an effective tool in providing learning facilities because it is equipped with important learning support features such as assignments, quizzes, chat, collaboration, and main features that can upload various formats of learning material and are easier to understand because the information presented is not only in the form of writing but also images.

Moodle can be used to build systems with the concept of e-learning (electronic learning). The benefits of using LMS with Moodle are very important, including overcoming the limited frequency of face-to-face meetings between students and lecturers. Graf [11] stated that this model supports teachers in creating and managing online learning and provides them with various features that can be included in learning such as learning materials, quizzes, discussion forums, assignments, and so on. This model also allows lecturers to manage learning and exchange information with students quickly and flexibly. Lopes [12] stated the benefits of providing online content on learning make students learn anywhere and anytime, faster than other conventional distance education methods. In addition, communication resources can make it more efficient between teachers and students, when compared to other conventional methods. The final goal of this research is to produce a LMS with Moodle model to improve the creativity of candidate physics teachers.

Most of the learning management systems that have been developed are only for increasing mastery of concepts. Though the potential of the LMS is extraordinary. However, for the development of high-level skills (eg creativity), the LMS system must be developed more modern and smarter in supporting the development of those skills. Then was born the product LMS system that researchers developed in such a way that could support the development of creativity, especially in the candidate of physics teacher. The selection of teacher candidates as research samples aims to introduce teacher candidates to the great potential possessed by an LMS system if developed properly and seriously, and of course, the

best introduction is to try it out by yourself. Data on increasing creativity will provide a new understanding of the vast potential of LMS.

2. Methods

This research includes development research with ADDIE design (analysis, design, develop, implementation, and evaluate). However, the focus of this article is in explaining the results of product implementation in learning. In this implementation phase, researchers used a pretest posttest design research design to test the effectiveness of the product on improving the creativity of the research sample. An LMS with Moodle model had been developed to increase the creativity of candidate physics teachers. The research data were obtained from the creativity skills test instrument given before and after learning. The research instrument used to measure candidate physics teacher creativity is a creativity test consisting of 80 questions and consists of various types of tests both multiple-choice, short answers, and essays, which have been developed according to creativity indicators. Increased creativity in both classes was based on the verbal, figural, numerical, and procedural aspects. Increased student creativity was determined from the N-gain score. This is done to avoid mistakes in interpreting the acquisition score of increasing student creativity. An N-gain score is obtained from the following formula [13].

$$N - Gain = \frac{Post\ test\ score - Pre\ test\ score}{Maximum\ score - Pre\ test\ score} \text{ x } 100\% \quad (1)$$

N-gain > 70% (high); 30% ≤ N-gain ≤ 70% (medium); dan N-gain < 30% (low).

3. Result and Discussion

The results of the study are in the form of a learning process for candidate physics teachers using LMS with Moodle and increasing student creativity. Student creativity measured in research includes numerical, verbal, figural, and procedural aspects. In general, improvements occur in every aspect. Herayanti et al. [4] concluded that in learning using Moodle-based learning media, students showed an increase in critical thinking skills and provided ease of use and were effective in overcoming learning difficulties that students experienced. Increasing students' critical thinking skills will increase their creativity because in this critical process students must be able to give their logical and creative thinking well.

The average percentage score of N-gain creativity in verbal, figural, numerical, and procedural aspects of physics teacher candidates for 2nd semester, 4th semester, and 6th semester is shown in Figure 1 below.

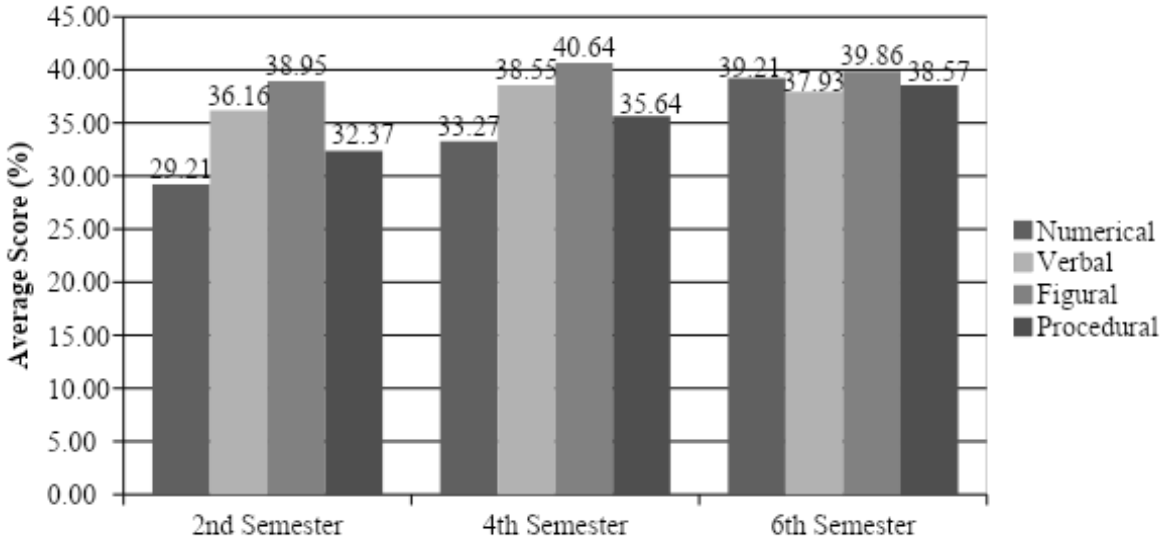

Figure 1. Percentage of N-gain Average Score Creativity of candidate Physics Teachers.

Second-semester students show a variety of increased creativity. In numerical indicators, the group of second-semester students increased by 29.21% in the low increase category. The indicator of verbal creativity has increased by 38.16% with the category of moderate improvement. Figural creativity increased by 38.95%. And the last indicator increased by 32.37%. Second-semester students experienced a fairly low increase in numerical and procedural creativity. This is because the second-semester students are still less reliable in dealing with numerical and conceptual problems. Jiao & Onwuegbuzie [14] stated that junior students are still struggling in adjusting their study habits at university so that sometimes they cannot be faced with problems at a higher level. Moreover, second-semester students are still struggling to build their basic concepts and when faced with higher concepts, they tend to experience difficulties. However, the application of project-based learning has been able to improve their high-level skills a bit, especially in their creativity. Bereiter & Scardamalia [15] stated that project-based learning is very good to help build knowledge in students.

Another result shows that fourth-semester students' creativity percentage is varied. In numerical indicators, the group of second-semester students increased by 32.27% in the category of moderate improvement. Verbal creativity indicator increased by 38.55% with the category of moderate improvement, figural creativity increased by 40.64%, whilst, the last indicator increased by 35.64%. Fourth-semester students also experienced a fairly low increase in numerical and procedural creativity. However, compared to the beginning semester students their ability on numerical and procedural creativity indicators has increased. This is in line with a study by Cavallo et al. [16] stated that both male and female students, over time their understanding of concepts continues to develop. The fourth-semester students struggle to build and apply their basic concepts, and when faced with a higher concept, they still experience difficulties, but their knowledge capital is better than before. However, the application of project-based learning has been able to improve their high-level skills a bit, especially in their creativity.

The sixth-semester students show improvement in creativity is relatively better. In numerical indicators, the group of second-semester students increased by 39.21% in the category of moderate improvement. The indicator of verbal creativity has increased by 37.93% with the category of moderate improvement. Figural creativity increased by 39.86%. And the last indicator increased by 38.57%. sixth semester students show that they have developed a series of knowledge from year to year. Indicators of their creativity are increasing gradually. McNeel [17] stated that the cognitive abilities of students will continue to develop in a supportive environment. Every semester students are faced with higher level subjects, this learning environment will train students and if it is adapted to good learning methods, such as the use of project-based learning, then their chances of developing better will be greater. This was confirmed by the results of this study.

Based on the percentage of increase in creativity it can be seen that the highest average percentage of the second semester is in the aspect of figural 38.95, the fourth semester is in the aspect of figural 40.64, while the sixth semester in aspect of figural is 39.86 in the medium category. Figural aspects are higher than other aspects such as numerical, verbal, and procedural. The highest percentage that occurs in the figural aspect shows the ability of creativity is quite high in bringing up new ideas or ideas through the drawings made. Gunawan et al. [18] said that the implementation of cooperative learning models with virtual media has a positive effect on student creativity on the concept of static fluids and there is an increase in creativity of both groups in verbal and figural aspects after treatment.

The difference in the percentage of N-gain in the numerical aspects of candidate physics teachers has increased at each semester level of physics teacher candidates. This is because candidate physics teachers are accustomed to doing things related to numbers and solving problems with number concepts. For example, in the second semester of basic physics and calculus; the fourth semester of wave material and basic electronics; and the sixth semester of modern physics. This shows the effect of student training activities with the creativity of candidate teachers. Herayanti et al. [19] stated that the use of Moodle as a learning medium in learning could improve students' conceptual understanding of wave concepts.

Students' verbal and figural creativity each semester is not significantly different. This shows the ability to make new combinations based on data, information, or elements found from possible answers

to one problem and verbally revealed does not develop in line with increased learning time. This is supported by research by Gunawan [20] which shows that the application of computer-based learning tends to support the development of procedural creativity, but the indicators of verbal creativity and figural creativity do not increase as well as procedural creativity. This is because candidate physics teachers in their learning environment associate more with numbers, mathematical equations and physics concepts, which of course these things rely more on procedural creativity.

This research data shows that the application of LMS can support the development of student creativity. The character of students in each semester can be well supported in accordance with their abilities and needs. Moodle besides being a non-paid application, also provides a variety of interesting learning experiences for students. Students are trained in creativity in every aspect of teaching, both in online and offline learning, and the simulations and animations provided are able to support student development. Hermansyah et al. [21], Gunawan et al. [22], and Herayanti [19] stated that all computer simulations both online and offline have great opportunities to support the improvement of various specific abilities, such as only student creativity.

4. Conclusion

The results of this study indicate that the product that has been developed in the form of a moodle-based learning management system has been able to increase the creativity of candidate physic teachers. The increase that occurs in each semester is different for each indicator. The results also showed that the difference in improvement at each semester level was different. The pattern of improvement shows that indicators of numerical and procedural creativity increase with increasing semester levels. However, verbal and figural creativity indicators show a non-significant increase. This relates to the experiences and learning environments of candidate physics teachers who are mostly faced with learning environments filled with numbers, mathematical formulas, and physics concepts, so of course the ability of creativity on indicators related to these will be greatly affected, especially if supported by the system learning right, like a moodle-based learning management system.

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