The Effect of Moodle Learning Media on Students' Mathematics Learning Outcomes

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Abstract
This study aims to determine the effect of Moodle learning media on elementary school students' mathematics learning outcomes in Makassar City. The study used a quantitative approach with an ex-post facto design. The research population consisted of fifth-grade elementary school students, with a sample of fifth-grade students from the Tidung State Elementary School UPT SPF with three learning groups who had participated in mathematics learning using the Moodle learning media, with a total of 142 student respondents. Data collection was conducted using a Likert scale questionnaire to measure the use of the Moodle learning media and a learning outcome test to measure students' mathematics learning outcomes. The data obtained were analyzed using descriptive statistics and simple linear regression analysis with the help of the SPSS program. The results of the descriptive analysis showed that the use of Moodle learning media was in the high category with an average score of 77.80, while the students' mathematics learning outcomes were also in the high category with an average score of 78.90. The regression test results showed that Moodle learning media had a positive and significant effect on students' mathematics learning outcomes with a regression coefficient value of 0.50 and significance of 0.000 < 0.05. Based on the results of this study, it can be concluded that Moodle learning media has a significant effect on the mathematics learning outcomes of elementary school students in Makassar City. Therefore, the use of Moodle as a technology-based learning medium needs to be optimized to improve the quality of mathematics learning.

Keywords: Mathematics Learning Outcomes, Moodle Learning Media, Technology-Based Learning.

INTRODUCTION

Moodle learning media is one of the *Learning Management System* (LMS)-based learning platforms that is widely used in education. Moodle is designed to support online and *blended learning* processes through the integrated management of learning materials, activities, and evaluations. According to Dougiamas and Taylor (2003), Moodle was developed based on a social constructivist approach that emphasizes the active involvement of students in constructing knowledge.

In the context of mathematics learning, Moodle serves as a means to present teaching materials, practice questions, discussions, and learning evaluations in a structured and systematic manner. Abstract mathematics learning requires media that can help learners understand concepts through clear and varied presentations. This is in line with Arsyad's (2017) opinion that learning media can help clarify messages and improve learners' understanding of the subject matter. Moodle provides various learning features, such as material uploads, discussion forums, online quizzes, and assignments, which can be optimally utilized by teachers and learners. Through these features, students can access learning anytime and anywhere according to their learning needs. Rusman (2018) states that the use of LMS in learning allows for flexibility in learning time and place, thereby supporting more effective learning.

The use of Moodle learning media also provides opportunities for students to learn independently, actively, and continuously. Students can review material, complete exercises, and discuss with friends and teachers without relying entirely on face-to-face learning. According to Munir (2017), e-learning-based learning encourages independent learning and

increases students' responsibility for their learning process. In mathematics learning, independence and active learning are essential for understanding complex concepts. Moodle allows mathematics material to be presented in various forms, such as text, video, and interactive exercises, thereby helping students understand abstract concepts more concretely. This is in line with the opinion of Smaldino et al. (2015), who state that a variety of learning media can increase students' absorption and motivation to learn.

In addition to providing benefits for students, Moodle also makes it easier for teachers to manage learning. Teachers can monitor student learning activities, provide direct feedback, and evaluate learning outcomes more systematically. According to Surjono (2013), the use of LMS helps teachers organize learning, monitor learning progress, and improve the effectiveness of learning evaluation.

Based on preliminary observations conducted on mathematics learning in several elementary schools in Makassar City, particularly UPT SPF SD Negeri Tidung, it was found that the mathematics learning process has begun to utilize digital technology, particularly through the use of learning media based on *Learning Management Systems* (LMS) such as Moodle. Moodle is generally used in upper grades (grades IV–VI) as part of online or *blended learning*. The observation results show that teachers have used Moodle as a means to deliver mathematics material, provide exercises, and carry out learning evaluations. Learning materials are generally uploaded in the form of text files and simple learning videos. Students can access these materials through mobile devices or computers, both at school and at home, according to the schedule determined by the teacher.

In terms of student activity, observations show that most students are interested in learning mathematics through Moodle. Students appear more enthusiastic when taking online quizzes and doing practice questions provided on the platform. Interactive quiz features and simple visual displays help students understand abstract mathematical material, such as arithmetic operations and simple problem solving. However, the observation results also show differences in the level of learning independence among students. Some students are able to access materials and complete assignments independently, while others still need assistance from teachers or parents. This is especially evident in students who have limited skills in using technological devices.

In addition, observations of learning interactions showed that the discussion forum feature on Moodle was not being used optimally. Interaction between students and teachers was still dominated by one-way communication, mainly in the form of providing materials and assignments. Discussions among students were still limited, so that Moodle's potential as a collaborative learning medium had not been fully realized. From the teachers' perspective, the observation results show that Moodle makes it easier for teachers to monitor attendance, learning activities, and student work results. Teachers can see task completion data and quiz results directly, allowing for more systematic learning evaluation. However, teachers still face challenges in managing time and preparing varied learning content tailored to the characteristics of elementary school students.

Based on these observations, it can be concluded that the use of Moodle learning media in mathematics learning for elementary school students in Makassar City has good potential in improving the quality of learning. However, it is necessary to increase assistance for students,

optimize the use of Moodle features, and improve teachers' competence in designing LMS-based learning so that students' mathematics learning outcomes can be optimally improved.

METHOD

This study used a quantitative approach with an ex-post facto design. This design was chosen because the study aimed to analyze the effect of using Moodle learning media on mathematics learning outcomes without directly treating the research subjects. The data analyzed was obtained from learning conditions that had taken place at school.

The research was conducted on fifth-grade elementary school students in Makassar City who had implemented Moodle-based mathematics learning. The research population was fifth-grade elementary school students, with a sample of fifth-grade students from the Tidung State Elementary School UPT SPF with three learning groups who had participated in mathematics learning using Moodle learning media, with a total of 142 student respondents.

The research variables consisted of two variables, namely Moodle learning media as the independent variable and mathematics learning outcomes as the dependent variable. Data collection was conducted using two research instruments. The Moodle learning media variable was measured using a Likert scale questionnaire with five response categories, covering aspects of ease of use, clarity of material, learning interaction, and the benefits of Moodle in mathematics learning. Meanwhile, mathematics learning outcomes were measured using a learning outcome test compiled based on basic mathematics competencies in accordance with the grade level being studied.

The collected data were analyzed using descriptive statistics to describe the characteristics of each variable, as well as inferential statistics to test the effect of the independent variable on the dependent variable. Hypothesis testing was performed using simple linear regression analysis with the help of the SPSS program at a significance level of 0.05.

RESULTS AND DISCUSSION

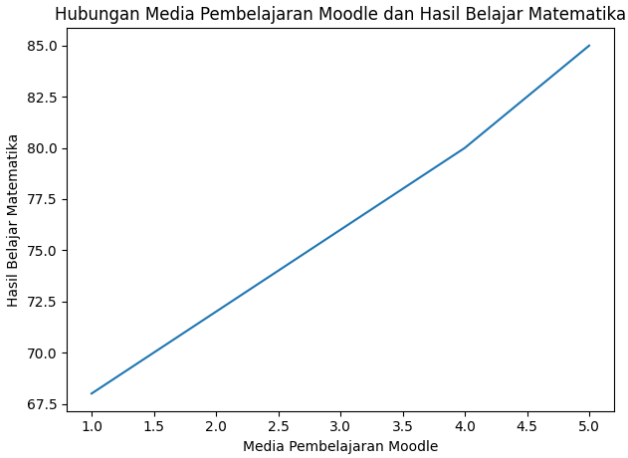
The results of descriptive statistical analysis show that the Moodle Learning Media variable has a mean value of 77.80 with a standard deviation of 7.40**.** This mean value is in the high category**,** indicating that the use of Moodle learning media in mathematics learning for elementary school students in Makassar City has been implemented well. The relatively small standard deviation indicates that students' perceptions of Moodle usage tend to be homogeneous.

Table 1. Statistical Analysis Results

Variable	N	Mean	Std. Deviation	Category
Moodle Learning Media	142	77.80	7.40	High
Mathematics Learning Outcomes	142	78.90	6.95	High

The results of the simple linear regression test show that Moodle Learning Media has a significant effect on mathematics learning outcomes (β = 0.50; t = 5.67; sig = 0.000 < 0.05). The Mathematics Learning Outcomes variable also shows a mean value of 78.90 with a standard deviation of 6.95, which is in the high category. This indicates that, in general, students have good mathematics learning outcomes. The standard deviation value, which is not too large, indicates that students' mathematics learning outcomes are relatively even among respondents.

Furthermore, the results of simple linear regression analysis show that Moodle Learning Media has a significant effect on mathematics learning outcomes. This is indicated by a regression coefficient (β) value of 0.50, which means that an increase in the use of Moodle learning media is followed by an increase in students' mathematics learning outcomes. The t-value of 5.67 with a significance of 0.000, which is smaller than the significance level of 0.05, indicates that the effect is positive and statistically significant.



Graph 1. Relationship between Moodle Learning Media and Mathematics Learning Outcomes

Based on the results of the data analysis, it was found that Moodle learning media was in the high category and students' mathematics learning outcomes were also in the high category. This finding shows that descriptively, the use of Moodle in mathematics learning has been implemented well and is followed by optimal learning outcomes. Furthermore, the results of the simple linear regression test show that Moodle learning media has a significant effect on mathematics learning outcomes, as indicated by the regression coefficient value (β = 0.50) and the significance value of 0.000 < 0.05. These results directly answer the research question, namely that there is a positive effect of using Moodle learning media on the mathematics learning outcomes of elementary school students.

The hypothesis proposed in this study is that Moodle learning media has a significant effect on students' mathematics learning outcomes. Based on the results of hypothesis testing, the hypothesis is accepted because the significance value is smaller than the specified significance level (α = 0.05). Thus, statistically, it can be stated that the use of Moodle learning media contributes significantly to improving mathematics learning outcomes.

The acceptance of this research hypothesis shows that Moodle learning media can effectively support the mathematics learning process. This is in line with Arsyad's (2017)

opinion, which states that learning media can increase learning effectiveness by helping students understand the material more clearly and systematically. In the context of mathematics learning, Moodle helps present material and exercises in a structured manner, making it easier for students to understand abstract concepts.

Based on the results of this analysis, it can be concluded that the use of Moodle learning media has a significant contribution to improving the mathematics learning outcomes of elementary school students in Makassar City. These findings indicate that the use of Moodle as a technology-based learning medium can be an effective alternative in supporting mathematics learning.

The results of the study show that the use of Moodle Learning Media is in the high category and has a significant effect on the mathematics learning outcomes of elementary school students in Makassar City. These findings indicate that the use of Moodle as a technology-based learning medium can effectively support the mathematics learning process. This positive effect is reflected in the regression coefficient value, which shows that the better the use of Moodle, the higher the students' mathematics learning outcomes.

The findings of this study are in line with Arsyad's (2017) opinion, which states that learning media functions as a tool to clarify the delivery of material and improve students' understanding of the concepts being studied. In abstract mathematics learning, the presence of technology-based learning media such as Moodle can help students understand concepts more concretely through the presentation of varied material. In addition, the results of this study support constructivism theory, which emphasizes that knowledge is actively constructed by students through learning experiences. Dougiamas and Taylor (2003) explain that Moodle was developed based on a social constructivism approach, which allows students to learn actively through interaction with materials, teachers, and peers. This can increase student engagement in mathematics learning, thereby improving learning outcomes.

The significant effect of Moodle on mathematics learning outcomes is also related to the flexibility of learning offered by LMS. Rusman (2018) states that LMS-based learning allows learners to learn without being limited by space and time, thus providing opportunities for students to repeat the material according to their individual needs and learning speeds. This condition is very relevant for elementary school students who have different abilities in understanding mathematics material. Furthermore, the use of Moodle encourages independent and active learning. Munir (2017) argues that e-learning can increase students' independence in learning because they have greater control over their learning process. In the context of this study, students can access materials, do exercises, and take online quizzes through Moodle, which ultimately helps strengthen their understanding of mathematical concepts.

From the teacher's perspective, Moodle also plays a role in improving the effectiveness of learning management. Surjono (2013) states that LMS makes it easier for teachers to monitor student learning activities, provide feedback, and conduct systematic learning evaluations. This convenience allows teachers to adjust mathematics learning strategies based on learning outcomes and student activities recorded in the system.

Thus, the results of this study reinforce the opinion of experts that the use of technology-based learning media, especially Moodle, has an important role in improving the quality of learning and mathematics learning outcomes. Mathematics learning supported by Moodle not only improves conceptual understanding but also encourages student activity, independence,

and motivation to learn. Therefore, the use of Moodle needs to be continuously developed and optimized in mathematics learning in elementary schools.

CONCLUSION

Based on the results of hypothesis testing, it can be concluded that the hypothesis stating that Moodle learning media has a significant effect on the mathematics learning outcomes of elementary school students in Makassar City is accepted. This finding confirms that the use of Moodle as a technology-based learning medium makes a real contribution to improving students' mathematics learning outcomes. Thus, Moodle learning media can be used as an effective alternative learning medium in mathematics learning in elementary schools. The optimal use of Moodle is expected to improve the quality of the learning process and support the achievement of better mathematics learning outcomes.

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