

Testing the Effectiveness of Micro Learning Based Digital Modules in Improving Students' Mathematical Understanding

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Abstract

The micro learning-based digital module developed has an impact on effectiveness in improving students' mathematical understanding in set and logic courses. This micro learning-based digital module contains teaching material for set and logic courses which is equipped with video motion graphics and video explainers which can help students understand the content of the teaching material well. The aim of this research was to find out how effective micro learning-based digital modules are in improving mathematical understanding of Mathematics Education Study Program students, FMIPA, Medan State University in set and logic courses. The effectiveness of a product can be seen from learning activities and increasing students' mathematical understanding. From all aspects of the results of observing student activities, it can be concluded that the micro learning-based digital module obtained a score of 78.46% in the effective category. Thus, it can be concluded that the use of digital modules based on micro learning in learning sets and logic in the Mathematics Education Study Program, FMIPA, Medan State University makes a positive contribution to increasing students' mathematical understanding.

Keywords: Effectiveness, digital module, micro learning, mathematical understanding

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Introduction

The COVID-19 pandemic has had a significant impact on various aspects of life, including education. Learning after COVID-19 involves a number of changes and adaptations to improve the sustainability of the education system. One aspect of post-COVID-19 learning that may develop is hybrid learning, namely a combination of online and face-to-face learning will become a major trend. Hybrid learning allows flexibility for students and lecturers to overcome health challenges and maintain educational continuity. To support this, lecturers are required to be able to develop digital teaching materials that can be accessed by students anywhere and at any time and are able to improve students' mathematical understanding skills well.

The ability to understand mathematics is considered an important goal in learning mathematics. Mathematical understanding involves students' ability to understand mathematical concepts, apply mathematical principles in real situations, and solve mathematical problems. Mathematical understanding ability is also the ability to absorb material, remember formulas and concepts, estimate truth, apply formulas and theorems in solving mathematical problems (Sarwoedi, et al., 2018). NCTM provides indicators of mathematical understanding ability, namely: 1) defining concepts in verbal and written form; 2) provide examples and non-examples; 3) use various diagrams, models, and symbols to present concepts; 4) create a form of representation into another form; 5) know the meaning of the concept; 6) mention the nature and conditions of the concept; and 7) distinguishing between various types of concepts (Khusna, et al., 2021).

Students' mathematical understanding abilities can be improved through the development of digital modules based on micro learning. The development of digital modules based on micro learning can be an effective approach to improving mathematical understanding. Micro learning is a learning approach that focuses on conveying information in small, easy-to-digest chunks, usually over a short period of time. The benefits of micro learning are (1) better retention of micro learning concepts, (2) better involvement of students in learning, (3) increasing student motivation, and students being able to engage in collaborative learning, and (5) can improve students' learning abilities and performance (K. Leong, 2021).

Based on several things explained above, a digital module based on micro learning has been developed to improve students' mathematical understanding in set and logic courses. Based on the results of research carried

out in the previous stage, the digital module based on micro learning in the set and logic courses produced is classified as valid and practical. The next stage is to test the effectiveness of the digital module that has been developed, by assessing it based on students' activities and mathematical understanding.

Based on this, the author conducted research on testing the effectiveness of digital modules based on micro learning in set and logic courses entitled "Testing the Effectiveness of Digital Modules Based on Micro Learning in Improving Students' Mathematical Understanding". This effectiveness test was carried out to find out whether the digital modules were based on micro learning. Can you improve the mathematical understanding of mathematics education study program students at FMIPA Medan State University?

Research Methods

Based on the problems studied, the type of research used is the development research method (Developmental Research). The development model for this device uses the Four-D Model suggested by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel (1974). At the stage of testing the effectiveness of the digital module based on micro learning, it was carried out to find out how effective this digital module could be in increasing students' mathematical activity and understanding in set and logic courses. Activities were observed by 2 lecturers as observers who directly monitored lecture activities in the set and logic courses.

The aspects observed by the observer are; 1) Study the material in the media. 2) Discussion between students and lecturers. 3) Discuss with friends. 4) Summarize the learning material. 5) Do practice questions (according to indicators of mathematical understanding). Data on increasing students' mathematical understanding can be seen from the pretest and posttest scores, which are in the form of 5 (five) essay questions with a time of 90 minutes. In this effectiveness test, the research subjects were first semester students of class PSPM-22E who were students taking set and logic courses.

To analyze student activity data, the percentage formula (%) is used (Arikunto, 2021), namely; $P = \frac{F}{N} \times 100\%$

Where:

P = activity percentage

F = frequency of each activity

N = number of student activity frequencies

Table 1. Score Assessment Criteria (Arikunto, 2021)

Percentage Value	Criteria
81 % - 100 %	Very effective
61 % - 80 %	Effective
41 % - 60 %	Effective enough
21 % - 40 %	Less effective
0 % - 20 %	Ineffective

Results and Discussion

Student activity data was obtained based on set and logic learning activities that took place using micro learning-based digital modules. Based on the results of observations carried out by 2 (two) lecturers as observers with reference to 5 (five) aspects, namely; 1) Study the material in the media. 2) Discussion between students and lecturers. 3) Discuss with friends. 4) Summarize the learning material. 5) Do practice questions (according to indicators of mathematical understanding).

Table 2. Results of Observation of Student Activities

NO	Aspects of student activities observed	% Indicator	Category
1	Study the material in the module	98.7	Very effective
2	Discussion between students and lecturers	28	Ineffective
3	Discuss with friends	72	Effective
4	Concluding learning material	99.6	Very effective
5	Do practice questions	94	Very effective
Amount			392.3
Average			78.46

Based on table 2, it can be seen that student activity in studying the material in the microlearning-based digital module was 98.7% in the very effective category. Likewise in terms of concluding learning material with a percentage of 99.6% (very effective category). In table 1 it is also clear that students are able to work on practice questions that have been adjusted to indicators of mathematical understanding with a percentage of 94% (very effective category). The results of this test indicate that the micro learning-based digital module developed is effective in helping students understand the content of the material well. This is because in micro learning-based digital modules, explanatory videos and motion graphics videos are inserted in material chapters that are

considered difficult for students to understand.

The second aspect, namely the discussion aspect between students and lecturers, received a score of 28% in the ineffective category, while the discussion aspect with friends received a score of 72% in the effective category. Based on this data, it can be concluded that the level of student activity in discussing with lecturers is not as active when compared to discussing with friends. This means that microlearning-based digital modules can enable students and their friends to study the material presented in the digital module.

From all aspects it can be concluded that the digital module based on micro learning in improving students' mathematical understanding obtained a score of 78.46% in the effective category. In other words, digital modules based on micro learning are effective in increasing students' mathematical understanding in set and logic courses.

Conclusion

Based on the results of the research and data analysis that has been carried out, the conclusion of this research is that micro learning-based digital modules are effective in improving students' mathematical understanding in set and logic courses with a percentage of 78.46%

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