

Developing Interactive Mathematics Learning Media Using Geogebra to Improve Student Learning Outcomes Using the 5M Approach to Straight Line Equations

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ABSTRACT

This study aims to develop interactive mathematics learning media using GeoGebra to improve student learning outcomes using the 5M approach to linear equations and to test the feasibility of the developed learning media. This research is a Research and Development (R&D) development study using a modified 4D model with three stages: define, design, and development. This research was conducted at MTsN 1 Aceh Tenggara in class VIII A EKS. The study involved 18 respondents, consisting of three validators: two expert lecturers, one teacher, and 15 students. The results showed that the interactive mathematics learning media using GeoGebra had been developed, receiving input from the validators and students. The feasibility test obtained a score of 92.8%, categorized as "Very Valid." The mathematics learning outcomes, in terms of lesson plans (RPP), were categorized as "Very Valid." Furthermore, the analysis of student responses showed a percentage of 94.5%, categorized as "Very Good." This indicates that the interactive mathematics learning media using GeoGebra is suitable for student use.

Keywords: Development, Learning Media, Geogebra.



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1. INTRODUCTION

Education is crucial because it can shape character for the advancement of a nation. Through education, individuals can gain better experiences and knowledge in life and develop their potential through the learning process. Education directly impacts character formation, as an individual will be of high quality if the education provided is also of high quality. According to Susanto (Schwarz et al., 2014), learning is a teacher's programmed activity within instructional design, designed to foster active student learning, emphasizing the availability of learning resources.

Effective learning activities can be created by modifying learning activities, including innovations in the use of learning media. The use of appropriate and engaging learning media can boost student motivation, resulting in improved learning outcomes. Low student learning outcomes are often due to students' difficulty understanding the material being taught. Due to their limited thinking skills, students often lack the capacity to grasp and respond to abstract concepts or concepts that have not yet been memorized.

Today, the learning process is inseparable from technology. Technological developments are entering the fourth industrial revolution, better known as Industry 4.0. The rapid development of technology and communication has resulted in a revolution in information being collected and disseminated openly and accessible to everyone through media, such as the use of media in learning. Technology-based learning media is commonly used through applications, one of which is GeoGebra. GeoGebra is dynamic mathematical software that combines geometry, algebra, and calculus.

Education in Indonesia is inseparable from mathematics. Mathematics itself is crucial for everyday life. However, many students still consider mathematics a difficult and boring subject, resulting in poor learning outcomes. It is necessary to develop learning methods that can increase student engagement in mathematics,

ultimately improving student learning outcomes (Panggabean & Harahap, 2020). Therefore, innovations in the learning process are needed to foster students' enjoyment of mathematics, particularly linear equations.

Success in the learning process depends not only on the development of learning media but also on the approach used. The 5M approach to learning requires basic steps, including observing, questioning, associating, experimenting, and communicating (networking). Through this approach, students are expected to develop significantly better attitudes, skills, and knowledge. Enjoyable learning is not simply about understanding and engaging with the learning process; it also involves students being able to seek and find learning information and construct it into a unified understanding (Amiruddin, 2014:1). This process of independently seeking and discovering information by students to construct understanding is the hallmark of the 5M approach in learning.

Based on observations with a mathematics teacher at MTsN 1 Southeast Aceh, it was revealed that many students still experience difficulties in learning mathematics. This lack of understanding stems from students being taught monotonously using lecture and discussion methods and not using teaching aids such as GeoGebra. Learning resources are still textbooks and worksheets, even though students already have smartphones, and the school also provides a computer lab and free Wi-Fi. These problems at the school result in some students still experiencing poor learning outcomes. This is all characterized by shortcomings in the learning process strategy. Some students still complain about their learning outcomes. Therefore, the researcher believes that students at this school need engaging learning strategies to improve their learning outcomes. One new innovation to improve student learning outcomes is the GeoGebra-assisted 5M approach, which can provide engaging and easy-to-understand line visualizations, especially for linear equations.

Based on the above background, the researcher considers it important to conduct research on "Developing Interactive Mathematics Learning Media with GeoGebra to Improve Student Learning Outcomes Using the 5M Approach to the Material"

2. RESEARCH METHOD

In this study, the researcher used the research and development method, better known as Research and Development (R&D), using a modification of the 4-D development model (four D model). This learning development model was developed by S. Thiagarajan et al. This model was chosen because it is systematic and suitable for developing learning media because the steps of the model are able to provide detailed directions so as to provide clear information about the media applied. The steps of this 4-D development model consist of 4 stages, namely define, design, development, and disseminate.

A. Define Stage

The purpose of this stage is to establish and define learning needs by analyzing the objectives and limitations of the material. This stage includes five main steps:

1) Front-End Analysis

The front-end analysis aims to identify fundamental issues that need to be addressed in the development of interactive mathematics learning media using GeoGebra using the 5M approach to improve student learning outcomes in linear equations. This research does not develop existing material in the curriculum.

2) Student Analysis

The student analysis aims to examine the characteristics of MTsN 1 Aceh Tenggara students that are appropriate for the design and development of learning media. This analysis is conducted by considering the characteristics, abilities, and experiences of students, both as a group and individually. The remaining analysis includes academic ability, age, and response to the subject matter.

3) Concept Analysis

The concept analysis aims to identify, detail, and systematically organize the concepts that students will learn in the linear equations material. Previously, the learning media used did not include concept maps, so an interactive mathematics learning media using GeoGebra was created that displays the main parts of the learning material.

4) Task Analysis

Task analysis aims to identify the tasks students will complete. Task analysis consists of an analysis of core competencies and learning outcome indicators.

5) Specification of Learning Objectives

The specification of learning objectives serves as a reference in designing interactive mathematics learning media using GeoGebra using the 5M approach to improve student learning outcomes in linear equations. The indicators or learning objectives are aligned with the Core Competencies (KD)

B. Design Stage

The purpose of this stage is to design and develop interactive mathematics learning media using GeoGebra that will focus on linear equations using the 5M approach. Researchers also developed an assessment instrument in the form of a questionnaire completed by validators and subject teachers. This stage consists of two steps:

1) Media Selection

Media selection is based on the results of the task analysis, concept analysis, and student characteristics at MTsN 1 Aceh Tenggara, as media is useful in assisting students in achieving basic competencies. GeoGebra is used in the development process in class.

2) Format Selection

Format selection is carried out as an initial step to ensure the chosen format aligns with the learning material. The presentation format is selected according to the learning media used. Format selection in development involves designing learning content, selecting approaches, learning methods, and learning resources.

C. Development Stage

The development stage involves producing a product, which is carried out through two steps: (1) expert assessment, and (2) development trials. The purpose of this stage is to produce revised learning media based on expert input and data obtained from field trials. The steps taken at this stage are as follows:

1) Expert Validation

This step involves evaluation by experts in the field. The experts referred to in this case are validators who are competent to assess the learning media and provide input and criticism to improve the developed learning media.

2) Development Trial

3) The trial aimed to obtain direct feedback on the developed learning media, resulting in a final product.

4) The development trial was conducted on 15 students in class VIII A EKS at MTsN 1 Aceh Tenggara.

3. RESULTS AND DISCUSSION

This research is a developmental research study, specifically the development of GeoGebra learning media, implemented at MTsN 1 Southeast Aceh. This research resulted in a product in the field of education: the development of interactive mathematics learning media using GeoGebra using the 5M approach. This research used a 4-D model consisting of four stages: define, design, development, and disseminate. However, in this study, the researcher limited the process to the development stage only; the dissemination stage was omitted due to the considerable time required. The description of the development of this interactive mathematics learning media, including the lesson plan (RPP), GeoGebra learning media, and the results of the mathematics learning media development, is as follows:

Based on the description of the research findings, the use of mathematics learning media using the 5M approach, based on a modified 4-D model, was found, with the stages of definition, design, and development.

The learning development stage begins with the definition stage. The definition stage aims to analyze the needs of the learning process being implemented. This stage consists of the initial and final stages, student analysis, concept analysis, task analysis, and specification of learning objectives. The initial and final analysis was used to identify problems encountered in the school where the research was conducted. The student analysis was used to examine student characteristics, the analysis of the concepts taught was

modified with material analysis, and the specification of learning objectives aimed to outline the research indicators.

The next stage is design. This development is designed to produce tests that can be compiled into initial designs for the learning media content, including lesson plans and GeoGebra mathematics learning media. After students are familiar with the developed media, a student response questionnaire is administered at the end of the meeting to determine the feasibility of the product after development.

The final stage of this research is development. The research instrument was validated before being used to measure the validity of the lesson plan (RPP) and the appropriateness of the developed learning media. The lesson plan and learning media were validated by subject matter experts and a mathematics teacher before being used in the field trial.

Based on the analysis of the lesson plan assessment by the validators, namely two expert lecturers and one mathematics teacher, the lesson plan feasibility score was 94%, with the criterion "very valid." This result indicates that the developed lesson plan aligns with the principles of lesson plan development. Furthermore, based on the analysis of the learning media assessment by the validators, namely two expert lecturers and one mathematics teacher, the media feasibility score was 92.8%, with the criterion "very valid." This result indicates that the developed mathematics learning media aligns with the principles of mathematics learning media development.

Following validation by the validators, namely two expert lecturers and one mathematics teacher, the learning process was piloted with 15 students in grade VIII A EKS MTsN 1 Southeast Aceh. The learning process was designed for two meetings. The learning activities were divided into preliminary activities, core activities, and closing activities.

Following the trial of the mathematics learning media, a questionnaire was completed to determine student responses to the developed product. The analysis of student responses showed a percentage of 94.5%, which can be considered "Very Good."

4. CONCLUSION

The conclusions that can be drawn from the results of this research and development of learning media include:

- A. The development of interactive mathematics learning media using GeoGebra using a modified 4-D model with the stages of definition, design, and development. After going through these three stages, the final product was a lesson plan (RPP) and learning media using the 5M approach for linear equations for grade VIII A EKS students.
- B. The learning development stage begins with the definition stage, which serves to analyze the needs of the learning process being implemented. The next stage is design, with activities at this stage including test preparation, media selection, format selection, and initial design. The final stage of this research is development. The research instrument was validated before being used to measure the validity of the lesson plan and learning media, as well as the student response questionnaire.
- C. Based on the analysis of the lesson plan assessment by validators, two expert lecturers and one mathematics teacher, the lesson plan's feasibility score was 94%, with the criterion of "Very Valid." Furthermore, based on the analysis of the learning media assessment by validators, consisting of two expert lecturers and one mathematics teacher, the media's feasibility test was 92.8%, with the criteria "Very valid."
- D. After the trial of the lesson plans and learning media, a questionnaire was conducted to determine student responses to the mathematics learning media. The analysis of student responses showed a percentage of 94.5%, which can be considered "Very good."

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