Development of Android-Based Mathematics Learning Media

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Abstract
The objectives of this research and development are 1) to develop android-based mathematics learning media, 2) to determine the development of android-based mathematics learning media, 3) to determine student responses to the development of android-based mathematics learning media. This study uses research and development methods with a 4D (Four-D) model, namely: Define, Design, Development, Disseminate. By being limited only to the design stage, due to time constraints and in a state of the covid-19 pandemic. The definition stage is carried out through analysis of previous research and literature studies with five stages, namely: 1) initial analysis, 2) student analysis, 3) task analysis, 4) concept analysis, and 5) formulation of learning objectives. The design stage is carried out through four stages, namely: 1) preparation of test standards, 2) media selection, 3) format selection, and 4) initial design.

Keywords: Learning media, Mathematics, Based on android

1. Introduction
Education is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation, and state. Therefore, an educator has a big responsibility in guiding and educating students to develop their potential. An educator must be able to create an interesting and interactive learning process, let alone the development of science and technology, encouraging educators to make updates in the use of these techniques results in the learning process. One way to use technology in learning is the use of technology resources as media in the learning process [1]. Eyler and Giles' research (in Widharyanto, 2003) proves that the effectiveness of learning is influenced by the media used by the teacher. They found that the learning model that was located at the top of the cone, namely learning that only involved verbal symbols through the presentation of the text, was the one that produced the highest level of abstraction. The most effective learning is learning that is at the base of the cone, which is directly involved with purposeful learning experiences. The level of abstraction in this learning model is very low, making it easier for students to absorb new knowledge and skills.

Learning media has a very important role in the learning process, learning media can help students in delivering learning material. The success of a learning process is determined by two main components, namely the teaching method and learning media. These two components are inseparable and interrelated [2]. Educators are required to be
creative in using and utilizing the learning media that has been provided in schools, or they can also design and develop new learning media following the learning objectives to be achieved.

Mathematics is a means to think things logically, critically, rationally, and systematically and to train students' abilities to get used to solving a problem that is around them. The importance of mathematics in learning can be seen from the elementary school to university level which has a function in developing one's reasoning ability to think. The results of observations and interviews with students who take mathematics lessons, current learning tends to use the lecture method and conventional modules in the form of hardcopy modules in the learning process, so that students feel bored and less interested in participating in the learning process. In addition, students also have difficulty understanding the material given. The benefits of using media as a learning resource in the learning process, among others, can add and expand the scope of the class, can improve thinking, and develop further. The material developed in the media is enrichment. Students can broaden their horizons by studying additional material presented in the media, providing games so that users do not get bored with the material and pearls of knowledge to increase students' self-motivation, besides that there is also a discussion of some of the material given in class. Thus, students can learn independently and can be a trigger for creativity for them [3]. Technological developments encourage a combination of printing technology with computer technology in learning activities. Answering the above problems, it is necessary to develop module teaching materials using technology so that they can support varied student learning styles.

2. Methodology

This product development is carried out using research and development with a 4-D (Four-D) approach. The 4-D model was developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel in 1974. This model consists of 4 steps, namely: a) define, b) design, c) development, d) disseminate, with limited only to the second step, due to limited time, funds, and unfavorable conditions caused by the covid-19 pandemic. The product development design can be seen in the image below [4].

![Figure 2. Development procedure](image)

3. Results and Discussion

The development of this learning media is in accordance with the 4-D (Four-D) model approach which consists of 4 steps, namely a) define, b) design, c) development, d) disseminate.
a) Define

The initial stage in the 4D model is the definition of development requirements. Simply put, this stage is the needs analysis stage. In product development, the developer needs to refer to the development requirements, analyze and collect information on the extent to which development needs to be done. The defining stage or needs analysis can be done through analysis of previous research and literature studies. Thiagarajan et al (1974) state that there are five activities that can be carried out at the defined stage, namely:

1) The initial analysis
   The initial analysis is carried out to identify and determine the basic problems faced in the learning process so that the background for the need for development [4].

2) Analysis of students
   Student analysis is an activity to identify how the characteristics of students who are targets for developing learning tools. The characteristics referred to are related to academic abilities, cognitive development, motivation, and individual skills related to learning topics, media, format, and language.

3) Task analysis
   Task analysis aims to identify the skills that the researcher examines and then analyzes them into additional skill sets that may be needed [4]. In this case, educators analyze the main tasks that students must master so that students can achieve the specified minimum competencies.

4) Concept analysis
   In a concept analysis, the main concepts to be taught are identified, put in a hierarchical form, and detail individual concepts into critical and irrelevant things [4]. Concept analysis besides analyzing the concepts to be taught also arranges the steps to be carried out rationally. This concept analysis includes competency standard analysis which aims to determine the amount and type of teaching materials and analysis of learning resources, namely the identification of sources that support the preparation of teaching materials.

5) Formulation of goals
   The formulation of learning objectives is useful for summarizing the results of concept analysis and task analysis to determine the behavior of the research object [4]. The summary will be the basic foundation in compiling tests and designing learning tools to be integrated into the learning materials to be used.

b) Design

The second stage in the 4D model is design. There are 4 steps that must be followed at this stage, namely constructing criterion-referenced tests, media selection, format selection, and initial design [4].

1) Development of test standards
   The preparation of test standards is a step that connects the defining stage with the design stage. The preparation of test standards is based on the results of the analysis of the learning objectives specifications and the analysis of students. From this, a learning outcome test grid is arranged. The test is adjusted to the cognitive abilities of students and the scoring of the test results uses an evaluation guide that contains scoring guidance and question-answer keys.

2) Media selection
   Broadly speaking, media selection is carried out to identify learning media that is suitable/relevant to the characteristics of the material. The selection of media is based on the results of concept analysis, task analysis,
characteristics of students as users, and distribution plans using various media variations. The selection of media must be based on maximizing the use of teaching materials in the process of developing teaching materials in the learning process.

3) Format selection
The format selection in the development of learning tools aims to formulate the design of instructional media, the selection of strategies, approaches, methods, and learning resources.

4) Initial draft
Thiagarajan et al (1974) states that the initial design is the entire design of the learning device that must be done before the trial is carried out. This design includes a variety of structured learning activities and practice of different learning abilities through teaching practice (Microteaching).

References