

Development of Geogebra Assisted Teaching Materials Surface Area of Roving Objects

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Abstract. One of the learning activities is teaching materials. Teaching materials are very helpful for students when they have difficulty understanding the learning material. The purpose of this research is to produce teaching materials assisted by geogebra material on the surface area of rotating objects that are valid and practical. This research method uses the 4D development research method, but the researchers only arrived at the 3D stage of defining, designing, and developing. The research instrument used a validation sheet of 2 material experts and 1 media expert. The results of the study obtained that teaching materials assisted by geogebra material on the surface area of rotating objects were valid and practical. The average acquisition of expert validation is 3.90, which means that the average score of expert validation is in the good category and is feasible to be tested. The results of the questionnaire response analysis and direct interviews, it can be concluded that these teaching materials help students learn the material because they are considered easy to understand and lead students to find problem solving using geogebra.

Key words: teaching materials; geogebra; surface area of roving objects.

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INTRODUCTION

Technological developments are so fast that it affects various existing media. This encourages people to be more creative in managing science so that they are able to change the mindset of humans to be able to think effectively and efficiently so as not to be left behind in developments in the world of information and communication technology. The development of information and communication technology currently involves the multimedia field because it is effective in conveying information.

The use of learning media is one element that plays an important role in the learning process in addition to the methods used in teaching. (Hamalik, 2008), suggests that "the use of learning media in the learning process can increase new desires and interests, generate motivation and stimulation of learning activities, and even bring psychological effects on students".

One field of study that plays an important role in the quality of education is mathematics. This can be seen from the time hours of learning mathematics are more than other subjects. Mathematics is an important subject in the world of education because mathematics covers all aspects of life, we cannot be separated from mathematics in everyday life such as counting,

determining shapes, determining sizes and others, so mathematics is mandatory to learn. Mathematics is not just a collection of formulas that must be memorized, but an abstract science.

Seeing the mathematics learning process that has been going on so far, that the learning process that occurs is still focused on the lecturer as the main source of knowledge (transfer of knowledge from lecturers to students) and the use of models and learning methods has not varied in the classroom. This is one of the weaknesses of the learning process in schools, meaning that the learning that is carried out lacks effort in involving and developing the active process of students so that learning Mathematics is still less effective. because the activities carried out are sitting, listening, and taking notes.

In Mathematics there are various materials that are taught, be it about surface area, circumference, volume. lecturers as student facilitators in learning must package learning to make it more interesting for students by using appropriate techniques and methods. As one example through a discussion or practice model. but the idea has not been able to increase the enthusiasm of the students because in its delivery it is not packaged in an attractive manner.

Based on the results of the researcher's observations, student involvement in the learning process has not been maximized. Learning is still

oriented towards lecturers. Lecturers explain the subject matter using textbooks and student learning materials because these books are the handbooks for students and lecturers. In the calculus course, the average daily test value for the material has a very low surface area, which is 68.00. This greatly affects the teaching and learning process, thus lecturers will develop teaching materials that can make students enthusiastic about learning so that learning objectives are achieved.

Teaching materials are components that must exist in learning (Hernawan, Permasih & Dewi, 2012). Teaching materials that contain learning materials, methods and evaluation of learning (Magdalena, I., Sundari, T., Nurkamilah, S., Nasrullah, N., & Amalia, 2020). According to (Khulsum, U., Hudiyono, Y., & Sulistyowati, 2018), teaching materials have competencies and sub-competencies in them. From the understanding of the experts above, it can be concluded that teaching materials are one of a set of learning processes used by educators that contain learning materials, learning methods, learning evaluations and support learning competencies and sub-competencies.

Teaching materials in which there are elements of technology, then these teaching materials will make students more interested so that in the teaching and learning process there will be no more boredom in the classroom. The technology used is the geogebra application. Geogebra is a very simple and easy to understand math application. With the help of this geogebra application, the teaching materials made will be easier for students to understand, especially on the surface area of rotating objects.

Geogebra helps the teaching and learning process of mathematics (Femmy, 2020). Geogebra is a software that combines algebra, geometry and calculus material (Bernard, M., & Sunaryo, 2020). Geogebra can present mathematical learning models (Simbolon, 2020). From the definitions above, it can be concluded that Geogebra is a mathematical software that combines algebra, geometry and calculus material so that it can present learning models into the teaching and learning process.

The purpose of this study was to produce geogebra-assisted teaching materials on the surface area of rotating objects that are valid and practical. For the purpose of this study, researchers are expected to be more careful in making teaching materials so that the research objectives are achieved as expected.

METHODS

This research includes research and development (Research and Development). This study aims to produce products with valid and practical quality. The product developed in this research is geogebra-assisted teaching materials. The method used was adapted based on the characteristics of the form of development of teaching materials. This method provides an advantage for designers to produce comprehensive teaching material products and can be developed according to the characteristics of the material that will be used as a reference in the development of teaching materials. This method consists of the 4D method or the Thiargajan model (Ratiyani, 2013) which is used as the basis for determining the model of teaching materials.

The 4D method consists of define, design, develop and disseminate steps. The define step is used to define and define the development requirements starting with an analysis of the objectives of the material to be developed (Khasanah, A., & Mulyatiningsih, 2017). This step includes 4 main steps, namely curriculum analysis, material analysis, campus analysis, and formulation of learning objectives. This step consists of media selection, format selection, and initial design (Prabawati, M. N., Herman, T., & Turmudi, 2019). This phase is intended to prepare the design of teaching materials and pay attention to the format from the beginning to the end (Yuliasuti, R., & Soebagyo, 2021). In the development step, it aims to modify the product developed by evaluating and revising before it becomes a valid and practical product and has a potential effect so that it can be applied in the learning process (Dewi, T., Risma, P., & Oktarina, 2019). Thiagarajan divides the development stage into two activities, namely: expert appraisal and developmental testing. Expert appraisal is a technique to validate or assess the feasibility of the product design that has been produced. In this activity an evaluation is carried out by experts in their fields. While developmental testing is a product design trial activity consisting of individual trials.

RESULTS AND DISCUSSION

Several analyzes were carried out to obtain information related to the teaching materials to be designed. According to Wahyuni et al (2022), the stages of analysis consist of needs analysis, student character analysis, and curriculum analysis. Curriculum analysis and student

characteristics were conducted by interviewing mathematics lecturers. From the results of interviews, obtained information related to the teaching materials used, academic abilities and student character. According to the mathematics lecturer, the students' lack of attention in participating in the mathematics learning process and the students' difficulties in understanding the learning materials were obstacles faced by the lecturers in achieving learning objectives. Therefore, it is necessary to develop a teaching material that is in accordance with the characteristics of students. Learning resources that have been used by students to study are books in the campus library. Most of the students do not have these learning resources, and they just wait and just accept what the lecturers say in class. Therefore, teaching materials are needed that are made by the lecturers themselves as an effort to motivate students to learn. Researchers are advised to design teaching materials that are easy to understand and can be used when studying independently.

Furthermore, the selection of materials that will be used in teaching materials first goes

through the process of analyzing the results of interviews with mathematics lecturers. From the results of the interview, the material of the surface area of the rotating object is used. The materials are identified, collected and arranged systematically. This teaching material is designed using the geogebra application as a reference for preparation, which in this teaching material describes each stage of using the geogebra application, which can make students learn independently. Learning objectives are also formulated so that the material presented does not deviate from the original purpose.

Furthermore, in the context of developing teaching materials, at this step the researcher has made an initial product design from teaching materials that is in accordance with the content framework of the results of curriculum analysis that is adapted to the use of geogebra applications in student learning activities. Making the design includes a cover, material, activity steps, sample questions (Agustianingsih, Lusiana, & Kesumawati, 2021). The following is an example of the design of teaching materials developed:



Picture 1. Cover Page of Teaching Materials

The development step is the product realization step. In this step, product validation is carried out by experts. Validation is carried out until the product is finally declared feasible to be implemented in learning activities.

After making the teaching materials, it is continued with the product design validation step. The validation used is content validation. This study involved one lecturer in mathematics education and one lecturer in informatics education. Each validator provides assessments, suggestions, and comments on the teaching materials that the authors develop to see the

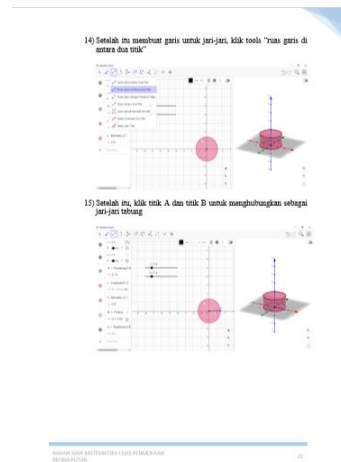


Figure 2. Design of Teaching Materials

feasibility of the product as teaching materials.

Based on the validation results, draft 1 of teaching materials still needs to be revised. Some validator inputs are:

1. Page numbering needs improvement
2. The table of contents is still ambiguous
3. Margin format needs to be fixed

Based on the results of the validation, it can be seen that the mathematical teaching materials for the surface area of rotating objects using the help of geogebra have been carried out 2 times, starting with draft 1 which was validated by both validators. Based on the suggestions and

comments of the validator, the authors improve the teaching materials that the authors developed to become draft 2. After that, draft 2 was re-validated by 2 validators in this second validation step, the validator has stated that the mathematics teaching materials for the surface area of rotating objects use the help of geogebra that the authors developed has been declared good and can be used as teaching material in learning without revision.

This validation is done by giving a questionnaire to the validator. From the product validation data by the validator, the average expert validation is 3.90. Based on the validation level criteria, the average expert validation score is in the good category and is feasible to be tested.

CONCLUSION

From the results of research and analysis that has been carried out, it is found that the surface area teaching materials of geogebra-assisted rotating objects that have been developed are considered valid and practical by learning media experts and mathematicians. In addition, the teaching materials received positive responses from lecturers who had used them. The responses of lecturers who have used these teaching materials, among others, are that the teaching materials are easy to understand and very helpful in working on practice questions using the geogebra strategy step.

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