



Development of Interactive Learning Media Based on Geogebra Classic 6 to Improve Mathematical Communication on Solid Geometry

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Abstract. *This study aims to determine: Showing an interactive learning media of mathematics on students' mathematical communication skills as a whole, The magnitude of the influence of using Geogebra-based interactive learning media on mathematical communication abilities based on educational level, the magnitude of the effect of using interactive mathematical learning media on mathematical communication skills based on previously used interactive learning media, the large influence of the use of interactive learning media plays an important role in systematic mathematical methods, the large effect of the use of interactive learning media on mathematical communication skills is imaginative to mathematical communication based on the mathematical ability that is measured. This study uses the addie model. This sampling technique is highly influential using the Addie model and obtained 20 studies that match the criteria. This data collection technique uses freetest and posttest with the help of Geogebra Classic 6 software and the help of Microsoft powerpoint. The results of this data experiment show that: overall this interactive learning media has a major influence on students' mathematical communication abilities.*

Keywords: *Indeks Prestasi Akademik, Prestasi, Akademik, Mahasiswa Program Studi Pendidikan Matematika.*

Abstrak. Penelitian ini bertujuan untuk mengetahui: Menunjukkan media pembelajaran interaktif matematika terhadap kemampuan komunikasi matematis siswa secara keseluruhan, Besarnya pengaruh penggunaan media pembelajaran interaktif berbasis Geogebra terhadap kemampuan komunikasi matematis berdasarkan tingkat pendidikan, Besarnya pengaruh besarnya pengaruh penggunaan media pembelajaran interaktif terhadap kemampuan komunikasi matematis berdasarkan media pembelajaran interaktif yang telah digunakan sebelumnya, besarnya pengaruh penggunaan media pembelajaran interaktif berperan penting dalam metode matematika sistematis, besarnya pengaruh penggunaan media pembelajaran interaktif terhadap komunikasi matematis keterampilan komunikasi matematis imajinatif berdasarkan kemampuan matematis yang diukur. Penelitian ini menggunakan model addie. Teknik pengambilan sampel ini sangat berpengaruh dengan menggunakan model Addie dan diperoleh 20 penelitian yang sesuai dengan kriteria. Teknik pengumpulan data ini menggunakan freetest dan posttest dengan bantuan software Geogebra Classic 6 dan bantuan Microsoft powerpoint. Hasil percobaan data ini menunjukkan bahwa: secara keseluruhan media pembelajaran interaktif ini berpengaruh besar terhadap kemampuan komunikasi matematis siswa.

Kata kunci: Indeks Prestasi Akademik, Prestasi, Akademik, Program Studi Pendidikan Matematika.

INTRODUCTION

The development of technology in the twenty-first century is now growing very rapidly, not only developing as a medium for social interaction or often called social media, but also developing in the field of education. Almost all components in education involve technology. The teaching and learning process can not be separated from technology. Information technology today, must be integrated in all subjects, not least in mathematics subjects. With the advancement of technology, the development of education in schools is increasingly experiencing change and encouraging various changes. Education in schools has shown rapid development in the areas of curriculum, methodology, equipment, and assessment. Likewise, there have been changes in the field of education administration, organization, personnel (HR), and educational supervision. Therefore, overall it can be said that the changes that occur are a renewal in the education system that concerns all aspects or components that exist (Sanaky, 2013:1)

Talking about the quality of education, can not be separated from the learning process in the classroom. Learning and learning activities in the classroom are actions and abilities that involve each teacher and student together to achieve a goal that improves the quality of education rationally. So it is expected that with the change in the progress of the times in the field of science and technology, with the advancement of science and technology will be able to influence the mindset of educators in facilitating the learning needs of their students, one of which is in the use of learning media. With the existence of interesting learning media such as impressions or displays generated from learning media delivered by teachers using the curriculum. Curriculum is a plan that is prepared to launch the teaching and learning process under the guidance and responsibility of the school or educational institution and its teaching staff, as well as events that occur under the supervision of the school, so in addition to formal culinary activities as well as informal activities. This curriculum is intended to be able to direct education towards the intended direction and objectives in thorough learning activities. Some of the components in question include: (1) objectives, (2) teaching materials, (3) learning and learning activities, (4) methods, (5) learning tools, (6) learning sources, and (7) evaluations (Ekayani, 2017).

In Indonesia, efforts to develop formal education are also carried out at various levels, ranging from primary, secondary, to national education, as contained in the National Education System Law No. 20 of 2003 Article 3 (Wikipedia.org) which reads: "The purpose of national education is to develop the potential of learners to become human beings who believe and fear God Almighty, be noble, healthy, knowledgeable, capable, creative, independent, and become a democratic and responsible country".

But in reality the quality of education in Indonesia is still relatively low, especially in the field of mathematics. This can be seen from the results of The Third International Mathematics and Science Study (TIMSS) 2015, Where Indonesia is in the position of 45 out of 50 countries with a score of 397 and the score is still below the average international score of 500 (Puspendik.2016). This should be a very important concern for the government to improve the quality of education, both in terms of curriculum, quality of educators, facilities and infrastructure and other matters related to education. Many teachers have not been informed due to the lack of comprehensive socialization regarding the application of this curriculum. Teacher training in implementing learning in accordance with the 2013 curriculum is still uneven, both in the manufacture of RPP and in the maximum use of learning media and props (Siregar, 2017).

There are two important reasons why the learning media can enhance the teaching and learning process expressed by Sanaky (2013). The first reason, with regard to the benefits of media in the learning process, among others: (1) Learning will attract more students so as to faster learning motivation; (2) The method of learning will be more varied, not solely verbal communication through the teacher's speech of words by the teacher, so that learners do not get bored and the teacher does not run out of energy, if the teacher must teach for every hour of the lesson; (3) The learning material will be clearer can be better understood by learners and allow learners to master learning goals better; (4) Learners do more learning activities, because not only listen to the teacher's description, but also other activities such as observing, doing, demonstrating, and others. The second reason, pleasing to the level of thinking of the learner. Human thinking levels follow the stage of development, starting from concrete thinking to abstract, starting from concrete thinking to abstract, starting from simple thinking to complex thinking. By using the medium of learning well, abstract things can be condensed and complex things can be simplified (Sanaky, 2013).

In addition, learning media has a role to influence the learning process in the classroom. Based on the results showed that a person's knowledge is obtained from hearing experience 11%, from vision experience 83%. While memory is in the form of darkening obtained from what is heard 20%, from the experience of what is seen 50%. When viewed from the ability to see higher, the position of interactive learning media is very strategic, because the ability of learning media can: (a) stimulate the learning process, (b) present the original object directly, (c) make things abstract to the concrete, (d) give equal perception the barriers of time, place, number and distance, (f) re-present information consistently, and (g) provide a relaxed learning atmosphere (Sanaky, 2013).

LITERATURE REVIEW

A. Theoretical Framework

Research and Development is a process or steps to develop a new product or improve an existing product, which can be accounted for. Strategies to develop an educational product by Borg dan Gall (Setyosari, 2016). The purpose of this development research method is used to produce specific products in testing the effectiveness and usefulness of the product, as well as knowing how learners and educators respond to the products developed. Development research consists of two words, namely research (research) and *development* (development). The first activity is to conduct research and literature studies to produce a specific product design, and the second activity is development that is testing effectiveness, validation of the design that has been made, so that it becomes a product that is tested and can be utilized by the wider community

According to Puslitjaknov-Balitbang Depdiknas (2008) Research and development methods contain three main components, namely 1) development model, 2) development procedures, 3) product trials. Research and development is a model used to improve the quality of education and learning that is able to develop various learning products. The development model is the basis for developing the product to be produced. Development models can be procedural, conceptual, and theoretical models. A procedural model is a descriptive model, showing you the steps you need to follow to produce a product. Conceptual model is an analytical model that mentions the components of the product, analyzes the components in detail and shows the relationships between the components to be developed. A theoretical model is a model that describes a frame of mind that is based on relevant theories and supported by empirical data. (Sugiyono.2016)

Research and development generally applies broadly to the terms of purpose, personal, and time as complements. Products are developed to know certain needs with detailed specifications. When resolving certain needs with detailed specifications. Although the research and development cycle is expensive, it produces quality products designed to meet the needs of the field of Education. Based on this definition development research as distinguished by simple learning development, is defined as the systematic study of designing, developing, and evaluating programs, processes, and learning outcomes must make of consistency and effectiveness internally.

B. Learning Media

The word media comes from Latin and is the plural form of the word medium literally meaning intermediary or introduction (Sadiman, 2009:6). Arabic, media is the intermediary or delivery of messages from the sender to the recipient of the message. Many understandings are given to the word media, so that the boundary between understanding one another sometimes becomes blurred, especially for the word learning media. According to Wahyuningtyas dan Shinta (2017 : 9), Learning media is everything to convey the message of learning so as to stimulate the mind, interest and attention of students. The role of learning media cannot be separated from learning activities Wahyuningtyas dan Shinta (2017 : 9) The learning media has several functions, the function of the learning media is :

1. Can clarify the delivery of messages and information so as to facilitate learning and improve achievement,
2. Can direct students' attention to the material, so that it can lead to motivation to learn,
3. Can provide experience to students and can relate to the daily life.

In utilizing the medium of learning should not be arbitrary according to the wishes of the teacher, unplanned and not systematic. Teachers must take advantage of it according to certain steps there are six steps that teachers can take at the time of teaching by using media. These steps are:

- a. Formulate learning goals by utilizing media
- b. Teacher preparation, in this phase students or classes must have preparation, before they receive a float using media. Teachers must be able to motivate them to be able to assess, anticipate, live lessons by using learning media

- c. Class preparation, in this phase students or classes must have preparation, before they receive a float using media. Teachers must be able to motivate them to be able to assess, anticipate, live lessons by using learning media
- d. Step presentation of lessons and uses of media, in this phase the presentation of lesson materials by utilizing learning media. The teacher's skills are demanded here. Media developed for the effectiveness and efficiency of achieving goals.
- e. Step student learning activities, in this phase students learn by utilizing learning media. The use of media here can be students themselves who practice it or teachers directly use it, either in the classroom or outside the classroom
- f. Learning evaluation step, in this step the activity is evaluated, to the extent to which the teaching objectives are achieved, which at the same time can be assessed the extent to which the influence of the media as a tool can support the success of the student learning process. The results of the evaluation can be used as a basis or material for the next learning process.

RESEARCH METHODS

- **Types of Research**

This research includes research and development or research and Development (R&D) using the ADDIE development model. This research focuses on the development of Geogebra-based interactive learning media on solid geometry (Pyramid and Block).

- **Place and time of research**

This research was conducted in Mathematics Education and the class to be given research and development of interactive learning media is class VIII junior high school. The research will be conducted in the odd semester of the study year 2022/2023.

- **Research Subjects**

The subjects in the study were middle school year 2021/2022 students who were willing to come to school, while the object in the study was geogebra-based interactive learning media on solid geometry (Pyramid). The next subject there is 1 class of 20 students. In class A and then there is 1 class numbering 20 students and class B in classroom VIII junior high school for field implementation tests and interactive learning media trials.

- **Data Collection**

Kuesioner A test is a spate of questions or exercises or other tools used to measure the skills, knowledge, intelligence, abilities or talents possessed by an individual or group. The test used by researchers in this study is a post test. Post test is a test used to measure whether students have mastered certain competencies as formulated in the indicator of learning outcomes. Tests are a tool for collecting data on this study. The same test question is given to students after carrying out the learning process. Test questions are used to find out the results of students. In classes who are taught using open and learning media. Data from assessment of the use of book development products and learning media against students in the analysis using effectiveness analysis.

- **Development Model**

In the development of geogebra-based interactive learning media, this research is used by the ADDIE development model. The ADDIE model was chosen because it is simple and can be done gradually or systematically to produce a product that is worth using. Model ADDIE (Sugiyono, 2015 : 200), contains several stages that can be used to design and develop an effective and efficient program, where the stages are: a) analysis (analyzing); b) design (design); c) development (develop); d) implementation (implement); e) evaluation (evaluating). The core of activities at each stage of development is also almost the same. Therefore, this model can be used for various forms of product development such as models, learning strategies, learning methods, media and teaching materials. Describes the ADDIE development design stage as met:

1. Analysis Stage
2. Stage Design
3. Development Stage
4. Implementation Phase
5. Evaluati

HASIL DAN PEMBAHASAN

Bagian ini This research is a development research, so the product of this research is a learning media using Geogebra Classic 6 Software assisted by Microsoft Powerpoint on the material of flat sided pyramids and beams. The purpose of this study was to describe (1) the validity of learning media using Geogebra software and (2) the practicality of learning media using Geogebra software (3) the process of developing learning media using Geogebra classic 6 software (4) the resulting form of developing learning media using software Geogebra Classic 6. Description and analysis of research data obtained from each stage of development are presented, which is:

Description of Learning Media Development Result

1. Analysis Stage

a) Needs Analysis

In the needs analysis process, identification was carried out through an interview process which was conducted by researchers directly at UPT SMPN 1 Medan on October 12, 2022. The results of the interview with the teacher, namely Mrs. Juliana, S.Pd. that the problem that often occurs with learning mathematics is that students' interest in learning mathematics is very lacking and students' desires are not good, then the media used in the learning process of mathematics is inadequate and inappropriate, then some students experience difficulties in participating in learning because students do not understand material that has been conveyed by the teacher in the classroom and students who are embarrassed to ask about material that they do not understand. In addition, the use of instructional media is also limited because teachers are still not used to using technology as an interactive learning medium.

b) Curriculum Analysis

The curriculum that is run at UPT SMPN 1 Medan is an independent learning curriculum. The material developed in this study is the material for flat sides, namely pyramids and beams. There are basic competencies and indicators of achieving competence in flat sided space construction materials. The learning objectives set in the learning media that have been developed in the flat sided space build material are:

1. Students are able to explain the meaning of flat side shapes (Limas and Beams)
2. Students are able to find the formula for the volume, surface area of a flat side shape (Limas and Blocks)
3. Students are able to solve the problem of applying flat side shapes.

c) Analysis of Student Characteristics

Based on the results of a brief discussion with UPT students of SMP Negeri 1 Medan, that learning is applied to mathematics during the Covid-2022 pandemic by holding meetings 4 times a week with limited people and time and implementing health protocols, resulting in less effective learning, because when learning takes place online, students are told to do assignments with student handbook sources tend not to do assignments because of a lack of students understanding the material.

d) Analysis of Media Characteristics

Media is needed in the learning process, because the media can help the learning process in the classroom. In the current learning period the characteristics of the media are needed because it can attract the attention and interest of students and can also be used in distance learning. Media is very necessary, by utilizing existing technology both with visuals collaborated with audio can create learning media that can help students understand the material that will be taught by the teacher.

e) Condition Analysis

The learning conditions at UPT SMP Negeri 1 Medan, specifically learning mathematics, are not optimal due to several factors. The learning process that occurs at UPT SMP Negeri 1 Medan is carried out face to face and online, therefore it is necessary to have a variation in the teaching and learning process so that learning conditions can run optimally, with the use of learning media, conditions like this can be implemented. overcome, therefore the need for innovation and creativity in producing learning media that can help students understand the learning process both face-to-face and online, the researchers came up with an idea, namely the development of mathematics learning media based on Geogebra Classic 6 Software assisted by Microsoft Powerpoint to increase the effectiveness of class VIII flat sided space construction materials.

2. Stage Design

- **Designing the menu bar and button bar**

The learning bar menu is made in interactive learning media in flat sided building materials like ordinary learning but the form is in the form of animation. As for filling in the geometric graphs of each corner and rib of the image which was made by the researcher himself named Hendri Johan Tambunan, before designing the menu bar, the display must first be adjusted to be used with a unique and interesting background, when explaining the material, the researcher adjusting the appearance of the image according to the explanation with the material presented in Microsoft powerpoint and in the interactive learning Geogebra Classic 6 Software application that has been designed, after that each menu bar

will be edited and positioned according to what the researcher wants then the researcher inserts a hyperlink that has been connected to Geogebra Classic 6 software into rectangles and circles with hyperlinks

- **Preparation of Instruments**

The preparation of the instrument aims to collect data at the time of research. The compiled instrument must be validated in advance by experts or validators, if the experts or validators state that the instrument is feasible to try out, the researcher can test the instrument for expansiveness. The instrument that will be validated in this study is:

- a) Media validation sheet
- b) Material validation sheet
- c) RPP validation sheet
- d) Test validation sheets, namely freetest and posttest

3. Stage Development

Development stage is the manufacturing stage up to the review stage by media experts and material experts as well as making revision improvements submitted by media experts and material experts. Making this media begins with designing, compiling the menu bar, and editing to produce unique and interesting media. The application that helps in making this media is to use Microsoft Powerpoint which can be accessed which can be specifically designed for making interesting animations with certain specifications. The resulting interactive learning media is in the form of neatly arranged animations and can assist students in improving mathematical communication on flat sided geometric material.

4. Stage Evaluation

The evaluation stage is carried out in order to correct errors and deficiencies in the learning media that have been developed using the Microsoft Power Point application on flat sided geometric material. At the development or development stage, improvements are made through suggestions and input from the validators, then tested at the implementation stage. After conducting trials, at the evaluation stage the responses and suggestions were given by the teacher and students, through a questionnaire that the researchers had given to teachers and students, in terms of giving responses to interactive learning media used to further refine the interactive learning media that had been developed.

Discussion

Based on the development procedure carried out in this study, the ADDIE development model was used in which the first stage was the Analysis stage, the second stage was the Design stage, the third stage was the Development stage, the fourth stage was the implementation stage. Implementation), the fifth stage is the Evaluation stage, which is the result of the development of this research is learning media in the form of Geogebra Classic 6 Software which is made using the Microsoft Power Point application on flat sided geometric material, but even though it is already in the very feasible category, there are still suggestions and input from media experts to maximize learning media to be even better. The material in the learning media in this study was also validated through a questionnaire. The average assessment made by material experts on the material in learning media is 92.09% with a very decent category, even though the material in the learning media has been said to be very feasible, but there are still suggestions and input on the material in the learning media so that the material in the learning media even better interactive.

Furthermore, the implementation was carried out at UPT SMP Negeri 1 Medan by implementing learning media and test instruments that had been validated beforehand, therefore the researchers processed the responses of teachers and students through questionnaires given to teachers and students who took part in learning using learning media. In the student response questionnaire, the responses given had an average of 60.8 out of a maximum score of 75, so based on the student response questionnaire the practicality percentage of 82% was included in the very practical category and for the teacher's response questionnaire with an average total of 93 out of the maximum score 100 so that the meaning of practicality according to the teacher's response is 92% and is included in the very practical category.

The drawbacks that occur during research at school are that the size of the classrooms at school is not too large, while the learning program from the school is that interactive learning based on Geogebra Classic 6 is carried out offline and online by making a learning schedule alternately or alternately such as learning Wednesdays. offline, online learning is carried out on Tuesday, so as a result the class room is not too large. for next Tuesday, students who take part in offline learning are students with absent numbers 12 to 22, and so on so that offline learning is also carried out alternately with their friends. Furthermore, the teacher's lack of understanding to make Geogebra Classic 6 Software so that most teachers provide interactive learning media so that most teachers do learning through passive media, namely printed books. Furthermore, there are still many students who don't have laptops to download the Geogebra Classic 6 Software application, only 10 people bring laptops and download the applications that are told

by researchers, so students who don't have laptops for assignments given by the teacher must be handed over to the teacher by coming to school on the day and time determined by the teacher concerned, while for students who have laptops the assignments given to the teacher are given online via GoogleForm and whatsapp by sending assignments. When the researcher gave an assignment link in the form of a Googleform link to students, many students who did not have laptops complained that they could not see videos on the researcher's YouTube, so students who did not have laptops could also learn through videos shared by researchers on the researcher's YouTube.

CONCLUSIONS AND SUGGESTIONS

- **Conclusion**

Based on the results of previous research and discussion, the conclusions of this study are as follows.

1. This interactive learning media using Geogebra Classic 6 Software on the building material of the flat side space of Limas and Beams has a validity percentage of 89% with the Valid category, so that the learning media developed can be katakana valid.
2. Interactive learning media using Geogebra Classic 6 Software on the building material of the Limas and Blok flat-sided spaces has a percentage of practicality from the results of the teacher response questionnaire and the category is very practical, so that the learning media developed can be said to be practical.

- **Suggestion**

This research was carried out only on validity tests and practicality tests, so that learning media using the Geogebra Classic 6 software has not been tested effectively if used in mathematics learning in schools. Learning media using geogebra classic 6 software is only developed on the building material of the flat side space of Limas and Beams, so it is hoped that it can also be developed on mathematics learning materials limas and Blocks and bia used also in other mathematics learning studies for further research.

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