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ABSTRACT (Book Antiqua)

This study aims to find out the magnitude of the increase in the activity and achievement of mathematics learning at SMA Negeri 14 Medan. Problem-based learning is a learning that starts with real-world problems so that students can construct their own knowledge with their thinking skills. Geogebra is used to visualize the mathematical material to be transformed. Through the visualization process, students try, reason, and finally can find the concept of transformation. By implementing a problem-based learning model that utilizes geogebra software, it can improve students' understanding of concepts, reasoning, critical thinking skills and mathematical communication.

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INTRODUCTION

Mathematics learning at school is learning that refers to the three functions of mathematics subjects, namely, as tools, mindsets and science or knowledge. Where the study materials for mathematics are in the form of arithmetic, measurement and algebra. Two important things that are part of the purpose of learning mathematics are the formation of traits by thinking critically and creatively. This is in accordance with the standards for primary and secondary education units of mathematics subjects (Regulation of the Minister of National Education No. 32 of 2013 concerning National Education Standards) has stated that mathematics subjects need to be given to all students starting from elementary school to equip students with the ability to think logically, analytically, systematically, critically and creatively. learning from students who are informed to students who find out, the assessment process from output-based to process-based and output-based and balancing soft skills and hard skills. One of the hard skills required in the 2013 curriculum and 21st century competencies must be built is the ability to think critically (Hasibuan 2016).

Computer learning media is applied at the stage of concept planting, concept understanding and mastery skill development. The learning stage of concept understanding emphasizes mastery and expansion of insights. Meanwhile, the learning stage of developing concept mastery skills focuses on fostering students' skills to apply the concepts that have been learned (Vormes Gema Merdeka, Najwa Zahratul, Diar Dwi Sutia and Muhammad Gani Baihaqi Darussalam4, Ridha Febriliana, Riska Putri Anggraini 2022).

Geogebra is a software created by Markus Hohenwarter in 1976, to solve geometry and algebra. It has a GNU (General Public License), so that the program can be downloaded and used and developed by its users. Dynamic geometric parts that support all image constructions, points, lines, and curved curves (such as circles, ellipses) (Parinduri, Hutagalung, and Panjaitan 2021).

Problem-Based Learning (PBM) is adopted from the English term, Problem Based

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Instruction (PBI) states that the problem-based learning model is a learning model where students work on authentic problems with the intention of compiling their own knowledge, developing higher-level inquiry and thinking skills, developing independence and confidence (Hasibuan 2016).

METHODS

Place and Time of Research

The implementation of the research was carried out in the mathematics learning process at SMA Negeri 14 Medan.

Research Methods and Design

The description of the research stages is as follows:

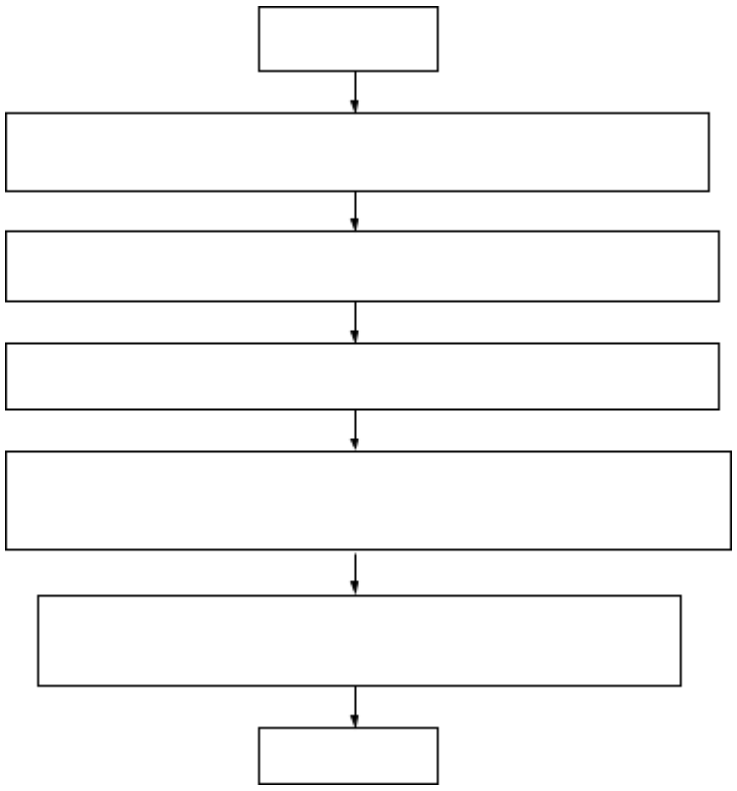


Figure 1. Flow Chart of Research Implementation Methods

Activity Implementation Method

The implementation method of this research activity consists of:

1. Formulation of a literature review of mathematics materials
2. Installation of *Geogebra software* on students' laptops
3. Data Input Mathematics Lesson to *Geogebra Software*

Implement a problem-based learning model

4. The output of the math lesson simulation display.

Preparation and Planning

In the implementation of this research, it is necessary to pay attention to the preparation and planning which consists of:

1. Formulating the concept of mathematics subject matter
2. Geogebra software *installation*

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3. Concept of Mathematics Subject Matter inFacing *Geogebra Software*
4. Implement a problem-based learning model
5. Analysis of the simulation display of mathematics material

RESULTS AND DISCUSSION

So far, the teaching process at SMA NEGERI 14 MEDAN in mathematics subjects is still carrying out the teaching and learning process using books and LKS (Student Worksheets) both in explaining formulas and image displays, both graphs and results, where there is ineffectiveness in teaching or it is said that teaching is only one-way.

Implementation materials consist of visualization materials:

Quadratic Equation Material (Equation Graph)

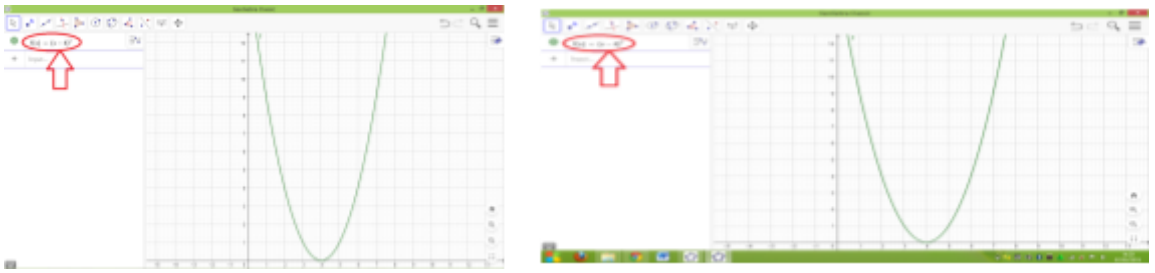


Figure 2. Display of Quadratic Equation Input Results

Certain and indeterminate integrals

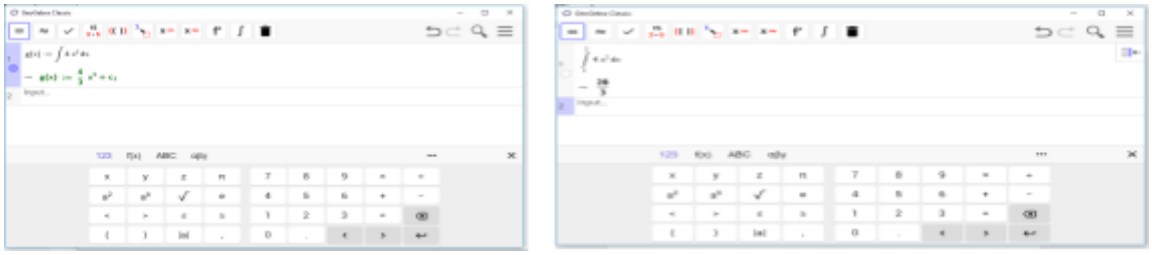
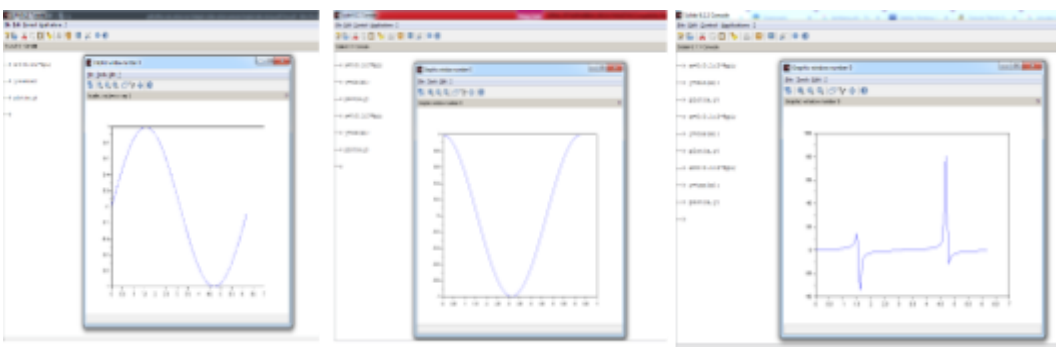


Figure 3. Display of Input Results on Integral Equations



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Figure 4. Integral Equation Graph Result Display

Calculation of the Volume of a Rotating Object

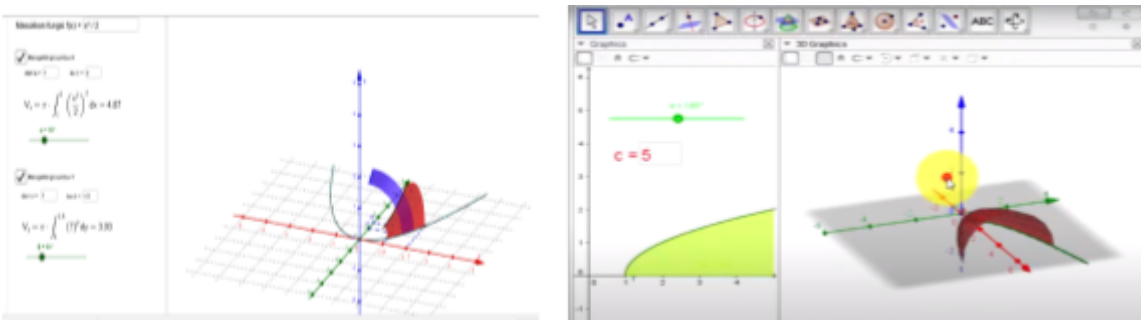


Figure 5. Display of the Equation of Volume of a Rotating Object



Figure 6. Researcher Delivering Material

Discussion

By using the Geogebra *application*: Graphs, algebra and tables are dynamically connected; Easy to use has advanced features, *authoring tools* for interactive learning web pages; available in many languages, *open source* apps can be *downloaded.* So that it makes it easier for students to solve problems in mathematics lessons

The problem-based learning model is a learning model where students work on authentic problems with the intention of compiling their own knowledge, developing inquiry and higher-level thinking skills, developing independence and confidence that can increase the growth and development of student learning activities both individually and in groups.

CONCLUSION

Answering the problems that exist at SMA NEGERI 14 Medan, conclusions were obtained including: *Geogebra* software helps to explain mathematics subjects with visualization learning displays, examples of graphs and calculations. The accompanying teacher can make questions and answers to quizzes, mid-semester exams and end-of-semester exams well and can be understood by students at SMA NEGERI 14 MEDAN. By using a problem-based learning model, it can create the activeness and independence of students of SMA Negeri 14

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MEDAN in the teaching and learning process.

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