

**IMPLEMENTATION OF GEOGEBRA APPLICATION MEDIA
IN IMPROVING THE WORK RESULTS OF THREE-
DIMENSIONAL MATHEMATICS SUBJECTS IN CLASS XII
MIPA B MAN 1 BANDUNG CITY**

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ABSTRACT

The purpose of this study is to determine the implementation of geogebra application media in improving the learning outcomes of three-dimensional material subjects in class XII MIPA B MAN 1 Bandung City. The problem faced by teachers is that students still have difficulty in visualizing building space, especially understanding the concept of distance in building three-dimensional space. Student learning outcomes, it is known that the average class score on space building material is 53.47, this does not meet the Minimum Completeness Criteria (KKM). The research method used is classroom action research, which makes continuous improvements to the learning process through the stages of planning, implementation, observation and reflection. The results of the study found that in cycle 1, student learning outcomes increased to 27.40% who met the criteria, while in cycle 2 increased to 75.70% of students meeting the minimum completeness criteria. It should be noted that the use of the geogebra application requires hardware devices such as laptops and mobile phones, if all students can provide their devices, then all students can try the application on their respective devices.

Keywords: Geogebra application; Work Results; Mathematics



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INTRODUCTION

The concepts of points, lines, planes and distances are fundamental understandings in mathematics subjects, especially in three-dimensional materials. A good understanding will make students able to visualize these concepts so that they are able to measure *higher-order thinking skills or known as higher-order thinking skills* (HOTS). Noor, P. P., & Timeless, A. P. (Noor & Timeless, 2022) revealed that the problem of mathematics education at the upper secondary level is the lack of higher-order thinking skills because students are taught to memorize, write and do homework without being trained with innovative methods and media. Students have difficulty thinking at a higher level in solving three-dimensional problems, because students have difficulty in giving examples of certain concepts, student difficulties in giving namespaces, difficulty in classifying, lack of student skills in basic skills, calculation errors, procedure errors, students do not master algorithms and do not understand basic concepts. (Syahrir et al., 2013)

Dwiranata, D., Pramita, D., & Syaharuddin, S. Through observations at SMAN 1 Maronge, the results of the three-dimensional material test scores are still students who are less than the minimum average completeness score (KKM), which is 70, so teachers must do remedial. (Dwiranata et al., 2019) Often students still have difficulty in visualizing building space, especially understanding the concept of distance in three-dimensional space builds. The understanding of the fourth three-dimensional material, the basic concept of building space that is still low is also found in Class XII MIPA-B MAN 1 Bandung City. Based on student learning outcomes, it is known that the average class score on space building material is 53.47. Meanwhile, the KKM agreed by the school is 77.00. So that the percentage of students who managed to reach or exceed KKM with the agreed value of the school only amounted to less than 70%. Then, a remedial program has been carried out by teachers with the aim of getting better student grades. However, remedial that is carried out continuously is not an effective step because there is still other material that must be delivered. Remedial implementation if carried out continuously can cause other learning programs to be hampered. In addition, repeated remedial programs will reduce learning motivation in future material to study harder.

The low understanding of students about the concepts in building space is caused by several factors that result in the non-optimal value of classical KKM. Factors that can make students have a low level of understanding include: (1) learning media in the form of slides that are not enough to facilitate students' understanding to have higher-order thinking skills; and (2) the delivery of material is difficult to understand because it requires a real image as in distance material in three-dimensional space. This is in accordance with what was stated by Suryawan & Permana (Suryawan & Permana, 2020) regarding factors that affect students' understanding of mathematics, including: (1) mathematics is less preferred, especially on some topics that are difficult to imagine or solve, and (2) most students do not understand concepts because they focus too much on memorizing formulas.

GeoGebra is an interactive geometry, algebra, statistics, and calculus application designed for the teaching and learning of math, science, and engineering (Ziatdinov & Valles Jr, 2022). Its dynamic interface allows users to visualize their work, models, and results accurately and interactively. GeoGebra uses a synthesis of three main features: modeling, visualization, and programming (MVP).

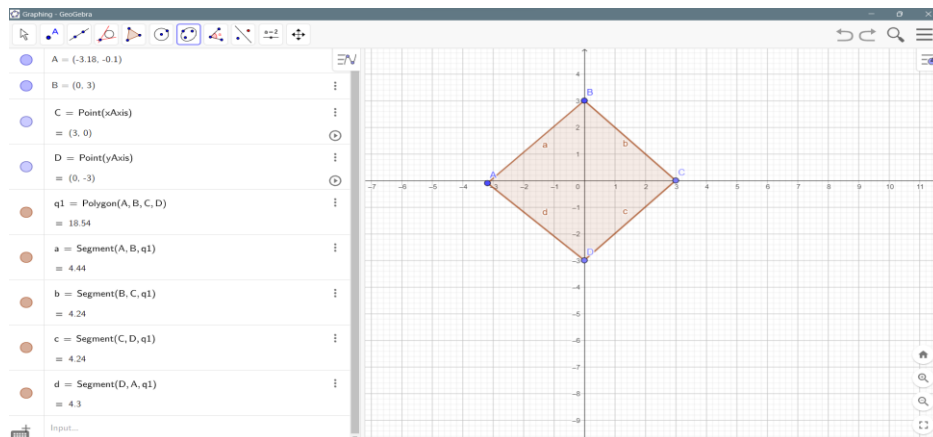


Figure 1 Geogebra application

One solution that teachers can do to solve classroom learning problems related to the four concepts mentioned earlier is to use the GeoGebra application learning media. GeoGebra was created with the intention of helping students gain a better understanding of mathematics. GeoGebra is an application that combines geometry, algebra, and calculus materials that can be used for mathematics learning media at the school level starting from elementary school (SD) to (Pratiwi, 2016) university (Hohenwarter & Jones, 2007). In addition, GeoGebra provides effectiveness for teachers in creating an interactive online learning environment while still allowing students to explore various mathematical concepts. Through the results of research Muñante-Toledo, M. F., Salazar, G. D. C., Rojas-Plasencia, K. M., & Flores, J. M. V. E. (Muñante-Toledo et al., 2021) shows that GeoGebra software has become a decisive factor in the development of mathematical competence, with emphasis on mathematical understanding, geometric reasoning, and problem solving. Therefore, based on the description above, the author as a teacher feels motivated to use the GeoGebra application media in mathematics learning and carry out research with the title: "Efforts to Improve Three-Dimensional Learning Outcomes through the Geogebra Application Media for Class XII MIPA B Students at MAN 1 Bandung City".

RESEARCH METHODS

This research is a classroom action research or classroom action research that makes improvements and changes to classroom learning. Classroom action research is characterized by continuous improvement of the learning process where these improvements are expected to improve the quality of learning in the classroom. The implementation stage is carried out through four stages, namely; planning,

execution, observation and reflection. This research was conducted at MAN 1 Bandung City in class XII MIPA B mathematics subjects of three-dimensional material. A total of 35 students were the subjects of research on improving learning outcomes through cycle 1 and 2 approaches.

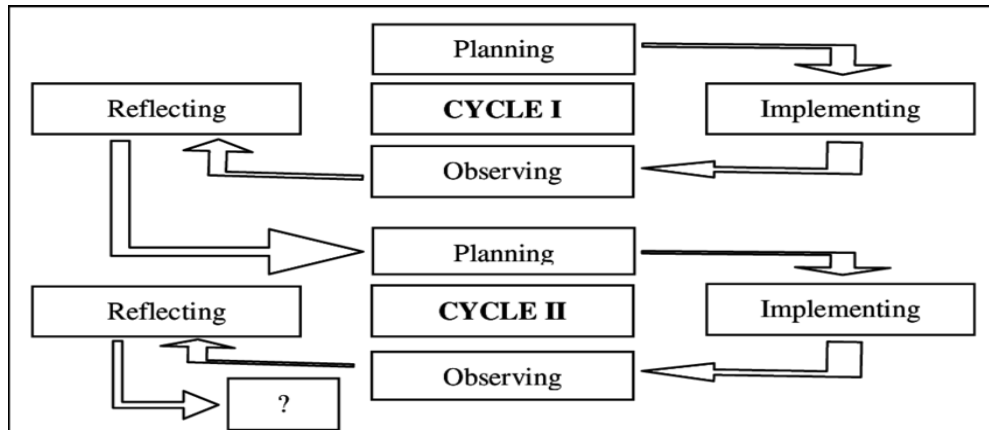
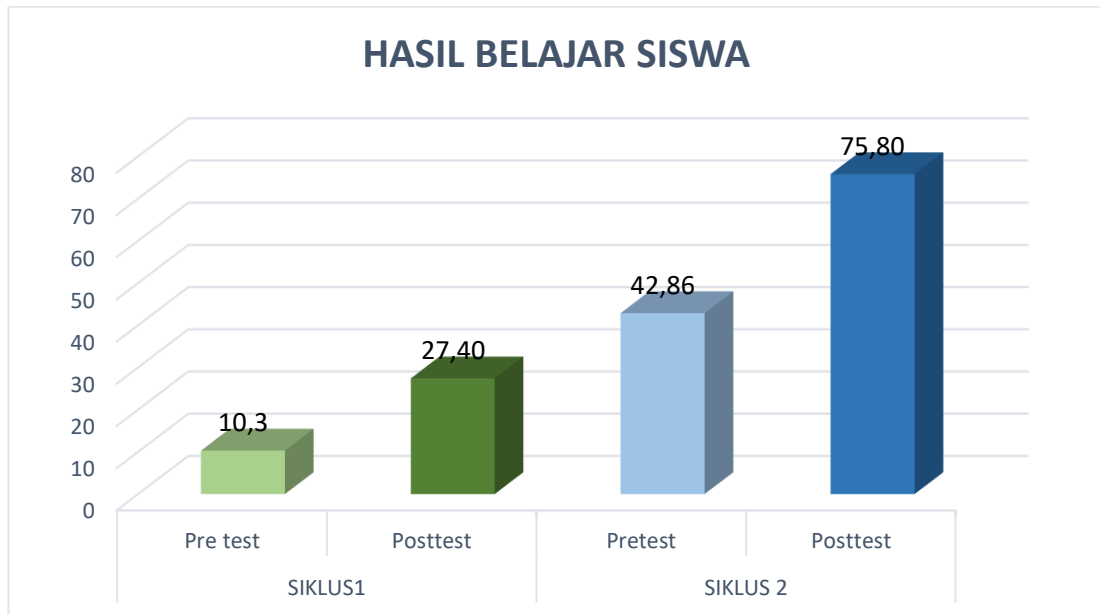


Figure 2 Classroom Action Research

Source : Arikunto, S. (Arikunto, 2021)

RESULTS AND DISCUSSION

The use of the Geogebra application to improve three-dimensional learning outcomes in mathematics subjects for class XII MIPA B MAN 1 Bandung City runs effectively. These results can be seen from cycles 1 and 2 through the process of planning, implementation, observation and reflection. Based on the assessment of student learning outcomes, that there is an increase in student understanding of the three dimensions of mathematics subjects through the geogebra application media. In the first pre-cycle, students have not used the geogebra application to understand the third dimension, so the understanding of the material regarding the 3rd dimension is still limited to concepts. Then when tested in the first cycle about the third dimension, students better understand the three-dimensional material because, the point and line material can already be visualized. Students are better able to understand the concept of three-dimensional material points and lines with the help of geogebra applications that facilitate visual drawing and imagination.



In the implementation of cycle 2, a pre-test is carried out first for students to repeat the three-dimensional material on the aspects of points and lines before continuing on the next material, namely fields and distances. It can be seen from the results of the pretest-cycle 2, students can understand the three-dimensional material better than cycle 1. This proves there is an increase in students' abilities from meeting to next meeting. Student learning outcomes in post-test cycle 2 have improved quite significantly. The use of geogebra applications on three-dimensional material aspects of fields and distances, students can understand and visualize fields and distances well. These results prove that students are more happy and enthusiastic about learning mathematics with the help of applications. Ishartono, N., et al. Conducting research using pre-test and post-test on the Geogebra application, the results also prove that this application helps students in independent learning in improving students' self-regulated learning levels in mathematics learning. (Ishartono et al., 2022) The help of this geogebra application helps students be more creative and makes it easier for students to see and sharpen their critical thinking.

The use of GeoGebra in mathematics learning is also able to help students construct mathematical concepts and improve problem-solving skills. At the secondary school level, improvements in mathematical critical thinking skills among students who learned using the Geogebra-assisted blended learning model were better than students who learned using the Geogebra-assisted blended learning model. Arbain, N., (Arnawa & Fitriani, 2022)(Samura, 2023)& Shukor, N. A. investigated the effectiveness of using GeoGebra software on Mathematics learning among 62 students in Malaysia, the results of which GeoGebra can benefit students' Mathematics learning and diversify classroom learning. (Arbaeen & Shukor, 2015) The success of using the geogebra application is not only seen from improving student learning outcomes, but how teachers perform their competencies in supporting the learning process. Observations were made by other mathematics

teachers as observers who assessed the researchers' classroom actions in implementing geogebra applications in mathematics subjects of three-dimensional material.

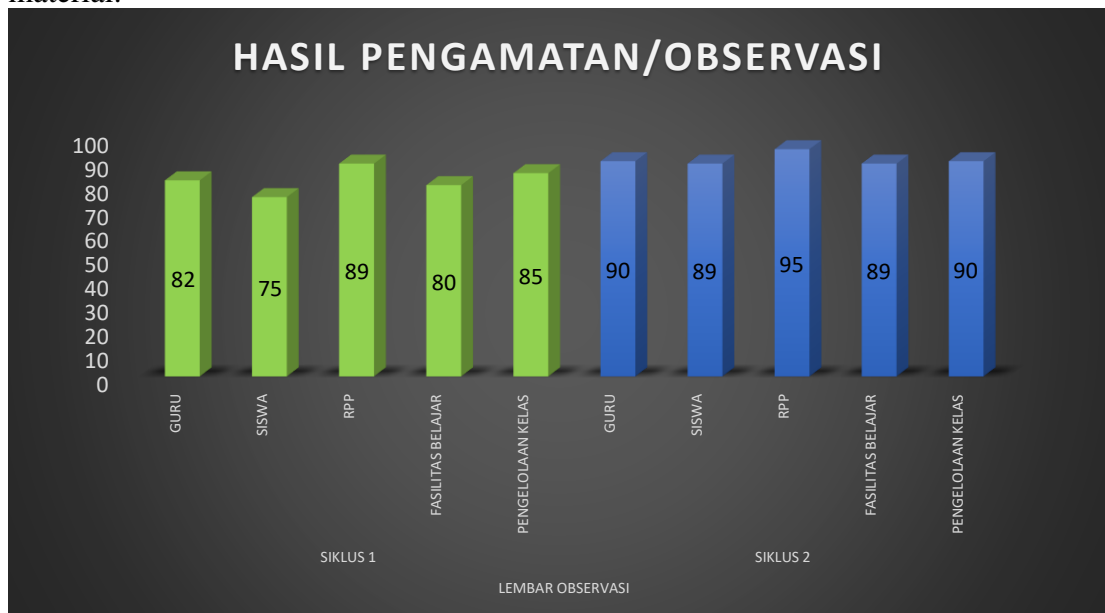


Figure 3 Class Observation Results

In the results of the observations above, observers assess that researchers / teachers carry out learning activities well. In the first cycle, there were several obstacles and obstacles, including when starting learning, some students did not bring laptops as a place to install the geogebra application, so some students had to join with friends nearby. Then, in the implementation of the first cycle, time constraints in installing the geogebra application on laptops require a long time for each student, so that learning hours become shorter and the provision of material becomes denser. Faradiba, S. S., Abidin, Z., & Khasanah, I. explained that the training on the use of the GeoGebra application requires adequate software. (Faradiba et al., 2023) In the second cycle, there are no significant obstacles in the learning process, because the use of the geogebra application is transferred to mobile devices, but with a small screen, sometimes it makes students have to more carefully visualize the field and distance of three-dimensional material. Learning Shapes and Spaces using GeoGebra's dynamic geometry software has enabled students to produce work with evidence of critical, creative and innovative elements in their solutions (Kim & Md-Ali, 2017).

Through the results of data processing, research that has been carried out through both cycles and observation sheets shows that the application of geogebra is effective in learning mathematics three-dimensional material. Septian, A., Inayah, S., Suwarman, R. F., & Nugraha, R. In his research, he also explained (Septian et al., 2020) that the improvement of the problem-solving ability of students who learn using a problem-based learning approach assisted by GeoGebra is better than students who learn with conventional learning.

CONCLUSION

The use of the geogebra application in improving student learning outcomes in mathematics subjects of three-dimensional material in class XII MIPA B MAN 1 Bandung City can be concluded that there is a significant improvement. When teachers have not used the application, students find the delivery of material difficult to understand because it requires real images. But with the use of the geogebra application, in cycle 1 and cycle 2, that student learning outcomes are increasing as seen from the pre-test and post-test. This proves that with the visualization of images, aspects of points, lines, planes and distances can be directly imagined in the form of images through applications. Students can easily operate the application so that teachers can facilitate the understanding of students to have higher-order thinking skills in mathematics subjects. Although at the time of initial use of the application requires devices such as laptops and mobile phones and takes a long time to install the application on the device, students look more enthusiastic when getting used to the application. The recommendations in this study are expected that teachers continue to provide interesting learning using interactive learning media, because mathematics learning uses many varied formulas, so teachers need to hold application-based learning media so that students use the help of technological devices not only to socialize but also to use technological devices as a tool to increase knowledge and more learning media Affordable.

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