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"Digital Media in Learning"

Use of Geogebra Software on Flat-Sided Spatial Buildings Material at Mts Al- Ahliyah Aek Badak

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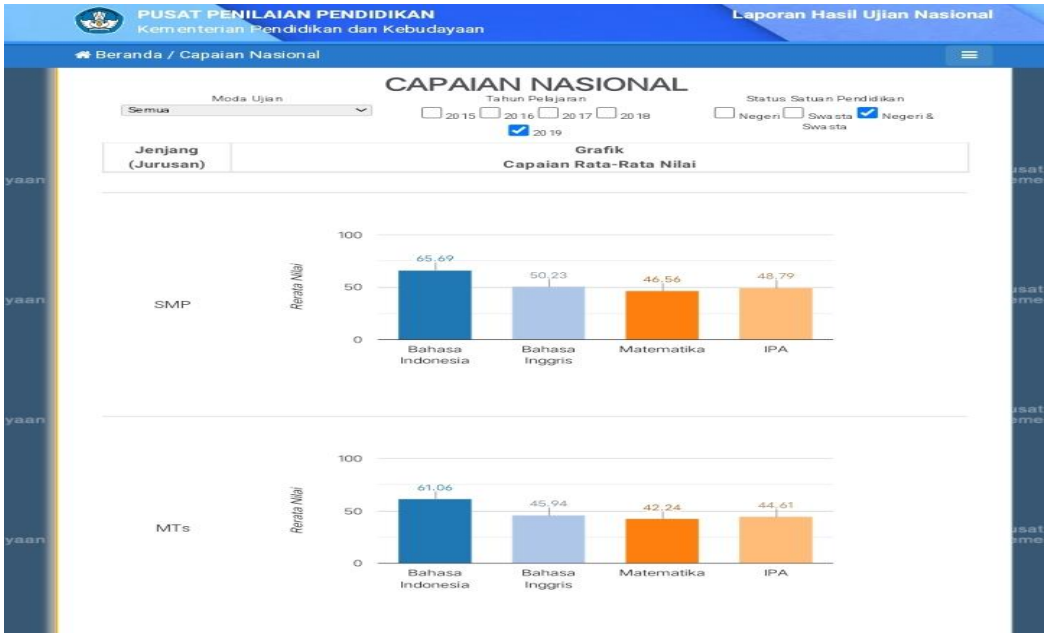
Abstract Technological developments make a major contribution to the field of education, especially in solving mathematics education problems. The use of mathematics learning media using GeoGebra software provides benefits so that abstract mathematics material can be understood by students more easily. But in reality, many teachers still have not used learning media in the teaching and learning process. Mathematics teachers at Mts. Al- Ahliyah admitted that he did not use GeoGebra technology media because he was not proficient in operating the software. This is the background for the holding of Community Service at MTs. Al- Ahliyah in the form of training using GeoGebra Software on flat-sided space building material to help math teachers utilize GeoGebra learning media in the teaching and learning process. This training method explains what GeoGebra is, the benefits and convenience of using GeoGebra, and, direct practice and assistance in making GeoGebra-based learning media. This Community Service has been carried out, teachers are very enthusiastic and interested in learning GeoGebra Software and teachers succeed in making cubes with the help of GeoGebra.

Keywords: Flat-Sided Spaces, Math, GeoGebra

INTRODUCTION

Mathematics is the basis of science, meaning that mathematics is a universal science that underlies the development of modern technology, mathematics has an important role in various disciplines and as a means of developing creative, logical, critical thinking needed in modern life today.(Priwantoro et al., 2019) Complex and abstract mathematical models, complex geometry visualizations and other mathematical problems are still a hot topic of discussion in every element of

education. The quality of mathematics education in Indonesia is still very low.(Simbolon, 2020) In 2019, the last time the UN was held, it was clear that the quality of mathematics education was low with scores at the lowest level compared to other subjects.



Source: kemendikbud.go.id

Some of the factors that influence student math learning outcomes based on research are interest in learning, creativity, learning habits, learning environment, learning model, teacher competence and learning media used.(Amrullah et al., 2021). Among these things, the most influential on the quality of student learning is the learning environment, teacher competence and the learning media used.

In the era of Society 5. 0, learning media must be a concern for every educator from elementary school level to high school level even to learning in the university environment. Media can increase student attention because with the media students' attention does not focus on monotonous things. In addition, the media also provides a deep understanding to students because in the presentation of the material provides a more real picture Learning media must be adapted to the technological developments that occur.

In accordance with Permendikbud No. 65 of 2013 concerning process standards, it states that one of the learning principles used is the utilization of information and communication technology to improve the efficiency and effectiveness of learning. Likewise, the principle of preparing lesson plans in the process standards states that the application of information and communication technology is integrated, systematic and effective according to the situation and conditions.

With the development of increasingly advanced technology, in the explanation of NCTM (National Council of Teachers of Mathematics) as an association of mathematics teachers in the United States has declared that technology is one of the six principles for learning mathematics at school.(Priwantoro et al., 2019) With this, so that mathematics learning is not left behind in the field of technology, the mathematics learning process must involve technology-based learning media. (Di et al., 2020)

In connection with this, computers as a technology that is developing very rapidly should be used in the learning process. In learning mathematics, there are many software specifically designed to solve mathematical problems, such as Maple, CABRI, Derive, Autograph, GeoGebra and so on.

One of the software used in developing math learning media is GeoGebra Software. Initially, GeoGebra was only used to support algebra and geometry learning, but in its development there are many new features that enrich the usefulness of GeoGebra software.(Armiznah, 2020)

GeoGebra is a combination of Geometry and algebra. GeoGebra is one of the math learning software that helps the learning process at school. GeoGebra software was developed by Markus Hohenwarter. Markus Hohenwarter started this project in 2001 as part of his master thesis research at the University of Salzburg, then developed at Florida Atlantic University in 2006-2008, at Florida State University in 2009 and now at the University of Linz along with the help of software development and translators around the world including in Indonesia.(Prof. Dr. H. Nanang Priatna, M. Pd dan Muhammad Arsani, S. Pd., 2019)

GeoGebra software is a technology product that is very easy to use both in geometry, algebra and calculus. This software makes math concepts dynamic. Construction and exploration of geometric shapes and graphs of an equation and can be used as a virtual learning media or drawing geometric shapes. One example of learning material that can be used with the help of GeoGebra software is flat-sided space material found in class VIII MTs / SMP.

Some of the benefits of GeoGebra Software in learning math are as follows:

- Can produce geometry paintings quickly, thoroughly and easily
- There are animation facilities and manipulation movements that can provide a visual experience in understanding abstract concepts
- Can be used as an evaluation material to ascertain whether the geometry paintings made have been correct
- Make it easier to investigate or show the properties that apply to a geometry object

So far, geometry learning in the classroom is only taught using blackboard media and has not utilized learning media such as computers. The delivery of material that is often done by teachers is in the form of conventional learning such as lectures, so there are students who have difficulty understanding the material presented. For this reason, other media are needed that can help students' understanding of geometry.

Teachers can take advantage of GeoGebra as a tool to construct, demonstrate and visualize some abstract material in mathematics, especially on flat-sided space building material which, if only manually depicted on the blackboard, will look like a flat shape and not see all the elements of the space building. Not only that, GeoGebra can also be used as a tool to create interactive and interesting learning so that students can explore various abstract mathematical concepts.(Simbolon, 2020)

MTs. Al- Ahliyah is one of the junior high schools located in Aek Badak Village, Tapanuli Selatan. The utilization of technological media in each subject is

still very minimal by the teacher. This is in addition to the age factor which causes teachers to be less interested in using tools such as computers in learning. Another factor is also due to the lack of teacher skills in using software related to learning, especially math lessons. Mathematics teachers at the school have never used GeoGebra software and do not understand how to run the GeoGebra software program, previously the media used during the learning process were simple media such as drawing cube nets, cube frames and other spatial images manually on paper.

From some of these problems, so that the author provides training in the use of GeoGebra software for Mts teachers. Al- Ahliyah, Aek Badak which amounted to 10 people, the author explained and provided products in the form of teaching modules related to the material of flat-sided Spatial Buildings which is the subject matter in class VIII Mts / SMP. With this activity, it is hoped that teachers can improve the quality of learning so as to improve the quality of mathematics education in Indonesia and the need for media in the learning process can be fulfilled.

RESEARCH METHODS

This research was carried out in Community Service Activities in the form of training for mathematics teachers in the Mts. Al-Ahliyah, Aek Badak Village, Tapanlui Selatan. In general, the method of implementing this activity goes through three stages, namely:



The process of implementing these activities, namely:

1. Preparation of Tools and Materials
   a. The tools used are Laptop, In focus, projector, GeoGebra software
   b. The material used is the teaching module for flat-sided space building material
2. Work Procedure
   a. Each teacher is given a download link for GeoGebra software to download on their respective laptops.
   b. All installation stages are guided by the instructor
   c. Verify the success of the installation results

d. After completing the installation, the product introduction stage is how to run the GeoGebra program Showing the menus available in GeoGebra software, such as available 2D graphics, 3D graphics, graphing, geometry and others.

3. The stage of making teaching materials
   a. How to create points, lines and line segments
   b. Create a square flat shape in 2D graphics then create a height so as to produce a 3D shape
   c. The first spatial building is a cube
   d. Clearly visible cube frames in GeoGebra software
   e. Opening the cube image so that the nets that make up the cube are visible
   f. Finding surface area and volume automatically in GeoGebra software

RESULT AND DISCUSSION

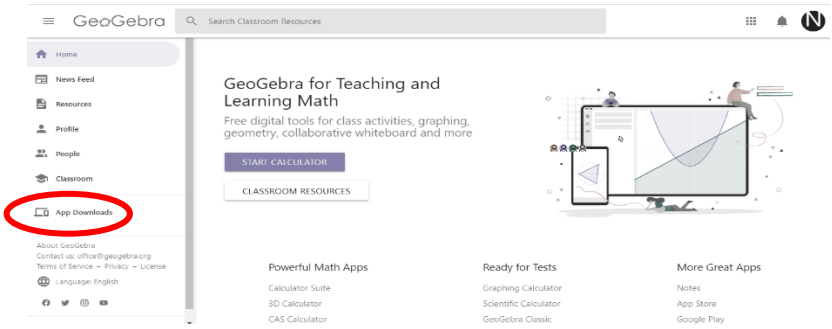
A. RESULT

This activity was realized precisely on Friday, May 31, 2024 at Mts. Al-Ahliyah, Aek Badak Village. The form of this activity is collaborative between lecturers and students. Participants who participated in this activity were 10 teachers from Mts / MA Al-Ahliyah school, Aek Badak Village, Tapanuli Selatan. This activity began with the introduction of mathematics learning media, namely GeoGebra software by speaker 1 Lecturer from UIN Sheikh Ali Hasan Ahmad Addari Padangsidimpuan, Mrs. Lili Nur Indah Sari, M. Pd. She explained the material to be used in the software, the benefits of GeoGebra software and the ease of using GeoGebra software.

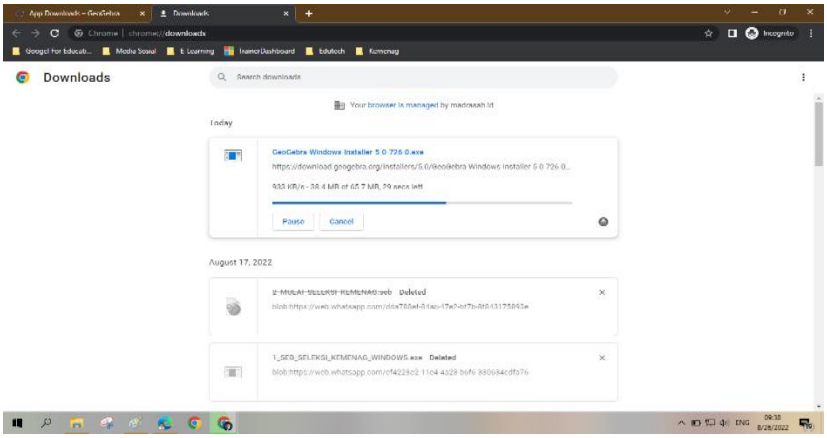


The second session was followed by the delivery of material and direct practice of drawing cubes on GeoGebra software explained by one of the students.

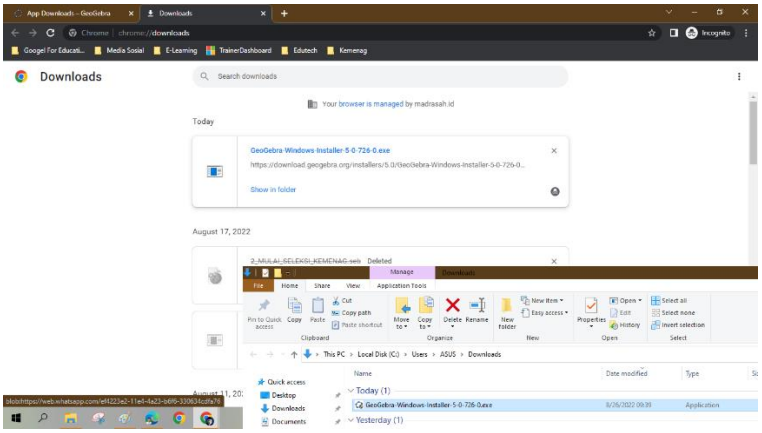
1. Installation Stage (Christersson Malin, 2021)
    - Enter keywords in the search field "GeoGebra"
    - Click "App Downloads "



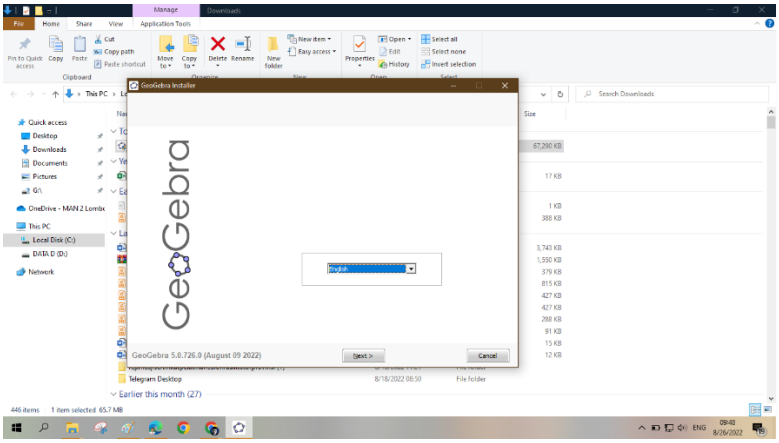
    - Wait for the download process to complete



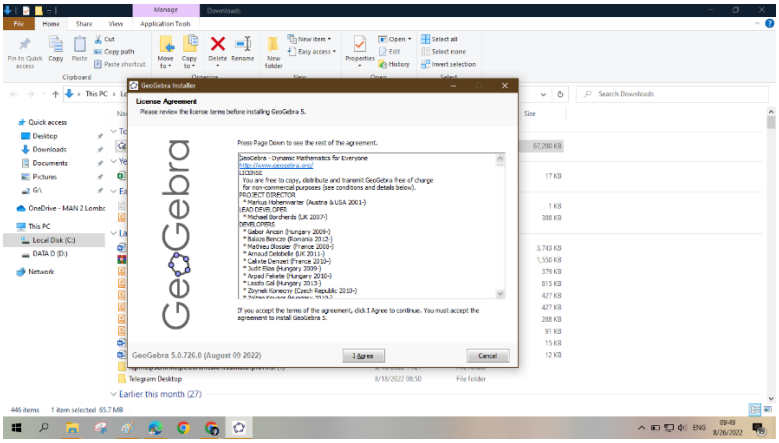
- Make sure the application has been downloaded in the laptop folder



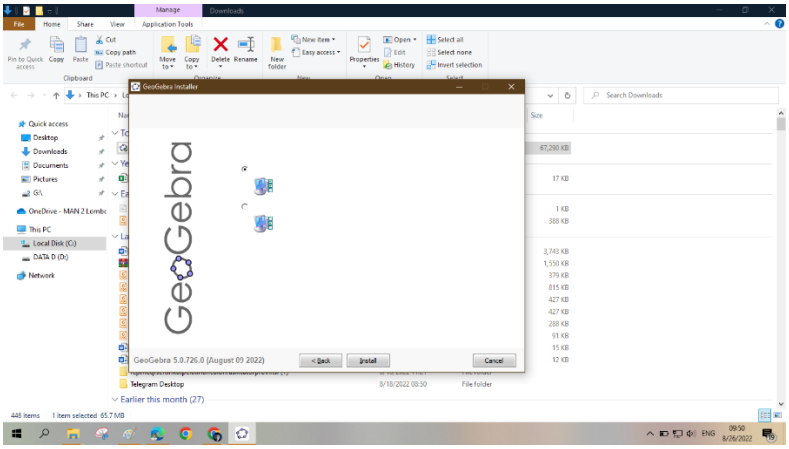
- Select the language to be used "Indonesian"



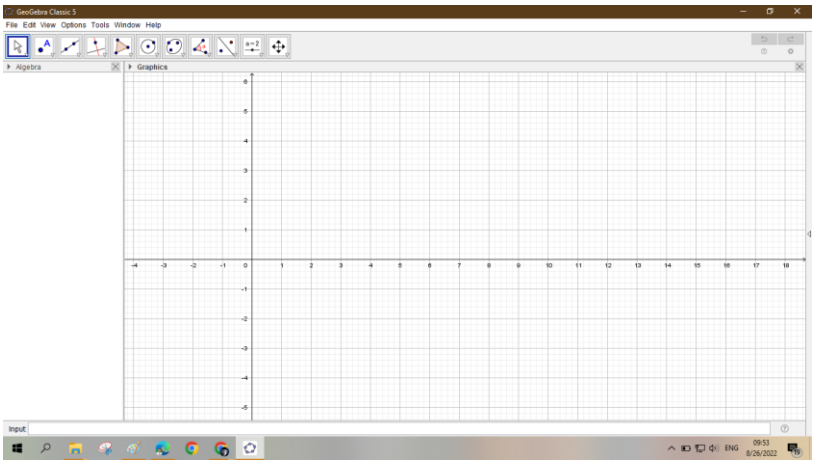
- Click “agree”



- Click install

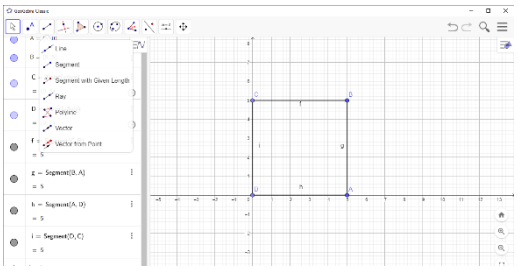


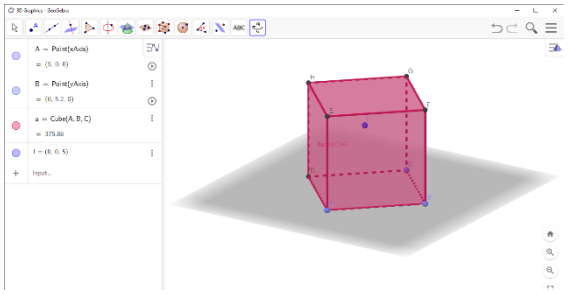
- Wait for the installation process, after the application is installed it will automatically open directly on the initial display



2. Designing learning materials "Flat Sided Spaces"

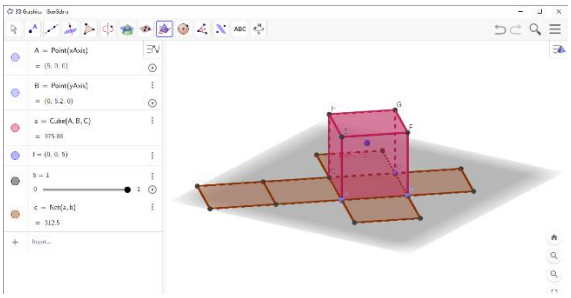
- Open the software GeoGebra
- Make points of flat shapes, make lines and make heights so that the cube





is built.

- Marking the skeletons of a cube such as sides, ribs, planes, diagonal planes diagonal space and diagonal planes
- Making the net of a cube



- Automatically determine the volume and surface area of cubes that are available in GeoGebra software.
- Proving the volume and surface area formulas in the teaching module using GeoGebra

In this second session, the teachers were directly involved in making mathematics learning media using GeoGebra based on instructions from the presenters and other students confused teacher



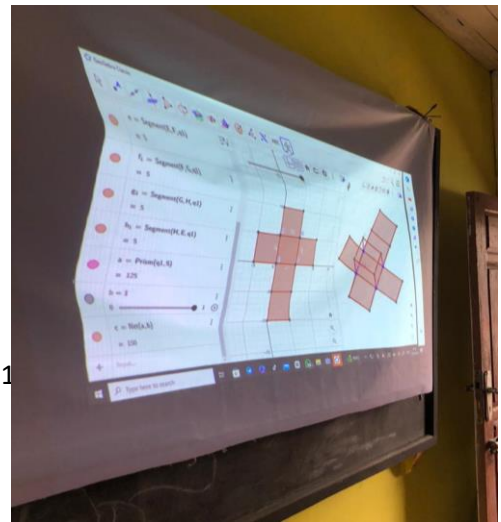


Figure 1.1: material explanation from one of the students



Figure 2.2: In-person training and guidance to Mts. Teachers. Al-Ahliyah Aek Badak

Due to time constraints, this training was only conducted on the cube. In the final results, the teachers involved in the training admitted that the explanation given was well understood and would be practiced directly with students in the learning process but some teachers still found it difficult to use the GeoGebra software, even so they were very interested in the media. Most teachers want a follow-up to this activity, according to previous planning, this activity was only carried out once with approximately 5 hours, but researchers also tried to hold follow-up activities according to the time available later. The product left by researchers to teachers is a teaching module that contains exposure to material related to flat-sided spaces that can be used by teachers and students in the teaching and learning process.

Teachers' difficulties in using the GeoGebra application do not only occur to teachers at Mts al-Ahlliyah, but teachers' difficulties in using the GeoGebra application are also expressed by Howenwarter et al, that the difficulties most often encountered by teachers in the introduction of GeoGebra are constructing

geometric shapes, using dynamic geometry tools correctly, entering the size of a space / flat shape correctly, entering algebraic forms correctly.(Waluyo, 2016)

B. DISCUSSION

The trend of using GeoGebra technology media in learning mathematics seen from 2007 to 2023 shows that the publication of an increase in 2020/2021. The main research focus in developing this learning media is at the junior and senior high school level. Some of the results of these studies prove that learning media with a realistic approach assisted by GeoGebra meets the effective criteria for completeness with 87.5% spatial ability and effective learning time in accordance with the lesson hours written in the curriculum.(Info, 2024)

It can be concluded that GeoGebra software is software that is used as a mathematics learning media that is fully facilitated to solve mathematical problems and has several advantages so it is very feasible to be used as a learning media in geometry space. This media can display visualization and construct objects in the geometry of space. With the help of this media, learning geometry is more interesting and will increase student interest and motivation.(Aminy et al., 2021)

The GeoGebra program complements various pre-existing computer programs such as Maple, CABRI, Derive, Geometry's sketchpad and others. If the programming is specifically for studying geometry or algebra separately, then the GeoGebra application comes as a unit that combines the programming of both.

The main menu in the GeoGebra application is file, edit, view, options, tools, windows and help to describe geometry objects. The file menu is used to create an object, open, save and export files. The edit menu is used when editing paintings. The view menu is used to set the view. The option menu to set various display features, font settings, styles of geometry objects and so on, and the help menu provides instructions or steps for using the GeoGebra application.(Dr. I Nyoman Sukajaya, 2021)

In learning geometry, especially the material of building space, abstract concepts make students have a heavier cognitive load. Therefore, GeoGebra software becomes one of the solutions to display visualizations of the skeleton of a more real space so that students are motivated and interested in learning mathematics. GeoGebra software can be used to build geometric objects, draw and process features and calculate these shapes such as area and volume.

GeoGebra software can be said to be a dynamic media if it meets the following three characteristics (Sumarni, M. Pd, Mohammad Riyadi, M. Si, Nuranita Adiastuty, M. Pd, Rahayu Syafari, 2022):

- The program in this software allows direct manipulation. When users move a point on a layer, they feel that they are moving a point, not just moving the mouse.
- This program applies continuous movement. There is no time lag between mouse Moves and dot Moves.
- The program is an immersive environment, which is a realistic display of items, making users feel like they are participating in the program.

The advantages and disadvantages of GeoGebra software

a. Advantages of GeoGebra software
    - Can be accessed easily by everyone who will use GeoGebra software. GeoGebra software is not only installed via a computer or laptop but this software can be installed on a Smartphone
    - GeoGebra software provides many languages including Indonesian so it is very easy to learn and develop in the Indonesian education environment.
    - GeoGebra software has provided algebra and geometry windows
    - Teachers and students can utilize mathematics teaching materials with the help of GeoGebra software more interactively
    - Students become more active in the learning process
b. Disadvantages of GeoGebra software

- GeoGebra software more or less replaces the role of a teacher
- Tends to ignore academic or social aspects
- GeoGebra software can be understood but takes a lot of time
- If GeoGebra software is not fully mastered, it will form ineffective learning
- Changing the role of teachers who used to master conventional learning now prefer to use GeoGebra software.

Research conducted by Al-Ikhlas, et al in the research title "The Effect of GeoGebra Application Learning Media on Student Learning Outcomes" states that the effect of GeoGebra learning media on the mathematics learning outcomes of 8th grade students of SMP Negeri 7 Kerinci is declared good. This is evidenced by the results of the student pretest and posttest with an average student learning outcome of 70.14 for the pretest and 77.46 for the posttest. The posttest average value is higher because it has been given the effect of using GeoGebra learning media. This study also analyzed based on data using the t test obtained the results of the sign value. (p-Value) < α or expressed in the form of numbers 0.000 < 0.05 then H1 is accepted(Ikhlas et al., 2023)

Jasiah, et al in a study entitled "The Effect of GeoGebra Application Approach to Creative Thinking Skills" showed that learning by using GeoGebra application learning media had a significant effect on students' creative thinking skills. This is due to the use of GeoGebra application learning media that can help students to develop their creative thinking skills in solving various types of problems given by lecturers such as statistical problems. In addition, using GeoGebra learning media can train students to learn independently, train reasoning skills, and involve students actively in learning to find new creativity in solving problems given by lecturers. This study concluded that from the results of pretests and posttests, the average value of students' creative thinking skills was 70.14 and 81.26, respectively. The average value of the posttest is higher than the average value of students' pretest creative thinking skills. Furthermore, based on data analysis using the t-test, the significance value (p-

value) << or in other words 0.000 <0.05 means H1, there is an Effect of GeoGebra Application Use on Creative Thinking Skills.(Jasiah et al., 2023)

CONCLUSIONS

Based on the observations and implementation of the service carried out, it can be concluded that the training participants, namely the teachers of Mts. Al-Ahliyah is very enthusiastic about participating in this training activity, this is one of the solutions to the problems faced by students both individually and as a whole. This training is focused on the basics of drawing flat shapes and making them into spaces, showing the skeletons of spaces, the nets of spaces and finding the area and volume of spaces. Teachers involved in the training admitted that the explanations given were well understood and would be practiced directly with students in the learning process.

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