



Vol.xx No.xx Bulan 2024 Hal.53-60 ISSN : xxxx-xxxx E-ISSN : xxxx-xxxx DOI : xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx https://journal.cerdasnusantara.org/index.php/aljabar	Article History Submitted: 21 Oktober 2024 Accepted: 11 November 2024 Published: 31 Desember 2024
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THE USE OF GEOGEBRA-BASED LEARNING MEDIA IN IMPROVING THE UNDERSTANDING OF VOLUME AND SURFACE AREA OF SOLID FIGURES IN FIFTH GRADE

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ABSTRACT

The use of media in the world of education plays an important role in enhancing the learning experience. One of the effective media used in mathematics learning is the GeoGebra application. GeoGebra aids in the exploration of volume and surface area concepts of three-dimensional shapes, and it can also enhance students' learning motivation. This increase in motivation leads to better learning outcomes. This media is also in line with the scientific learning approach that is the core of the 2013 Curriculum, making it relevant to the educational needs in the era of the Fourth Industrial Revolution. This study aims to examine the suitability of GeoGebra as a pedagogical tool in understanding the volume and surface area of three-dimensional shapes. Using qualitative methodology and case study design, this research involves fifth-grade students from SDN 8 Prabumulih as subjects. The research results show that GeoGebra increases students' interest and motivation to learn, thereby helping them better understand the material being taught. This confirms the effectiveness of GeoGebra as a learning medium that supports the achievement of optimal learning outcomes.

Keywords: *geogebra, volume, geometry*

A. INTRODUCTION

Mathematics education is a subject that plays an important role in the world of education. Almost every subject requires mathematics, and even in all aspects of life, mathematics is always used in daily life. Therefore, mathematics becomes a necessity to study so that problems occurring in daily life can be solved, even though most people consider mathematics to be a difficult field of study and tend to feel lazy or even uninterested in studying mathematics. Even students who are currently undergoing education tend to study mathematics mostly out of necessity as a prerequisite for pursuing that education. There are several factors that cause students to find it difficult and even tend to be lazy when it comes to studying mathematics.

There are 3 factors that cause students to experience difficulties in learning mathematics according to (Jamal, 2014), namely: perception (calculations in mathematics lessons), intervention, and extrapolation in the implementation of the teaching and learning process, which will determine the extent to which students' success in mathematics subjects should be achieved. The presentation of concepts in mathematics learning makes mathematics education increasingly boring to study, especially with the difficult lessons making students even less interested in learning mathematics. The presentation of concepts given by teachers is mostly in abstract form, causing students to think that the concepts taught do not exist in everyday life. In reality, mathematics is often encountered and widely used to solve various problems in everyday life. Interest in learning mathematics becomes one of the important parts of the mathematics learning process to foster students' attention in learning. As stated by Asmani in (Sirait, 2016), interest is a feeling of liking and greater attraction to something or an activity without being

prompted. This is similar to what Slameto (2010: 57) stated, which is: "Interest is a persisting tendency to pay attention to and enjoy the same activities and or content" ("Interest is a persistent tendency to pay attention to and remember certain activities"). These activities include those that students are interested in and will continuously pay attention to, accompanied by a sense of enjoyment.

Mathematics is a fundamental science whose application is needed by science and technology. (Maskur et al., 2020; Parwati, Suryawan, & Apsari, 2018). Ironically, mathematics among students is a subject that is less favored, resulting in students' mastery of mathematical concepts being less than optimal, especially on certain topics that are considered difficult to visualize. (Suryawan, 2019). Actually, many efforts have been made to address this issue, but they have not been implemented optimally on certain topics, for example, the topic of Volume and surface area of three-dimensional shapes on a cube. Students still have difficulty imagining three-dimensional objects because, in spatial learning, they are only presented with two-dimensional images found in books or written on the board. Moreover, students only memorize formulas without understanding the concepts, whereas this material actually requires appropriate visualization assistance. (Septian & Komala, 2019). Referring to the results of the problem identification, the issues found can actually be addressed by providing students with the opportunity to experience the discovery of concepts themselves through simulation of learning media on the topic of spatial shapes. (Widodo, 2018).

Media is one of the important components in learning, especially in mathematics learning. Media is important in mathematics because mathematical objects are abstract in nature, requiring a teaching aid. Mathematical learning media can help present abstract concepts in a simplified manner by integrating images, videos, sounds, and animations. (Musfiqon, 2012). In the era of globalization and the current development of science and technology, it is necessary for the younger generation to master technology. The development of science and technology will bring changes and have a significant impact on the world of education. The technology commonly used in the field of education is computers with various devices. One of the software applications on computers that can be used in mathematics learning is GeoGebra software.

GeoGebra is a free mathematics education software offered by Hohenwarter and Judith Preiner. This software has various facilities. GeoGebra is very suitable to be used as a medium for mathematics learning. This GeoGebra software can demonstrate or visualize various concepts in mathematics learning. The GeoGebra software, as one of the learning media, is very beneficial for teachers as a tool to deliver the teaching and learning process in a way that is not monotonous and tends to attract students' attention. In line with Khairani, 2016; Ahern, 2016 in (Masykur, Nofrizal, & Syazali, 2017), which states that learning media is a supporting factor for the success of the teaching and learning process in schools because learning media can assist teachers in conveying information to students and vice versa from students to teachers.

The GeoGebra program is a complementary program to various existing computer programs to assist in algebra learning, such as Maple, Derive, MuPad, or computer programs for geometry learning, such as Geometry's Sketchpad or CABRI. These computer programs are specifically intended to teach and provide understanding of algebra or geometry learning separately. One of the GeoGebra programs for teaching geometry concepts includes facilities in the form of animations and manipulation movements (dragging) that provide a more visual and clearer

experience for students. These facilities can greatly assist teachers in conveying geometry concepts. Teachers can draw points, polygons, vectors, lines, line segments, circles, cones, sections, and 2D curves.

The teacher can also create various 3D shapes in the GeoGebra program and make animations of them. The animations and their movements will greatly attract students' attention, making it easier for them to remember and understand the conveyed concepts. In addition to creating animations of various three-dimensional shapes, GeoGebra can also easily find the volume of three-dimensional shapes through its features. Previously, finding the volume of three-dimensional shapes required manual calculations, but in this GeoGebra program, finding the volume of three-dimensional shapes no longer requires tedious calculations or measurements to obtain the results. With the GeoGebra program, every 3D shape created will automatically be measured with its volume. Of course, this GeoGebra program will greatly assist teachers in explaining the concept of finding the volume of three-dimensional shapes, and likewise, it will make it easier for students to understand the concept.

Based on the above description, to foster students' mathematics learning activities both inside and outside the classroom, teachers need to provide media that can facilitate students in activating relevant learning resources in accordance with the demands of education in the 4.0 industrial revolution era and in anticipation of the 5.0 society era. Thus, this research aims to develop valid, practical, and effective online learning media based on Geogebra to enhance students' understanding of mathematical concepts on the topic of curved surface solids.

B. RESEARCH METHOD

The method in this study uses a qualitative approach with a case study design, involving fifth-grade students at SDN 8 Prabumulih as research subjects. This research aims to measure the effectiveness of using learning media in the form of GeoGebra, specifically designed to understand volume and surface area in three-dimensional shapes. The data obtained from interviews with educators at SDN 8 Prabumulih will be the main discussion point relevant to the research objectives. The interview was conducted on September 27, 2024, in a hybrid format. The questions asked were related to the teaching methods used, the obstacles faced, and the evaluation of the enrichment activities. The results of this observation are expected to provide a deep understanding of digital-based learning media combined with the Geogebra application to enhance the reasoning abilities of fifth-grade students in the subject of volume and surface area of three-dimensional shapes.

C. RESULTS AND DISCUSSION

In this study, the researcher explains the application of GeoGebra in the material of volume and surface area of three-dimensional shapes to educators. The GeoGebra application serves as an alternative learning media that can help students overcome some difficulties and make mathematics learning activities more engaging, thereby improving the quality of classroom learning.

The main objective of this research is to determine and demonstrate that the GeoGebra application learning tool is suitable for use in teaching the volume and surface area of three-dimensional shapes. By using the GeoGebra application, students will be more interested and motivated in learning, thereby improving their understanding of the material being taught.

When the learning media is run, it will appear as shown in image 1. To start the learning, students can click on the polygon option.

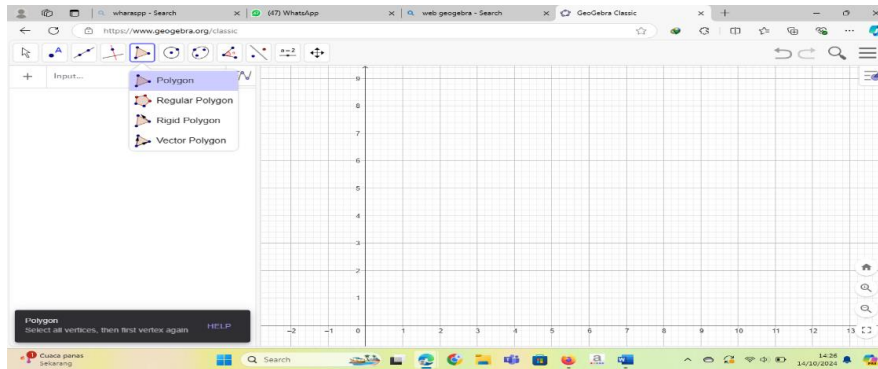
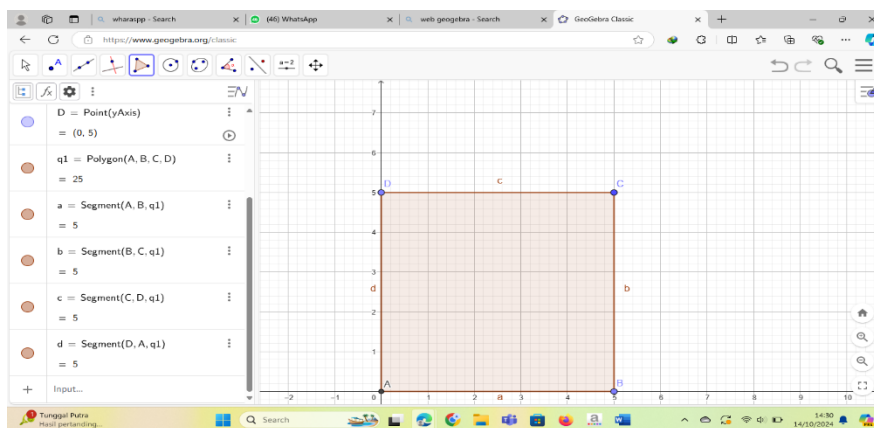
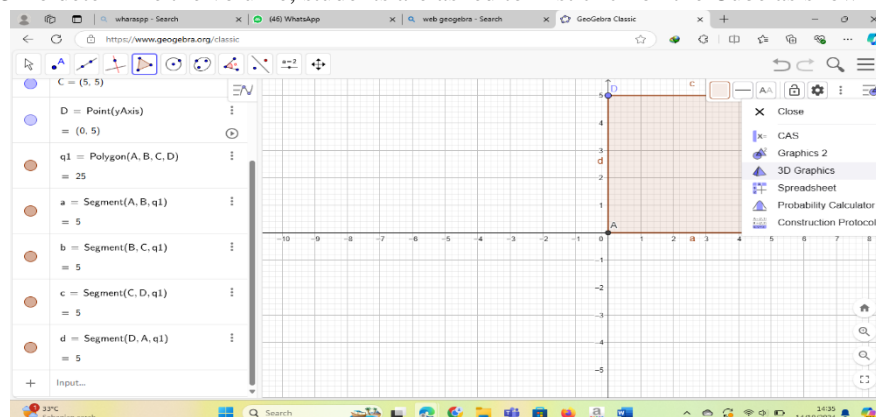


Figure 1. Initial Display of the Learning Media

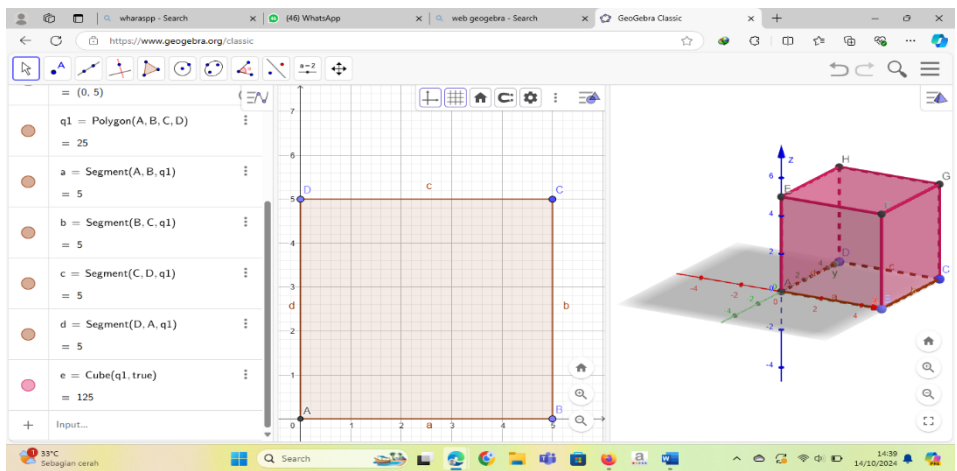
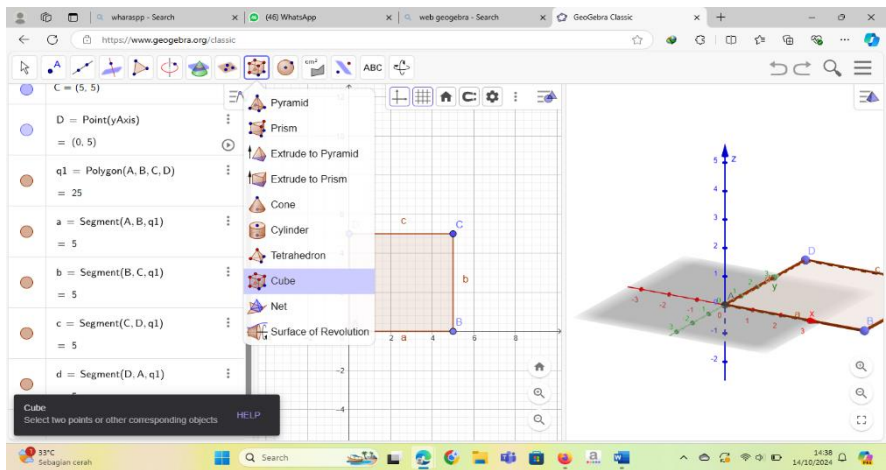
After the students select the polygon option, they click and determine the coordinate points as shown in images 2 and 3. Then we click the three dots in the upper right corner and select 3D Graphics.



Images 2 and 3 To determine the volume, students are asked to first click on the Cube as shown in image 4.

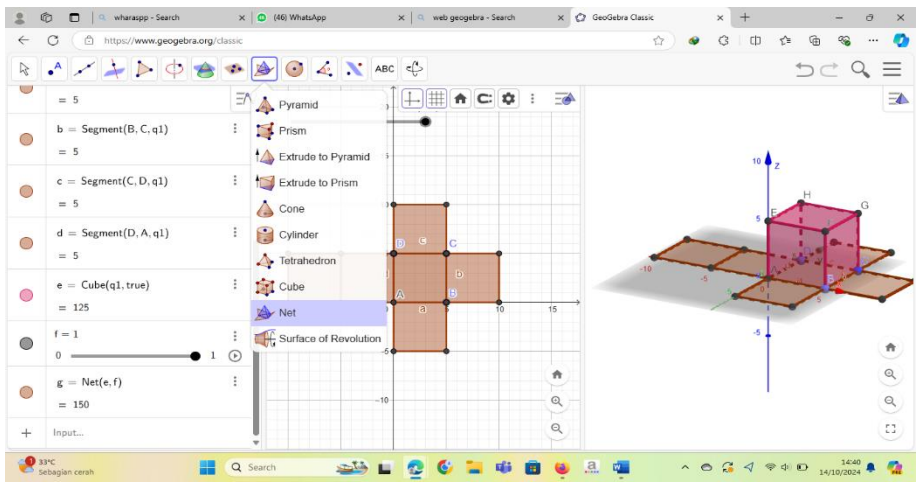


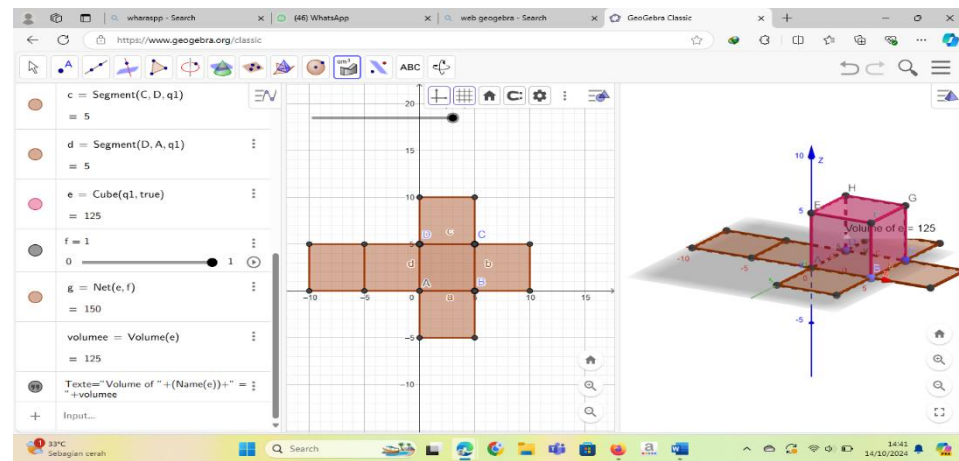
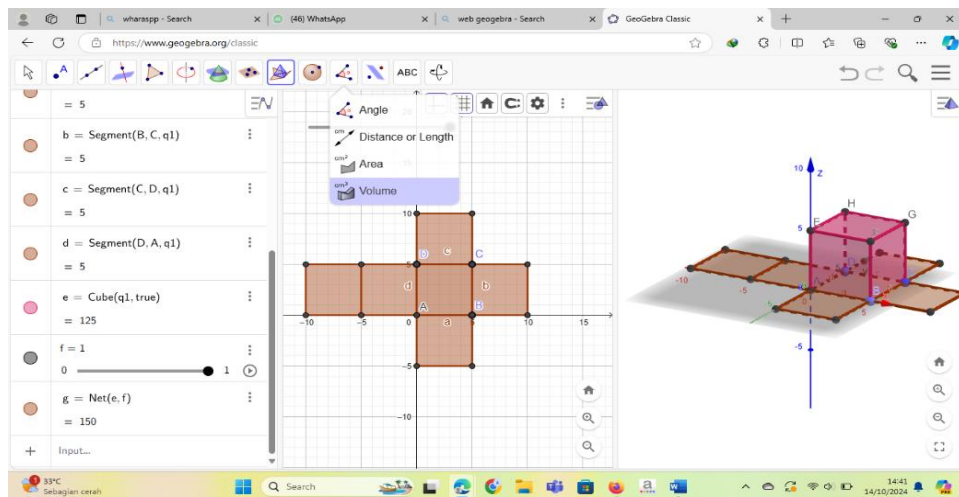
Then it will appear like in picture 5.



Figures 4 and 5

To determine the volume, students click the net option as shown in image 6, then the cursor is directed to the 3D image, and a net will appear. After that, select the volume option as shown in image 7 and click on the 3D image, the volume will automatically appear as shown in image 8.





Figures 6, 7, and 8.

The success in obtaining valid, practical, and effective online learning media based on GeoGebra is due to students preferring to learn and seek learning resources through the internet. Students feel that learning and finding learning resources on the internet is easier and more enjoyable in the current era. Through the implementation of ICT (in this case, the use of Geogebra software), the mathematics learning process becomes more student-centered, resulting in improved learning outcomes. (Rahman, dkk., 2014). Moreover, in developing this media with reference to the scientific approach, the resulting media is specifically designed to stimulate the thoughts, feelings, attention, and will of the learners, thereby facilitating the learning process. Furthermore, the developed learning media contains information that can be in the form of knowledge or serve as a means for students to engage in learning activities such as: reading, observing, experimenting, solving problems, answering questions, and so on. (Sahid, 2010). This emphasizes that the function of utilizing learning media is very important because it discusses the relationship between students and learning materials or the learning system. (Septian, 2017; Warsita, 2008). In other words, this online learning media based on GeoGebra can be used as an appropriate learning resource in the context of activating learning resources, which is one of the demands of learning in the era of the 4.0 industrial revolution.

This product in the form of a learning media certainly has its advantages and disadvantages. The advantages are: (1) the learning media can help students learn independently or assist teachers in the classroom learning process; (2) this learning media is easily accessible online; (3) there are exploration media that can help students understand a concept; and (4) it is aligned with the 2013 Curriculum. Meanwhile, the disadvantages are: (1) there are no prerequisite materials in this media, so students must understand the prerequisite materials to facilitate the use of this learning media; (2) the materials covered only focus on the discovery of volume and surface area formulas of three-dimensional shapes; and (3) the developed media only extends to product development on a small scale.

D. CONCLUSION

Based on the results and discussion of the research, it can be concluded that the online learning media based on GeoGebra on the topic of curved surface solids has met the criteria of being valid, practical, and effective in enhancing the mathematical concept understanding ability of fifth-grade students. Additionally, this media is also in line with the scientific learning approach, which is the core of the 2013 Curriculum, and can be used as a relevant source to facilitate students in activating mathematical learning resources in accordance with the demands of learning in the era of the 4.0 industrial revolution.

The GeoGebra program is quite effective and efficient in helping to visualize mathematical objects, especially in the topics of volume and surface area of three-dimensional shapes. The use of the GeoGebra program offers several advantages, such as visualizations that are usually produced quickly and accurately, the ability to provide students with clearer visual experiences in understanding mathematical concepts, its utility as feedback/evaluation to ensure that the created visualizations are correct, and it facilitates teachers/students in investigating or demonstrating the properties applicable to a mathematical object.

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