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# THE DEVELOPMENT OF DISCOVERY LEARNING ASSISTED BY GEOGEBRA AND ASSEMBLR EDU APPLICATION TO INCREASE JUNIOR HIGH SCHOOL STUDENTS' UNDERSTANDING ABILITY ON GEOMETRY

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## ABSTRACT

Mathematics is a subject that has an important role in human life. The goal of learning mathematics at school is an understanding of mathematical concepts. Students must have an understanding of mathematical concepts after the mathematics learning process takes place. Students who have an understanding of mathematical concepts will be able to explain related concepts and apply them. This study aims to develop a discovery-based method of learning using Geogebra and Assemblr Edu applications to understand geometric concepts in junior high school students. This study uses the Multimedia Development Life Cycle (MDLC) model. Data collection was carried out by means of interviews and questionnaires. Media validation is based on material review experts and media experts. Data analysis technique by conducting qualitative descriptive analysis based on the validation of material experts and media experts. The average percentage score from material experts is 94.7% and the average percentage score from media experts is 95.8% indicating that the development of discovery-based method learning using the Geogebra and Assemblr Edu applications is feasible to use as an alternative solution to understanding geometry concepts in junior high school students. The author suggests that the learning media that has been designed can be tested on class IX junior high school students so that it can be useful for students to understand Geometry material. And in addition, further research can be carried out to determine the effectiveness of the learning media that have been made.

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## INTRODUCTION

Mathematics is a subject that has an important role in human life. Ruseffendi (2006: 94) mathematics is as a tool, as knowledge for scientists, as a pattern of thinking, as well as forming attitudes, therefore as educators must be able to encourage students to learn

mathematics well. By studying mathematics, a person can think scientifically, systematically and also use their creative power.

In studying mathematics, one of the important things and the goals of learning mathematics at school is an understanding of mathematical concepts. Students must have an understanding of mathematical concept abilities after the mathematics learning process takes place. Students who have an understanding of mathematical concepts will be able to explain related concepts and apply them. This certainly can make it easier for students to understand math lessons (Agustini, 2021).

Students consider mathematics is one of a difficult subject to understand, especially concepts of geometry. Geometry contains abstract material, for students who have low abilities in carrying out the abstraction process, they are less interested in following lessons and have difficulty understanding geometric concepts (Kusuma & Utami, 2017). According to Subarinah (2006: 36), a geometric shape is a three-dimensional geometric shape with boundaries in the form of flat planes or curved planes. The material in geometric shapes is abstract which makes it difficult for students to understand.

Difficulties in understanding geometry material require educators to find solutions in the form of methods that can make it easier for students to understand the material. The guided discovery method is a method that can be used to study curvilinear geometrical materials. Guided discovery learning is a learning in which students are given a situation or problem, which then collects data, make conjectures (conjectures), try (trial and error), seek and find regularities (patterns), generalize or compile formulas along with general forms, proving the correctness of his conjecture, Shadiq (2009:12). Therefore learning with guided discovery allows students to build their own knowledge through activities that are designed, so as to make a conclusion based on student understanding. Research (Dian, 2016) states that by applying discovery-based methods it is very appropriate to remember concepts or formulas rather than just memorize so as to increase student achievement. According to (Tahir & Kurniawan, 2020) students who study using the guided discovery method obtain an average score of higher problem-solving abilities compared to those using conventional methods. (Riyadi, Mulyono, & Purwasi, 2018) also obtained similar results the same that the achievement of mastery of students' mathematics learning outcomes after applying the discovery learning method (discovery method). The results of research conducted by (Saridewi, Suryadi, & Hikmah, 2017) that discovery learning (discovery-based learning) can have a positive influence on increasing the value of motivation and student learning outcomes. In line with research (Jumhariyani, 2016) ability of students in learning mathematics are higher by using the guided discovery method compared to the expository method.

In Permendiknas RI No. 16 of 2007, it is emphasized that the pedagogic competence that must be possessed by mathematics teachers is to be able to utilize information and communication technology for the benefit of learning. In addition, according to Sugiyono (2009) teachers in schools mostly do not use existing computers to assist learning, most teachers only use PowerPoint software.

Information and communication technology (ICT) is widely used to create learning media, such as the Geogebra and Assamblr Edu applications. According to Hidayat (2014), Geogebra is a dynamic, free and multi-platform mathematical software that combines geometry, algebra, tables, graphs, statistics, and calculus in one application that can be used for all levels of education. Application users can produce an interactive program. Geogebra is also free, that is, it can be used and reproduced for free and includes an open-source application so that users can change or improve the program. The result of research (Arista et al, 2020) is that

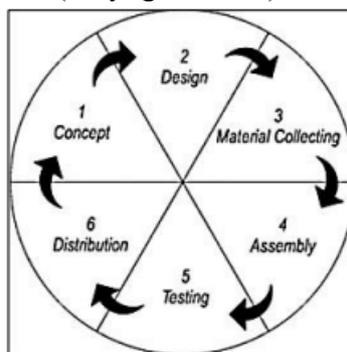
students more easily understand the concept of geometric material with the help of GeoGebra because by using GeoGebra students can see geometric shapes in 3D. In addition, according to research (Batubara & Hanif, 2020) learning the guided discovery method using Geogebra software is higher than the group of students who get learning through the guided discovery method without Geogebra software. Learning mathematics in geometrical materials using the GeoGebra application has been shown to increase learning outcomes in junior high school mathematics (Aryanto, 2019).

The GeoGebra application is widely used by educators to create learning media because of its features which are very supportive for explaining mathematical concepts. Assamblr Edu is an application that provides content features to create learning materials where the resulting content is a QR code by applying Augmented Reality. According to Adrian et al (2020) in his research Augmented Reality (AR) Books can be used as a step in improving learning and teaching in elementary schools because AR can give students the ability to learn interactively in any place and time they want. In addition, this technology is easy to use with mobile devices and 3D views that attract students to learn a lesson. In Rozi et al's research (2021), if the learning media used by the teacher is made very attractive, students will be more interested in participating in class learning. One of the learning media that makes students more interested in taking lessons in class is learning media using Augmented Reality technology.

Based on the background, this study aims to develop learning media to understand the concept of geometric (cylinders, cones) using the Geogebra and Assamblr Edu applications.

## **METHOD**

This study uses the Multimedia Development Life Cycle (MDLC) development model. The Luther version of the MDLC method (Prayogha, 2020) is shown in Figure 1.



**Figure 1.** Step of MDLC

### ***Concept Stage***

This stage defines the user, the type of application (presentation, interactive, etc.), the purpose of the application (information, entertainment, training, etc.) and general specifications. In addition, at this stage conducting a literature review of articles that are related to the research objectives, articles taken from journals accredited by Scopus and Sinta. In addition, collecting information from mathematics teachers in junior high schools on mathematics learning activities in schools is related to students' understanding of geometry.

### ***Design Stage***

This stage makes the initial design of the program to be made. The design is in the form of a story board, namely in the form of a scene or application display containing the guided discovery method to understand the concept of geometry (cylinders, cones). For the learning

process, worksheets were created to help and guide students in learning the concept of geogebra using the Geogebra and Assemblr edu application media.

### ***Collecting Stage***

This stage collects the materials needed for making the program.

### ***Assembly Stage***

At this stage, the program is made based on the design stage and uses the media collected at the material collecting stage. The program contains the concept of building geometry using the Geogebra and Assemblr edu applications.

### ***Testing Stage***

At the stage of the process of checking whether the program is running as it should. After the learning media product has been made, the testing phase consists of two stages, namely the alpha trial stage and the beta trial stage. The alpha trial stage is carried out by media experts and material experts, if in the trial process there are still suggestions for making changes then the media will be revised, if the results of the media trial meet the eligibility criteria then a beta trial can be carried out by application users.

Material validation assessment looks at the aspects of content feasibility, presentation feasibility and contextual assessment. Media validation assessment looks at the feasibility aspect of presenting content, media suitability with conceptual understanding requirements, media suitability with technical/graphical requirements, media interactiveness. Assessment techniques from material experts and ICT experts use a Likert scale with a scale of 4 which is then interpreted with reference (Azizah, 2019) which is presented in table 1.

**Table 1** Interpretation of Likert scale score results

| Validation Category (%) | Validation Level |
|-------------------------|------------------|
| 81,0 - 100,0            | Very feasible    |
| 61,0 - 80,9             | Feasible         |
| 41,0 - 60,9             | Less Feasible    |
| 21,0 - 40,9             | Not Feasible     |

### ***Distribution Stage***

At this stage, hardware and software specifications needed to execute the application, how to operate multimedia-based applications, explain the results of the display, evaluate the program or application.

## **RESULTS AND DISCUSSION**

### ***Results***

This research produces learning media using the guided discovery method of the concept of area and volume of cylinders and cones using Assemblr Edu and Geogebra with the following steps:

#### **Concept**

Learning media created using the Geogebra application are in the form of tube net animations to understand the concept of surface area and tube volume animations to understand the concept of tube volume. Presented using the Assemblr Edu application to fulfill the stages of guided discovery and an attractive appearance so that it motivates you to take part in learning.

**Design**

At this stage a plot design is carried out that will be displayed in the media with the aim of being able to provide an understanding of the concept of learning mathematics. The Story Board design of learning media is in table 2.

**Tabel 2.** *Story Board Design*

| <b>Scene</b> | <b>Visual</b>  |
|--------------|--|
| Scene 1      | This scene shows various kinds of objects that are often seen by students, especially in the home environment.     |
| Scene 2      | This scene shows various kinds of geometric shapes, both flat side shapes and curved side shapes.                  |
| Scene 3      | This scene shows a 3D cylinder objects and a video of cylinder net animation.                                      |
| Scene 4      | This scene shows a 3D cylinder objects and a cylinder volume animation video.                                      |
| Scene 5      | This scene shows a 3D cone object and a cone animation video.  |
| Scene 6      | This scene shows a 3D cone object and a video animation of the volume of a cone based on the volume of a cylinder. |

**Collecting**

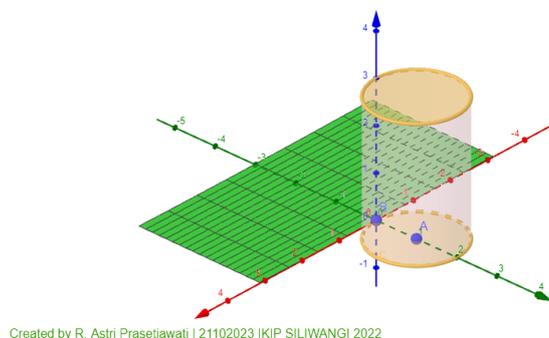
At this stage, learning materials are collected, in the form of materials, 3D objects, 2D objects, LKPD which contain the stages of guided discovery.

**Assembly**

This stage is the process of making media according to what was designed in the previous stage. The animation of the cylinder nets and the animation of the volume of the cylinder were made by researchers using the Geogebra application. The results of making learning media are as follows:

- The results of making animated cylinder nets on Geogebra.

**ANIMASI JARING JARING TABUNG**



**Figure 2.** Cylinder netting animation

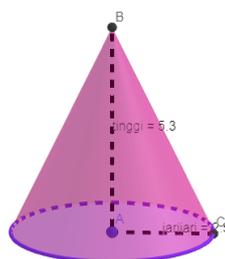
- The result of creating a cylinder volume animation in Geogebra.



**Figure 3.** Cylinder volume animation

- The result of creating a cone animation in Geogebra

### ANIMASI KERUCUT

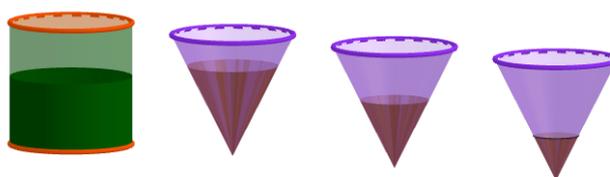


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**Figure 4.** Cone animation

- The result of creating a cone volume animation in Geogebra

### ANIMASI VOLUME KERUCUT



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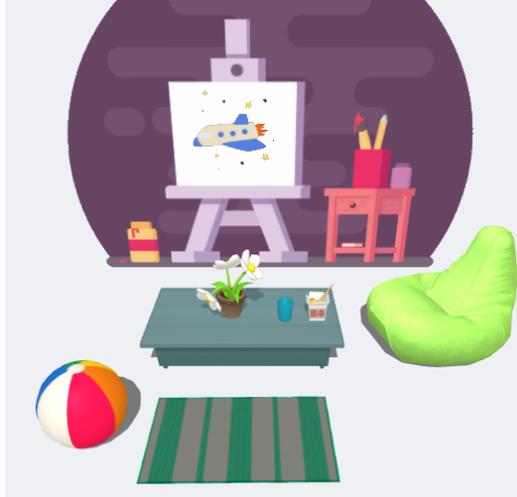
**Figure 1.** Cone volume animation

The animation that has been made in Geogebra is then recorded and uploaded to the researcher's YouTube account with the account name Zmika, the url or YouTube link is one of the items in creating learning content in Assamblr Edu with the account name

@astribelajar. In learning the understanding of the concept with the guided discovery method of the concept of the area and volume of the cylinder, the cone uses worksheets to guide students to understand the concept. The following is the content contained in Assamblr Edu along with activities that must be carried out by students related to their LKPD.

#### Scene 1 Geometry in everyday life

This display shows various kinds of objects that are often seen by students.



**Figure 6.** Example Geometry in everyday life

#### Scene 2 Types of Geometry

In scene 2, it shows various kinds of geometric shapes, both flat side shapes and curved side shapes. The teacher asks the students to write down on the LKPD the various geometric shapes and write down which geometric shapes are included as curved side shapes.



**Figure 2.** Types of Geometry

#### Scene 3 Area of Cylinders

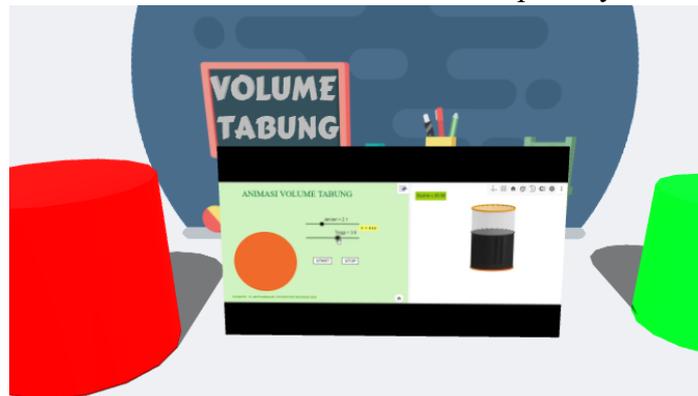
The scene 3 view shows 3D Tube objects and video animation of tube nets. The teacher asks students to observe the tube nets and answer the questions contained in the LKPD for students to understand the concept of tube area



**Figure 3.** Area of cylinders

#### Scene 4 Volumes of cylinder

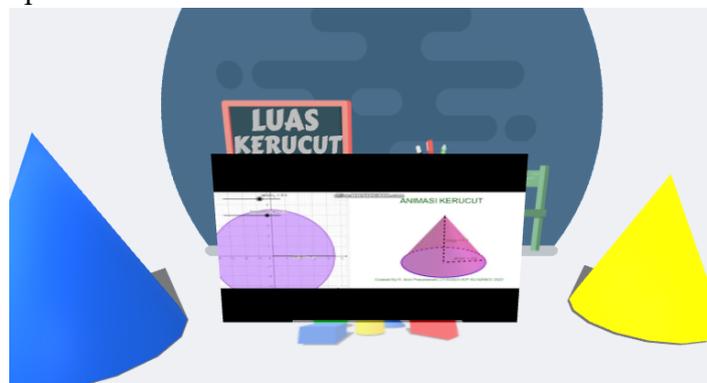
In the scene 4 view shows a 3D tube object and a tube volume animation video. The teacher asks students to observe the animated volume of the cylinder and answer the questions contained in the LKPD for students to understand the concept of cylinder volume.



**Figure 4.** Volume of cylinder

#### Scene 5 Area of cone

The scene 5 view shows a cone 3D object and a cone animation video. The teacher asks students to observe cones and answer the questions contained in the LKPD for students to understand the concept of the area of a cone.



**Figure 5.** Area of cone

#### Scene 6 Volume of cone

In scene 6, it shows a cone 3D object and a cone volume animation video based on the volume of the cylinder. The teacher asks students to observe the cone volume animation and

answer the questions contained in the LKPD for students to understand the concept of cone volume.



**Figure 11.** Volume of cone

### Testing

At this stage, the researcher performs a functional check of the media starting from the QR scans generated from creating content on Assamblr Edu then checking each scene whether it is running according to the initial design. After that, an alpha trial was conducted by media experts, namely a computer teacher and math teacher who had taught for more than 10 years at SMPN 9 Cimahi. Media experts and material experts conduct media and material validation assessments of the media that have been developed. In table 2 and table 3 there are the results of the assessment.

**Table 2.** Material Expert Assessment Results

| Aspects                     | Score Aquisition   | Presentation Average | Category      |
|-----------------------------|--------------------|----------------------|---------------|
| Eligibility Content         | 39                 | 97.5 %               | Very Eligible |
| Feasibility of Presentation | 42                 | 93.3 %               | Very Eligible |
| Contextual Assessment       | 14                 | 93.3 %               | Very Eligible |
|                             | Average Percentage | 94.7 %               | Very Eligible |

**Table 3.** Media Expert Assessment Result

| Aspects  | Score Aquisition  | Presentation Average | Category      |
|--|-------------------|----------------------|---------------|
| Media Compatibility With Diktatic Requirements / Feasibility of Presenting Content | 19                | 95 %                 | Very Eligible |
| Media suitability with the terms of understanding the concept                      | 15                | 100 %                | Very Eligible |
| Compatibility of Media with Technical/Graphic requirements                         | 14                | 93.3 %               | Very Eligible |
| Media Interactivity  | 19                | 95 %                 | Very Eligible |
|  | Rataan Presentase | 95.8 %               | Very Eligible |

### *Distributions*

At this stage, the researcher ensures that the equipment, namely in the form of cell phones for media experts and material experts, has sufficient specifications to run the program. The program is stored on the Assamblr Edu website with the account @astribelajar with the name Astri Prasetiawati or scan the QR code in figure 12.



**Figure 12.** QR code program

### *Discussions*

The results of a qualitative descriptive analysis based on the validation of material experts with an average value of 94.7% and media experts with a value of 95.8% show that the development of learning using the guided discovery method using the Geogebra and Assamblr Edu applications is feasible to use as an alternative solution to understand geometric concepts in junior high school students. The results of this study are supported by the results of research conducted by (Arista et al., 2020) is that students more easily understand the concept of geometric material with the help of GeoGebra because by using GeoGebra students can see geometric shapes in 3D. In line with the results of the study (Batubara, 2020) the increase in the ability to solve mathematical problems for groups of students who received guided discovery method learning using Geogebra software was higher than the group of students who received learning through the guided discovery method without Geogebra software. In addition, according to the results of research conducted by (Farida et al, 2022) it shows that learning through GeoGebra media with guided discovery is very effective in constructing student geometric graphs on geometry material.

### **CONCLUSION**

Based on the results of this study, it can be concluded that the development of discovery-based method learning assisted by Geogebra and Assamblr Edu applications is feasible as an alternative solution for understanding geometric concepts (tubes, cones) in junior high school students.

This media is expected to help especially mathematics teachers in learning mathematics and increase students' understanding of mathematical concepts. To find out the effectiveness of the media that has been designed, it is necessary to carry out further research, namely conducting product trials on Grade 9 Middle School students, because this material is taught at that level.

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