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Learning Circle through Geogebra Media Oriented to Understanding Concepts

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Abstract:- This research uses *GoGebra* aided Realistic Mathematics Education activities to develop concept understanding. This research was design research and impelemented in class 8th at one of schools in Indonesia. The data collection techniques and analyzed data through video recording, test, interview, and documentation. The results showed that GeoGebra aided Realistic Mathematics Education can develop student's concept understanding about determine circumference and wide of circle.

Keywords:- *Circle, Understanding Concepts, GeoGebra, RME.*

I. INTRODUCTION

Geometry is a part of mathematics whose application is very important in everyday life. Circle part of geometry, Circles occur naturally in the universe, ranging from ripples to moonlight. In nature, circles often form when a flat surface is affected by a force that works evenly in all directions. For example, when a marble falls into the water produces a wave that spreads flat in all directions as a series of circular ripples. Measurement of area and circumference of the circle area also has applications in daily life.

However, geometry (circle) still finds problems in understanding it. This is caused by abstract geometry, low spatial abilities of students, geometric language, and learning processes that are still dominated by the use of algorithms and formulas. Memorizing the formula and applying it to working on problems cannot help students understand circle material (Zacharos, 2006). Figure 1 is an example of student confusion in working on a circle problem.

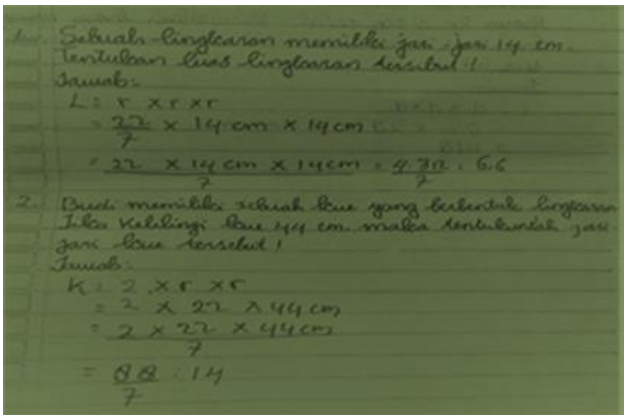

Fig 1:- Illustration of Student Confusion

From Figure 1, in questions 1 and 2, it is clear that students do not know and understand the concept (formula) of measuring area and circumference of the circle area. In addition, students are also not proficient in operating simple things from mathematics (addition, subtraction, multiplication, division). Students are also still confused in connecting between concepts with one another, for example in question number 2. In question number 2, which is known to be a circumference value but students actually work on the problem by looking for the value around the circle.

Starting from this, it is clear that relying on procedural skills alone is not able to support students for mathematical literacy. Therefore, researchers want to emphasize the conceptual understanding of aspects to support students in learning circles. In this case, the researcher seeks to use GeoGebra media; GeoGebra is one of the computer software. GeoGebra will be integrated in the learning model used, namely realistic mathematics education (RME). Realistic mathematics learning learns mathematics by using contextual problems, students are facilitated to solve the given contextual problems. Solving contextual problems is very positive for understanding students' mathematical concepts. Realistic mathematics learning is centered on students and instructed students to be active in constructing their knowledge (Buchori, 2016). Realistic mathematics learning has long been developed by a mathematician as well as an education in the Netherlands named Hans Freudenthal. According to him mathematics is a human activity, therefore mathematics should be associated with reality, close to students' daily lives, and contribute to human life

(Gravemeijer, 2016). The integration of GeoGebra in realistic mathematics learning can help students explain real objects commonly used to get the concept of circles. Caglayan (2014) and Viviana, et.al (2017) stated that GeoGebra learning media was used as alternative software to integrate technology in mathematics teaching and learning. There are also advantages of GeoGebra, which is able to explain the concept and the interaction between students and teachers in the teaching and learning process in trying to understand the material being taught. Utilization of GeoGebra provides an immediate response process to students and GeoGebra is seen as a stimulus. In mathematics learning, students are required to understand and master concepts, propositions, theorems, generalizations, and the principles of mathematics as a whole. In this regard, GeoGebra can help students both to construct knowledge and to solve problems. Some results of the study show that increasing procedural knowledge and conceptual knowledge of students' mathematics makes it easier for students to understand abstract mathematical concepts (Zulnaidi, et al., 2016; Hamzah et al., 2012; & Schoenfeld, 2013). In addition, GeoGebra also has a positive effect on student learning achievement, about geometry, algebra and calculus material (Arbain and Shukor, 2014; Botana, 2015; Zengin, 2012).

This study aims to determine the trajectory of circle learning through GeoGebra media which is oriented to develop the ability to understand the concept of junior high school students. The existence of this research is very important because it can inform that the GeoGebra media can help construct students' understanding of the circle well. GeoGebra can eliminate students' negative perceptions of mathematics (circles). This research is a basic research, this research should be able to contribute to those who need it.

The problem that will be answered in this study is how can GeoGebra assisted learning develop students' conceptual understanding of circle material?

II. THE RESEARCH METHODS

This research was conducted in the even semester of the 2018/2019 academic year at one of schools in Indonesia. The initial stage in design research is Preliminary Design. At this stage a literature study is carried out on the material to be examined, namely the circle, the scope of the material in the curriculum, the theory that will be used to understand the concept and approach of the RME. Then researchers and teachers discuss the conditions of the class, research needs, schedule, and implementation of research. At this stage also designed Hypotetical Learning Trajectory (HLT) or Learning Path Hypothesis. Learning Path Hypothesis has three components, namely learning objectives, learning activities, and guesses or hypotheses in the learning process.

The next stage is Design Experiment consisting of Preliminary Teaching Experiments (Pilot Experiment) and Teaching Experiments. Pilot Experiment (as cycle 1) or preliminary teaching experiment to test HLT that has been designed for students in small groups (involving 6 students from the class not the research subject), namely class VIIIA, with heterogeneous student abilities, each of which has 2 capable students low, medium and high. Pilot experiment is useful for collecting data in adjusting and revising the initial HLT and for use in the teaching experiment stage (as cycle 2). In this experimental study, discussions were held with the HLT model teacher who had been designed to achieve the objectives according to the learning objectives. This discussion is very necessary so that there is good communication between the researcher and the model teacher so that the suggestions from the model teacher can be heard and used to help researchers adjust the initial HLT design. This is done because the teacher knows more about the condition of students who will be the subject of research. The Teaching Experiment stage is the core stage of design research, because this phase HLT that has been designed and improved before will be tested in the actual class which is the subject of research. The teaching experiment phase was tested in the pilot experiment stage, but in different classes namely VIIIB class which amounted to 30 students. The results of this stage will be used to answer the problem in this study. The model teacher acts as a teacher and the researcher as an observer observes student learning activities. After teaching experiment, the data obtained from the learning activities in the class are then analyzed. HLT functions as the main reference to determine what things are the focus in conducting the analysis. At this stage, HLT is compared to actual student learning. Things that are analyzed are not only things that support HLT, but also examples of contradictions with conjectures designed. The results of retrospective analysis are used to answer research questions, draw conclusions and provide recommendations on how HLT is developed for future research. Data collection techniques in the form of video recordings, observations, interviews, documentation and field notes. The data were analyzed retrospectively and compared with the initial HLT. Data analysis was discussed with the teacher's model to improve reliability and validity in the research in the form of observations, interviews and documentation carried out qualitatively.

III. THE RESULTS OF THE RESEARCH AND THE DISCUSSION

Circle learning in this study consisted of three meetings with three activities. The first meeting was used to emphasize circle learning (including value search). Usually in finding the concept of circles and values, teachers and students use certain methods contained in the book. The method used involves real objects, but is taken in a very long way and takes a long time. Therefore, the existence of GeoGebra can overcome these shortcomings without reducing the

characteristic of RME. GeoGebra can feedback with students and in a short way students can find concepts around the circle. more details can be seen in the following description: Students are divided into 6 groups, each group consisting of 5 people. Each group is given the task of working on two different tasks. The following will be presented by the task of finding the concept of the approximation and around the circle area completed by each group. Please note that in GeoGebra, there are several instructions.

➢ First Group

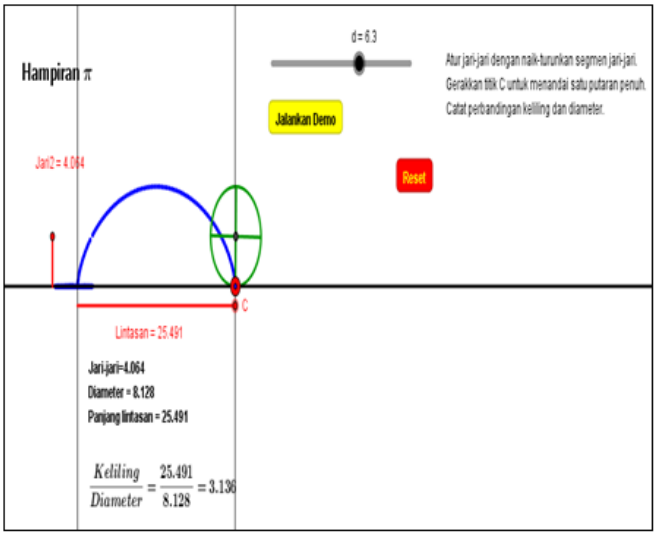

Fig 2:- GeoGebra Visualization and Group 1 Work Results for the First Assignment

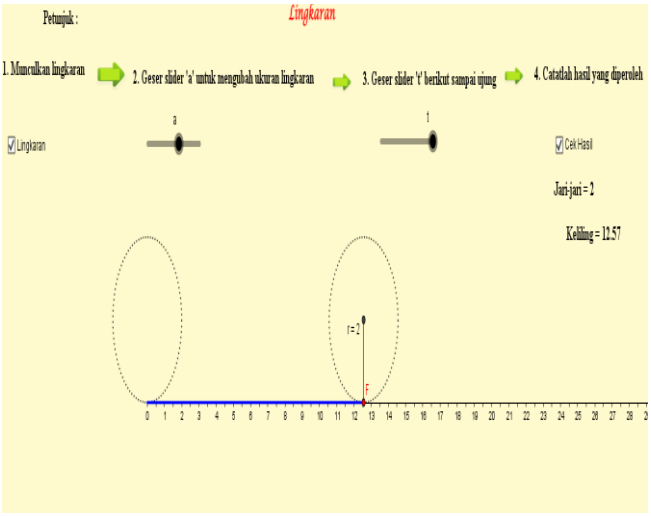

Fig 3:- GeoGebra Visualization and Group 1 Work Results for the Second Assignment

In the previous explanation, it was said that the integration of GeoGebra did not reduce the characteristics of RME, GeoGebra helped find the concept of circles easily and briefly. In the pictures, it appears that there is an image in the form of a particular vehicle wheel that is rotated. The instructions contained in the pictures are very clear and easy for students to follow so that it does not require a long time to find the concept around the circle and almost the value of phi. Note that the parameters of each unit for each group are different. This can be seen in the description of group 2 assignments.

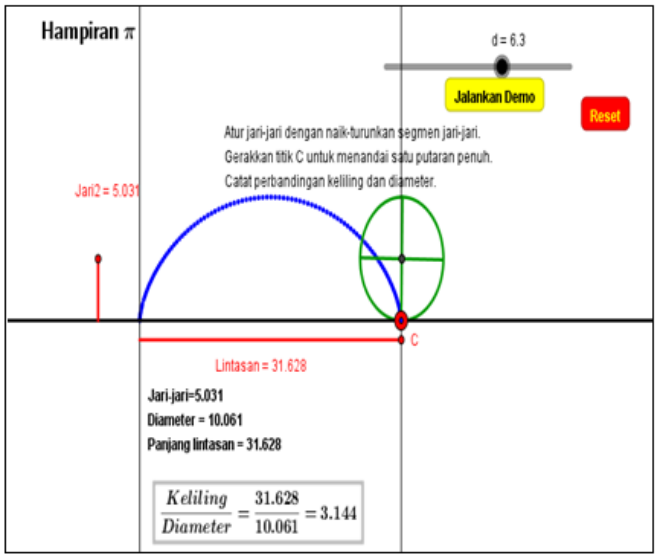

Fig 4:- GeoGebra Visualization and Group 2 Work Results for the First Assignment

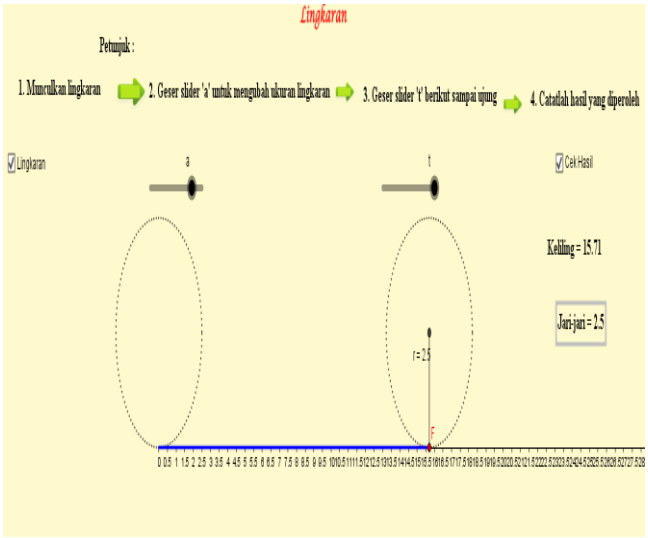

Fig 4:- GeoGebra Visualization and Group 2 Work Results for the Second Assignment

The researcher only displays group 1 and 2 work, because the work results of the other four groups support the discovery of the concept in question. From the first and second assignments, each group member discovers and understands the concept of almost phi and around the circle area. In addition, the group also found that there was a connection between almost phi and around the circle area. This can be understood in the following description:

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Tugas 1	Tugas 2
Diketahui $jari - jari = r = 4{,}064;$ $diameter = r = 8{,}128;$ $keliling = K = 25{,}491;$ $\frac{Keliling}{diameter} = \frac{K}{d} = \frac{25{,}491}{8{,}128}$ $= 3{,}136$ $\approx 3{,}14$ $\approx \frac{22}{7}$	Diketahui : $jari - jari = r = 2$ $Keliling = K = 12{,}57$

Table 1:- Result of First Group Work

Tugas 1	Tugas 2
Diketahui $Jari - jari = 5{,}031;$ $diameter = 10{,}061;$ $Keliling = 31{,}628;$ $\frac{Keliling}{diameter} = \frac{31{,}628}{10{,}061}$ $= 3{,}136$ ≈ 3.14 $\approx \frac{22}{7}$	Diketahui : $jari - jari$ $= r = 3$ $keliling$ $= 15{,}71$

Table 2:- Results of Second Group Work

After a good observation, it was concluded that there is a relationship between almost phi and around the circle area in finding each concept. This is very good because it can encourage students to construct knowledge related to the concept of the circle in question. From task 1, it can be found $diameter = 2\,x\,radius$. Basically almost phi is obtained from the comparison of circumference and diameter, and that is evident in each group job. So, found the concept around the circle area that is $2\,x\,\pi\,x\,r$ and can also be obtained from $\pi\,d$. This can be proven by the circumference value in the two tasks given. Thus, based on the description in this discussion it can be concluded that learning activities involving GeoGebra can help students construct the concept of a circle.

IV. CONCLUSIONS

Based on the results of the study, it can be concluded that GeoGebra aided RME can develop students' understanding of mathematical concepts in circle material. The advice that can be given is that the teacher should be able to use the GeoGebra aided RME as an alternative in classroom learning.

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