The influence of GeoGebra media use to student’s mathematics problem solving ability

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Abstract. The problem of this research was the low ability of grade V elementary students’ mathematics problem solving in Baitul Jannah Islamic elementary school. The objective of this research was to analyze the average of students’ mathematics problem solving abilities by using GeoGebra media and by using conventional learning. This was an experimental research. Population was all grade V students in classrooms V.A with GeoGebra learning for experiment and classroom V.B with conventional learning for control in Baitul Jannah Islamic elementary school. Students were given with five mathematics test problems in essay that had been tested for their validities and reliabilities. Data were analyzed by using t-test. The result showed that the average of students’ mathematics problem solving who used GeoGebra learning were higher compared to those with conventional learning.

1. Introduction

Education is a very important human need to prepare human resource for nation and state development. One of important elements in education is curriculum that consists of series of plans and settings concerning objectives, contents, learning materials, and it is a procedure to use to conduct learning activities. Nowadays Indonesia uses Curriculum 2013 in its educational system. In this curriculum students are demanded to think more creatively, innovatively, and responsively. In addition, students are trained to be encouraged to have logic in problem solving, including mathematics problem solving. Mathematics problem solving is a complex cognitive activity involving a number of processed and strategies [1]. Solving mathematical problem is common task for students at all educational levels. Problem solving is a core goal of mathematics instruction at school, which is justified by great importance that this skill has in everyday life [2]. In mathematics, a problem situation is a learning situation which the teacher imagines in order to create a space for reflection and analysis around a problem and question to be solved too [3]. Teaching mathematics problem solving is a challenge for teachers. Many of whom rely almost exclusively on mathematics textbooks to guide instruction [1]. Most textbooks are not very helpful when it comes to teaching students how to solve math problems. Almost all students have weak problem solving skills. Student are not able to read the problem correctly, students are difficult to read the concept existing in question, so that students are also difficult to determine the right solution. If they are a few students who do re-examining, they only check their calculation not the accuracy of the procedure that they use [4]. These students have special educational needs [1]. There are new forms of instructions, therefore, by asking students to construct their own
knowledge under guidance of their teachers. These students need explicit instructions in selecting strategies appropriate to the task, applying the strategies in the context of the tasks, and monitoring their executions. They have difficulties in abandoning and replacing ineffective strategies, adapting strategies to other similar tasks, and generalizing strategies to other situation and settings. They also gain a better attitude toward problem solving when they were successful. Researchers reported that low achievers trained in learning to monitor and control their own cognitive processes for solving mathematics problem do better than untrained.

The level of achievement of student’s mathematics problem solving ability on geometry was still low [5]. This is because student not use to solving problem that measure mathematics problem solving ability, weaknesses remember previous knowledge, and lack of problem solving framework. The students’ achievement level in mathematical problem solving ability on geometry in Baitul Jannah Islamic elementary school were still low. It could be seen from mathematics examination score data in odd semester. The interviews with teachers in Baitul Jannah Islamic elementary school revealed that most students found difficulties in solving non-routine or non-story examination problems. They did not want to try to seek answers, but only relying on teachers’ explanations. Many students find difficulty to understand mathematics because mathematics is abstract [6]. Students became not active in learning process. Students’ learning results only came the books given by teachers. Teachers did not yet use innovative learning media even though facilities in the school were sufficient. This made students to think that mathematics was boring and difficult materials. This made students’ abilities in mathematics problem solving was for from expectation.

This condition needs a solution so that students will be involved actively by using existing school facilities. A proper learning media use could stimulate students to learn actively. Learning media could also help students to visualize objects of abstract subject matter. In addition, learning media can make learning process to be effective and ease lesson content delivery, so that students would be easier to understand the concept being learned. It also makes learning time to be efficient especially in those materials involving objects or figures. Therefore, media is expected to facilitate students to have more efficient learning and to strengthen student’s material mastery.

One of learning media that can be used for mathematics learning process is GeoGebra. It is a sophisticated learning application software that support varying topics in mathematics. In addition, GeoGebra is easy to obtain because it is free and users can download it. It is a multi-platforms mathematics software that incorporate geometry, algebra, table, calculus, graphic, and statistic in single package that is easy to use by anyone in each educational level [7]. One of the reasons to use this technology in education is to visualize and explore the insight of mathematics with optimum possibilities [8]. GeoGebra gives visual meaning to symbolic ideas along with optimum dynamic possibilities. It is a dynamic program having facilities to visualize or demonstrate mathematical concepts and to help to construct mathematical concepts [9]. GeoGebra is being used at every level in mathematics education [8]. In elementary school, GeoGebra use with attractive display attracts elementary students who naturally like interesting audio and visual in learning process. The objective of this research was to analyze the average of mathematics problem solving abilities of students who used GeoGebra media learning and who used conventional learning.

2. Methods
This was an experimental research by implementing GeoGebra media as a treatment, and then its influence to grade V students’ mathematics problem solving abilities in Baitul Jannah Islamic elementary school in Bandar Lampung in academic year 2019/2020 was analyzed. Population was all grade V students in Baitul Jannah Islamic elementary school in odd semester in Bandar Lampung. Samples were students in classroom V.A as experiment classroom and students in classroom V.B as control classroom. Samples were taken by using cluster random sampling.

Data were collected by using 5 essay problems test to find out students’ mathematics problem solving abilities. Essay test instrument was tested for its validity and reliability. The test results were scored
based on scoring rubric for students’ mathematics problem solving abilities. Hypothesis was tested with normality test, homogeneity test, and finally t-test.

3. Results and discussion
This research was conducted in Baitul Jannah Islamic elementary school in academic year 2019/2020 in even semester with cube and block learning materials. Subjects were 28 students in classroom V.A as experiment group and 28 students in classroom V.B for control group. The researcher used GeoGebra media learning for treatment in classroom V.A and conventional learning for classroom V.B. research was conducted in eight meetings, where first to seventh meetings were to deliver learning materials and the eighth meeting was used to test mathematics problem solving ability. Each meeting lasted for 2 x 35 minutes both for experiment and control classrooms according to their lesson plans.

Normality and homogeneity tests were done before testing hypothesis. Analysis results from the classroom using GeoGebra media derived $L_o = 0.1120$ and $L_{table} = 0.1658$, so that $L_o < L_{table}$, meaning that $H_0$ was accepted and samples were normally distributed. Analysis results from the classroom using conventional learning derived $L_o = 0.1201$ and $L_{table} = 0.1658$, so that $L_o < L_{table}$, meaning that $H_0$ was accepted and samples were normally distributed.

After finding that data were normally distributed, homogeneity test was conducted by using F formula. The estimation results derived $F = 1.59$ and at significance level of 5%, $F_{table} = 1.72$; and $F_{value} < F_{table}$. The conclusion was that both data had the same variance. Hypothesis was tested by using t-test. The result is presented in Table 1 below.

Table 1. T-test analysis result.

| Groups       | N  | Mean in Posttest | $t_{obs}$ | $t_{table}$ |
|--------------|----|------------------|-----------|-------------|
| Experimental | 28 | 73.18            | 3.09      | 1.67        |
| Control      | 28 | 61.32            |           |             |

The table above shows that the averages of student’s mathematics problem solving abilities in experiment and control classrooms are 73.18 and 61.32 respectively. The estimation result derives $t_{obs} = 3.09$ with 5% significance level that produces $t_{table} = 1.67$. Because $t_{obs} > t_{table}$, $H_0$ is rejected. The conclusion is that the average of mathematics problem solving ability of the students using GeoGebra media is higher compared to those students using conventional learning.

The research result shows a general description of GeoGebra media implementation towards grade V students’ mathematics problem solving abilities in Baitul Jannah Islamic elementary school in academic year 2019/2020. GeoGebra implementation in experiment classroom shows a student-centered learning that makes students getting used to learn in groups and learning is started by giving students mathematics problems related to the lesson materials attracting students’ attentions through working sheet that will be finished by using GeoGebra media help. Students will use laptops and they see displays from projector how to use GeoGebra media in mathematics problem solving. Students in groups then would be given mathematics problems and they will solve the mathematics problem with GeoGebra media help. Students in experiment classroom seem active and cooperate each other in learning process and the problems solved by showing figures that students have made with solutions clearly available in GeoGebra application.

GeoGebra software surely makes the learning to be not monotonous, because students learn with a new and more interesting atmosphere and students are challenged to try new things [10]. GeoGebra gives new innovations to help students in abstract mathematics problem solving with visualization help of the main problem. In addition, by trying to understand the materials to learn, students would also understand the role of technology in learning and they would be able to develop more knowledge by using various cases of problem solving.

In different side, control classroom seems to have opposite result compared to experiment classroom. Students seem less active and slow in receiving materials delivered by teachers. During learning process
students feel bored and some are sleepy. This would influence students’ conditions where their knowledge procurement would be minimum and they will be difficult to do problem solving. Their ability to understand geometry would be less explored because they only rely on teachers and textbooks. Students have less opportunities to explore the abilities, so that their lesson materials acceptances would be not optimal. This makes students difficult to solve problems given by their teachers.

Problem solving indicators in this research are understanding the problem planning, performing the plan, and confirmation of the answer [11]. The students’ answers in experiment classroom showed that their answers had referred to the indicators, but some students often missed the confirmation of answer stage. This is because students considered that they had finished answering, so they did not need to re-check/conclude answers they made. In control classroom, students answered questions directly without previously understanding the problem. Their answers were less systematic and they also missed the confirmation of the answer stage. This was because students less understood the systematics of problem solving. The result of this study are appropriate with the research conducted by Widodo et al., [12] can concluded, the ability to solve mathematical problems is the ability of student to overcome the problems that were not clear the answer. Problem that arise in solving problems are ways that the students use in solving mathematical problem has not been systematic or sequential, so the ability of student in solving mathematics problem has not been maximized. Therefore, teachers would have important roles in learning process. The process of thinking in problem solving needs teachers’ attentions to help students in developing problem solving ability [13]. Teachers should be able to create learning activities that are adjusted to the student cognitive styles that students have good problem solving abilities. This indicates that teachers are demanded to be creative in using learning media to make students to be active and to have good and proper mathematics problem solving abilities.

4. Conclusion
The conclusion of this research is that the average of mathematics problem solving abilities of students using GeoGebra media is higher compared to those students using conventional learning. This indicates the influence of GeoGebra media use to grade V students’ mathematics problem solving abilities in Baitul Jannah Islamic elementary school in Bandar Lampung in academic year 2019/2020. This is because GeoGebra provides new atmosphere that attract students’ attentions to be active in learning process.

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