Using *Geo-Gebra* Assisted CTL Model to Increase the Student's Mathematical Representation

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ABSTRACT
This research is a quasi-experiment study with a non-equivalent control group design. The population in this study were all students of class VIII SMP Negeri 9 Palembang, with a purposive sampling technique taken two classes as the sample. The results of data analysis show the average initial ability of mathematical representations students in the experiment group was the same as the initial ability of students in the control group with a significance value of 0.054. However, after the treatment, there was a difference in the average mathematical representation ability of the experiment class, and the control class, namely 17.13, and p-value 4.105 with sig. (2 tailed) 0.0010, rejection for H_0, which means that the mathematical representation ability of the experiment class is better than the control class, and the difference in the increase in mathematical representation ability in the experiment class, and control class with p-value 0, 322 with sig. (2 tailed) 6.505, rejection also for H_0, meaning that there is a difference in upgrading mathematical representation in the experiment class, and control class.

Keywords: *Contextual, Teaching, Mathematical, Geo-Gebra.*

1. INTRODUCTION

Nowadays, we are in Society 5.0, Revolution Industry 4.0, and digital era. So that, we must prepare quality and superior resources [1]. The quality of Indonesian education must be better too [2]. In the field of education, technology plays an important role in advancing and developing students' skills. With technology, the teacher's task will also be helped [3].

Mathematics is a subject that needs to be given to all students to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to cooperate [4]. Actually, the use of mathematical representation by students will help students make mathematical ideas more concrete so that students can develop a view of mathematics [5]. An appropriate teaching methodology and relates to the students' real-life context, experience can stimulate student's interest in expressing their thoughts on generating concepts of knowledge [6]. The knowledge is built based on the context owned by the students [7]. Sometimes, limited ideas become the students' barriers in composing a good representation [8]. With the ability to represent mathematics students can solve problems both in their life, and in the community [9]. One of the efforts that can be made to influence so that it can develop students' mathematical representation abilities is to choose an appropriate learning model that can encourage students' enthusiasm for learning so that they can develop students' mathematical representation abilities maximally, and learn more meaningfully [10].

According to NCTM [9] explained that the ability of mathematical representation is the ability to restate notations, symbols, tables, images, graphics, diagrams, equations or other mathematical expressions into other forms [11]. Fitriana, et all explained that five indicators of the mathematical representation ability is use visual representation to solve a problem; present information into diagrams, graphs or tables and solve a problem using written words or texts; develop mathematical models and solve a problem by involving mathematical expressions; draws geometric patterns, to write down that steps with word and solve the problems with mathematical expressions; and create a problem situation based on the provided representation [12].

As an effort to improve students' mathematical representation, one alternative learning that is thought to be able to increase student representation is IT-assisted learning. The development of information, and representation technology began with the development of computer technology. And Geo-Gebra is a software interactive geometry, algebra, statistics, and calculus applications, Geo-Gebra developed as a learning facility, and the teaching of mathematics, and science from the start of primary school to university level. With Geo-Gebra we can define and define equations and coordinates directly [13].

Contextual Teaching and Learning (CTL) approach to address the necessities in education today. Contextual Teaching and Learning (CTL) is an approach which helps students understand what they are learning by connecting their subject with their lives' context [14]. CTL approach emphasises students' interest and experiences, so the students are easy to understand the material [15]. Additionally, some scholars found that Contextual Teaching and Learning (CTL) approach help students develop their achievement at school, also promote their critical and higher order thinking [16][17][18] [8].

One of factors found in the difficulties students faced in solving geometry problems in National Examination in Indonesia is students' lack of mathematical representation [19]. These hardships due to the lack of being unable to represent with diagram [20].

Working in mathematics with representation can foster students' speed in solving the problem [21]. The most students answer correctly questions measuring representation skill generally but when students are asked to identify function displayed in graph, table and equation among relations (not function), the results is not in harmony with the first result. Representation is also affected by teachers' perception about representation [22]. Teachers' content knowledge is also a central issue related to the success of mathematics learning with representation [23].

Table 1. Contextual Teaching and Learning Syntax

Component	Teacher, and Student Behavior
Conveying contextual problems related to the concepts to be studied.	Teachers, and students can convey contextual problems related to the concept of the material to be studied.
Contextual problem solving is carried out by students with teacher guidance.	Students solve contextual problems through questioning activities, compiling models, and findings. During this activity, Geo-Gebra software can be used predominantly from demonstrations to exploration to make it easier to achieve learning objectives
Presentation of problem solving results (concept discovery)	Students convey the results of problem solving in group, and class discussions. In this activity, the teacher conducts a process assessment.
Submission of conclusions	The teacher guides students in concluding the results of problem solving, and from the findings. At this stage the teacher assesses the process, and results.

Previous research conducted by Saputri & Sari examined the Improvement of Mathematical Representation Ability through the Wingeom Assisted Visualization Auditory Kinesthetic (VAK) Learning Model, and the result was that there was no difference in the ability of mathematical representation taught with the Wingeom-assisted Visualization Auditory Kinesthetic (VAK) learning model with Wingeom's usual learning model [24]. Then, Nopiyanti *et al* examined the Application of Geo-Gebra-aided Realistic Mathematics Learning to Improve Mathematical Communication Skills for Junior High School Students. The results showed that the mathematical communication skills of students who received realistic mathematics learning assisted by Geo-Gebra were better than students who received realistic mathematics learning without Geo-Gebra [25].

Meanwhile, Umiyatun *et al* examined the Effect of Geo-Gebra-Assisted Learning on Students' Understanding of Mathematical Concepts gets result that learning assisted by Geo-Gebra greatly affects the improvement of students' understanding of mathematical concepts compared to learning assisted with Power Point, and the contribution of learning seen from the results of the pretest, and posttest scores by calculating normalized average gain score 0.82 with a high category in the experiment class, and 0.66 with a moderate category in the control class [20].

From the description above, the research is focused on the implementation of the Geo-Gebra Assisted Contextual Teaching and Learning Model to Improve the Mathematical Representation Ability of Junior High School Students. The long-term objective of this study is to develop computer assisted learning as an alternative in learning mathematics. While the specific goals are 1) Examine in depth upgrades obtain a mathematical representation of students Geo-Gebra-assisted Contextual Teaching and Learning (CTL) compared to the upgrading of the mathematical representation of students who received conventional learning; 2) Implementing the Geo-Gebra-assisted Contextual Teaching and Learning (CTL) model to improve the mathematics representation skills of junior high school students.

2. METHOD

This research is included in quasi-experiment research or quasi-experiment research where the research uses classes that already exist. The design used in this study is the non-equivalent control group design. In this experiment design there are two groups of samples, the existence of a pretest, different treatments and the existence of a post-test. The sample in the first group is an experiment class that uses the Geo-Gebra-assisted Contextual Teaching and Learning Model. Meanwhile, the second group as the control class who received learning using conventional learning. Meanwhile the second group as a control class that gets learning using conventional learning. The existence of this control class is as a comparison, to what extent changes occur due to the treatment of the experiment class. The design diagram of this research is as follows [27]:

O X O
- - - - - - - - - - - - - - - -
O O

Information:

O: Pretest and Post-test represent ability of student representations.

X : Treatment using the Geo-Gebra-assisted Contextual Teaching and Learning Model

- - -: The subject was not selected randomly.

The population in this study were all students of class VIII SMP Negeri 9 Palembang. The sampling technique was carried out using purposive sampling technique. Samples on select from is graders VIII.3 were used as experiment class, and class VIII.4 used as a control class with the number of students in two classes of 46 students. The instrument that will be used in this research is a mathematical representation test.

3. RESULTS AND DISCUSSION

Descriptive statistics of mathematical representation ability in the experiment and control groups are obtained as shown in the following table 2.

Table 2. Descriptive Statistics Mathematical Representation Score

Test	Eksperiment Class					Control Class				
	N	Xmin	Xmax	$\bar{x}$	Sd	N	Xmin	Xmax	$\bar{x}$	Sd
Pretest	23	1 3	73	43.7	17.42	23	17	67	52.65	12.91
Post-test	23	50	10 0	73.26	14.3	23	23	80	56.13	13.9

The initial stage analysis carried out in this study was to analyze the pretest value. The pretest value analysis was carried out to determine whether there were differences in the ability, and increase in the mathematical representation ability of students in the experiment group, and the control group calculated by the pretest value similarity test using the Mann-Whitney non-parametric test. The results of the analysis state that the mean initial mathematical representation ability of students in the experiment group is the same as the initial ability of students in the control group with a significance value of 0.054, which means that it is greater than $\alpha = 0.05$. Furthermore, in table 3, a summary of the research hypothesis is presented, the type of statistical test used, and the results of the H_0 test.

Table 3. Summary of Hypothesis Testing at the Significance Level $\alpha = 0.05$

Hypothesis	Mean Difference	t	Sig. (2 tailed)	Testing H0
Ability Comparison Test	17.13	4.105	0.0010	Rejected
Comparative Ability Improvement Test	0, 322	0.515	6,505	Rejected

Based on the above table, the Sig (2-tailed) value obtained for the students' The ability of students' mathematical representation in the experiment class is better than the ability of students in the control class. The average value of the mathematical representation in the experiment class was 73.26, while the average value in the control class was 56.13. So that the mean difference is 17.13, and this shows a significant difference, as well as for the difference in the improvement of mathematical representation ability between the experiment class, and the control class. The average increase in the value of the class experiment after treatment was 0.396, while the control group was 0. 074, so that only their mean difference of 0.12. The comparison of the N-gain value in the experiment class, and control class can be seen in Figure 1.

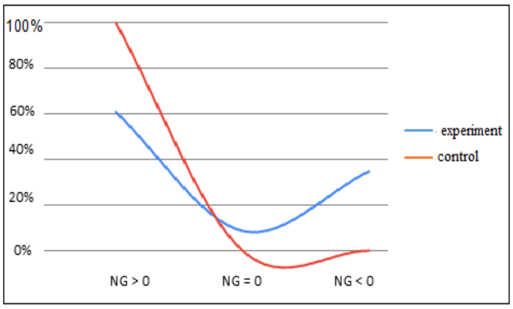

Figure 1. The graph of the comparison of the N-Gain value of the experiment and control class.

The results showed that students whose learning used the Geo-Gebra-assisted Contextual Teaching and Learning Model had a higher average mathematical representation ability than students who did not use the Geo-Gebra-assisted Contextual Teaching and Learning Model. This result is possible because through software -assisted learning, students who find it difficult to represent solving math problems can be helped by using software so that students get real, and precise visual images more quickly, and precisely. Meanwhile, these activities did not occur in mathematics learning in the control class.

In general, the learning process that occurs in the experiment class is in accordance with the syntax, criteria, and learning characteristics of Geo-Gebra-assisted Contextual Teaching and Learning. This can be seen from the active process of students in conveying contextual problems related to the concept of the material to be studied, solving contextual problems through questioning activities, compiling models, and findings, using Geo-Gebra software to represent pictures, and equations of lines, conveying the results of problem solving in group discussions, and class, and draw conclusions from the results of problem solving, and from the findings

The learning experience obtained by students after learning mathematics using the Geo-Gebra-assisted Contextual Teaching and Learning Model has stimulated students' creativity in using Geo-Gebra software, but the weakness is that students are less tidy in drawing themselves manually without software. On the other hand, during the mathematics learning process using the help of Geo-Gebra software, students are more enthusiastic about learning, because they can check to get precise, and accurate images using Geo-Gebra software besides that it is also able to improve their ability to represent solving mathematical problems.

Furthermore, if you look at the results of the research that has been stated, it shows that mathematics learning using the Geo-Gebra-assisted Contextual Teaching and Learning Model is better in improving students' mathematical representation abilities compared to conventional learning. Some of the reasons put forward are that in the implementation of learning in the control class that does not use the Geo-Gebra-assisted Contextual Teaching and Learning Model, the teacher provides informative learning even though it has used the 2013 curriculum so that learning still uses a scientific approach. The teacher provides an explanation of the subject matter in detail, provides examples of how to solve problems, and provides exercises. Students pay attention to the teacher's explanation carefully, then note what the teacher explains, and do the exercises. Student activities during this learning tend to be monotonous, and do not train students' creativity in learning compared to mathematics learning using the Geo-Gebra-assisted Contextual Teaching and Learning Model.

4. CONCLUSION

Based on the results of the research, several conclusions were obtained that the ability of mathematical representation in students whose learning uses mathematics learning using the Geo-Gebra-assisted Contextual Teaching and Learning Model is better than students who do not use the Geo-Gebra-assisted Contextual Teaching and Learning Model, and there are also differences in improvement. the ability of mathematical representation of students who learn using the Geo-Gebra-assisted Contextual Teaching and Learning Model, and students who do not use the Geo-Gebra-assisted Contextual Teaching and Learning Model.

AUTHORS' CONTRIBUTIONS

Author's contributions in this research is as the researcher.

ACKNOWLEDGMENTS

The researcher would like to thanks to the Rector of Sriwijaya University and the Institute for Research and Community Service/ Lembaga Penelitian dan Pengabdian kepada Masyarakat (LPPM) of Sriwijaya University for providing research grants for science, technology and arts schemes (SATEKS).

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