



The Effect of Discovery Learning Supported By Geogebra Application and Contextual Teaching Learning Towards Mathematical Problem Solving Ability

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Abstract: This study aims to determine the effect of discovery learning model supported by geogebra application and contextual teaching learning models to mathematical problem solving ability. Theresearch subjects were students class X1 MAN Pemalang of the 2018/2019 academic year. The sample used in this study was choosen by a cluster random sampling. The sample t-test was applied with a significance level 0.05 to cognitive test data consisting of 5 question. The result showed that Geogebra's assisted discovery learning model are better than contextual teaching learning models in improving students' problem solving abilities.

Keywords: discovery learning, contextual teaching learning, geogebra, mathematical problem solving ability.

***Abstrak:** Penelitian ini bertujuan untuk mengetahui pengaruh model discovery learning berbantuan aplikasi geogebra dan model pembelajaran kontekstual terhadap kemampuan pemecahan masalah matematika. Subjek penelitian adaah peserta didik kelas 11 MAN Pemalang. Sampel yang digunakan dalam penelitian ini diambil menggunakan cluster random sampling. Kemudian untuk mengetahui data tersebut peneliti menggunakan uji-t dengan taraf signifikansi 0,05 dalam bentuk data kuantitatif yang diperoleh melalui lembar tes kognitif yang terdiri dari 5 pertanyaan. Hasil penelitian menunjukkan kemampuan pemecahan masalah yang diajar menggunakan model pembelajaran discovery learning lebih baik dari model pembelajaran kontekstual.*

***Kata kunci:** discovery learning, pembeajaran kontekstual, geogebra, kemampuan pemecahan masalah.*

▪ INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by him, society, nation and state (Law on the National Education System No. 20, 2003). One of them is to strengthen the scientific, integrated thematic approach (thematic between lessons), thematic (in an eye of learning), it is necessary to apply disclosure / research learning (discovery or inquiry learning). Implementation of lesson plan in teaching- learning that includes preliminary activities, core activities, and closing activities. The core activities use learning models, learning methods, learning media, and learning resources that are tailored to the characteristics of students and subjects. The selection of integrated and/or scientific and / or inquiry approaches and / or thematic and disclosure (discovery) and/or learning that produce work based problem solving (project based learning) is adjusted to the characteristics of competency and education level (Minister of Education and Culture Regulations No 22, 2016).

There is a need to teach the pivotal skill of mathematical problem solving to students with severe disabilities, moving beyond basic skills like computation to higher level thinking skills. Problem solving is emphasized as a Standard for Mathematical Practice in the Common Core State Standards across grade levels (Spooner et al, 2017). Mathematical problem solving and increased competence in mathematics likely leads to better outcomes for individuals with ID by increasing access to general curriculum content, giving students exposure to a variety of real-world mathematical problems, and building opportunities for future mathematical success (Browder et al, 2012). According to (Ozcan, 2017) metacognitive experience was the only variable that directly affected mathematical problem-solving performance, as well as serving as a mediator of the effects of mathematics self-efficacy, mathematics motivation, and mathematics anxiety. The use of simulated, real-world mathematical problems is a feasible option that builds generality by replicating natural settings and situations outside of classroom environments and provides multiple exemplars to practice in a controlled environment without competing factors encountered during community-based trips, such as noise, time, limited trials, and added social interaction pressures (Ayres et al., 2009; Cihak et al., 2006; Mechling, 2005).

Discovery learning is a learning process of discovery in which it is not presented in a final form, but students are required to organize and determine their own concepts through various learning resources. As the opinion of Brunner (Minister of Education and Culture Regulations, 2013; Muhamad, 2017) that "Discovery learning can be defended as learning that is not presented with the subject matter in the final form. Brunner's idea is the opinion of Piaget which states that children must play an active role in learning in class. According to Wilcox (1987), states that discovery learning encourages students to be actively involved in the learning process both about concepts and principles. The teacher must provide experience so students find principles for themselves. There are several types of discovery learning, one of which is guided discovery learning. There is a need for educational software to supplement regular classroom instruction on basic combination software that provides simultaneous or proximate practice of number-after relations and adding 1 and doubles and everyday visual analogies. Stand-alone software could provide cost-effective training that many teachers do not have the time and training to deliver (Baroody, 2013).

Guided discovery learning is a learning model that creates learning situations that involve students learning actively and independently in finding concepts or theories, understanding, and problem solving (Wilcox, 1987). From the explanation it can be concluded that the learning model of guide discovery learning is suitable in the learning process in the classroom. Bruner (1983) states that the stages in implementing guided discovery are as follows: (1) stimulus, (2) statement of problems, (3) data collection, (4) data processing, (5) verification, (6) generalization. Formal education has several levels, namely: Elementary School, Middle School, and Higher Education. Every level of education has mathematics subjects. Therefore mathematics is said to be a basic science that is useful in everyday life. But not a few of the students consider mathematics subjects as difficult subjects. So the assumption can affect the activity and learning achievement of students, especially in problem solving skills.

The result of interview with mathematics teacher in MAN Pematang, on January 8, 2018. Problems faced by teachers in educating students are: learning activeness of students, in this case students are lazy to learn, lazy to interact, lazy to work on the problem and still lack of problem solving skills. In the learning activities the teacher uses the pre-test and post-test, lecture, and question and answer methods using the Contextual Teaching Learning model. PAS 1 XI MIA semester 1 2018/2019 Academic Year learning outcomes are completed by 20% with scores exceeding minimum completion criteria 76. The Percentage of problem solving abilities of students in the circle equation material class XI of the 2017/2018 academic year with 55% which passed the criteria.

Mathematics is one of the bases that must be mastered by humans, understanding of the achievement of mathematical concepts has not been well realized by teachers and students. In fact, the observations made by the understanding of mathematics in schools are only done by working on the questions routinely so that students are not accustomed to solving problems faced because students can only solve questions that are in accordance with the examples learned (Utami et al., 2014). Shadiq (2014) states that problem solving (problem-solving) is the process of thinking to determine what must be done when we do not know what we have to do. Lestari & Yudhenegara (2017) state that problem solving skills are the ability to solve routine, non-routine, applied routine, non-applied routine, applied non-routine, and non-routine non-applied problems in the field of mathematics.

Based on some of the opinions above, it can be concluded that the problem solving ability is an effort to solve a problem to obtain a solution or solution. According to Polya (Schoenfeld, 1987) indicators of problem solving (especially in mathematics learning) are as follows: (1) Understanding problems, (2) Planning solutions, (3) Running plans, (4) Examination. According to (Wilcox, 1987) one of the techniques for assessing problem solving skills is by testing (problem solving). Learning activity of students relates to all activities that occur both physically and non-physically. The activeness of students will create an active learning situation. When students are passive, students only receive information from the teacher. Therefore increasing the learning activeness of students is important in order to create active learning situations. The learning process in the classroom is an activity of transforming knowledge, attitudes, and skills. In this activity, students are very active, where students are a subject that does a lot of activities, while teachers are more guiding and directing (Wilcox, 1987). Learning activeness is the involvement of students in the learning process with the aim of having success in learning (Lestari & Yudhanegara, 2017: 99).

The activity of students in the learning process in diverse classes, as explained by Paul D. Diedrich (Isnani, 2011) divides the learning activities of students into 8 groups, namely: (1) visual activity, (2) moral activities, (3) listening activities, (4) writing activities, (5) mental activities, (6) emotional activities, (7) motor activities, (8) drawing activities. In this study will use 4 activeness indicators, namely: (1) visual activity, (2) moral activities, (3) listening activities, (4) writing activities. This is in accordance with the conditions of the students. The circle equation is one of the geometry material in mathematics. At the level of high school / equivalent, the material of the circle equation is a sub chapter of the circle material which discusses the equation of the circle, position (point, line, and circle) of the circle, and the tangent equation of the circle. Here students are required to understand the concept and be able to solve problems related to the equation of the circle. One of the problems of students in the material circle equation is visualizing the shape of the circle and the concept of circles that tend to be abstract. Therefore learning media is needed, so the students understand the circle equation material more easily.

One computer program that can be used as a medium of mathematics learning is the Geogebra application, with facilities owned by Geogebra, can be used to demonstrate or visualize mathematical concepts and tools to construct mathematical concepts. One of the tools that Geogebra can use is in the field of geometry. Moreover, the Geogebra application is suitable for learning media and the students can understand geometry material more easily, especially the material of circular equations. Idris's research results (2015) that Geogebra can improve student learning outcomes. Similarly, the results of the research by Aditama (2014) that the learning outcomes of students after Geogebra-assisted inductive learning in the two circle tangent material of the two circles are well categorized and the activities of the students during the Geogebra-assisted inductive learning process in the two circle alliance tangent material active

The results of Effendi's (2012) study that overall improvement in representation ability and mathematical problem solving of students who obtain learning with guided discovery methods is better than conventional learning. Besides the results of Purnomo's study (2011) that the guided discovery model is better the learning outcomes than cooperative learning and cooperative learning are better learning outcomes than conventional models. In moderate and low creativity, guided discovery and cooperative learning provide the same learning outcomes, but are better than conventional. On the other hand, in guided discovery learning, high creativity is better learning outcomes than moderate creativity and creativity is having the same learning outcomes with low creativity. In cooperative learning and conventional models, high, medium and low creativity have the same learning outcomes.

Dynamic geometry software (DGS) aims to enhance mathematics education DGS has been studied by some researchers and educators in geometry teaching. Jones (2002) classified DGS software into three categories: (a) students' interaction with the software (Arzarello et al., 2002), (b) instructional design (Laborde, 2001), and (c) effectiveness in improving the students' understanding of mathematical proof (Hölzl, 2001). However, many of the published studies were case studies as only weak evidence to support policymaking by teachers or school leaders (Hölzl, 2001; Marrades & Gutiérrez, 2000; Sinclair, 2003). Appropriate use of DGS should improve students' achievement (Isiksal & Askar, 2005), motivation, and engagement (Isiksal & Askar, 2005). DGS should help students develop their deductive skills (Healy & Hoyles, 2001). With the assistance of DGS, students should be able to explain various quadrilaterals,

particularly how to formulate and derive precise mathematical properties from imprecise languages (Jones, 2000). The study by Chan (2014), the statistically significant and high overall effect of DGS-based instruction on students' mathematical test scores demonstrated that DGS intervention should be an effective approach to transforming traditional teaching practices. The results of this meta-analysis support the school administrators or educational policymakers to encourage teachers to integrate DGS into the mathematics classroom. However, further research should be conducted to investigate the impact of DGS-based instruction in various settings, for example, using different pedagogical approaches and different assessment methods. Based on the background of the explanation, it is necessary to do research on the Guided Discovery learning model assisted by Geogebra's application of activeness and problem-solving abilities in mathematics subjects on subject matter concepts and circle equations.

▪ METHOD

This study is an experimental study with the population in this study were students class 11 MAN Pematang 2018/2019 academic year. The sample used in this study was taken using a cluster random sampling technique of 2 classes with 36 classes each. Then to find out the data the researcher using t-test with a significance level $\alpha = 0,05$ in form of quantitative data obtained through cognitive test sheets consisting of 5 question. All instruments of this research were validated. This research was applied to subjects on subject matter concepts and circle equations. The research design is used in this study was the Randomized Posttest-Only Control Design with guided discovery learning models (class experiment) and contextual teaching learning (class control). Analysis of the test data was carried out using the t test with a real level $\alpha = 0.05$ which was processed using the SPSS 17.00 calculation program. The acquisition of statistical data is then interpreted descriptively.

▪ RESULT AND DISCUSSION

Data obtained from calculations using the SPSS 17.00 program are presented in Figure 1 below. Figure 1 shows a comparison of the results of understanding concepts from the experimental class (eksperimen) and the control class (kontrol). The experimental group ($N = 83,917$) had a higher change compared to the control group ($N = 64,986$). The results of the analysis show that the data is homogeneous ($F = 3,595$; where $p > 0.05$). This shows that there is no variance between the experimental and control groups. In other words the data variation in the two treatment groups was the same.

Table 1. The result of T-test using significance level 0.05

	Levene's Test		T-test				
	F	Sig.	t	df	Sig.	Mean dif.	Std. error
Equal variances assumed	3.595	.062	4.932	70	.000	18.931	3.838
Equal variances not assumed			4.932	66.099	.000	18.931	3.838

The calculation of the two right t test using the SPSS program figure.1, obtained t-count of 4.932 with a level of 5%. Because $p\text{-value}(0.062) > 0,05$ then H_0 is rejected. Because the P-value is $0.00 < 0.05$, then H_0 is rejected. So that students' problem solving abilities taught with the Geogebra-assisted Guided Discovery Learning model are better than students taught with the Contextual Teaching and Learning model. Based on the results of calculations, it was found that students taught with Guided Discovery learning learning models assisted by Geogebra applications were better than students taught with the Contextual Teaching Learning model. The learning process by using the Guided learning learning model assisted by the Geogebra application creates active and independent students. These results are in accordance with Wilcox's opinion (1987), which states that discovery learning encourages students to be actively involved in the learning process both regarding concepts and principles. So that students are more critical and confident in working on the problems and in the learning process in class. Then the Guided Discovery learning learning model assisted by the Geogebra application is able to improve the ability of students to solve problems, especially in the subject matter of concepts and circle equations. This can be seen from the comparison of the value of students taught with the Geogebra-assisted Guided Discovery learning learning model compared to students taught with the Contextual Teaching Learning model, which states that students' problem solving skills are taught by application-assisted Guided Discovery learning learning models Geogebra is better than students taught with the Contextual Teaching Learning model.

▪ CONCLUSION

The results of this study can be concluded that to improve the understanding of the concept of learning, inquiry is one of the offers that can be applied in learning mathematics, especially the subject matter of concepts and circle equations. This can be seen from the calculation Geogebra-assisted guided discovery learning model are better than students taught with the contextual teaching and learning model.

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