

IMPLEMENTATION OF GEOGEBRA ONLINE BASED ON GUIDED INQUIRY TO INCREASE PROBLEM SOLVING ABILITY AND STUDENT LEARNING INDEPENDENCE

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Abstract

This study aims to test the improvement of students' mathematical problem solving abilities and learning independence using zoom with online Geogebra based on guided inquiry better than the students' mathematical problem solving skills using zoom with online Geogebra guided inquiry. The method used is quantitative research by designing a design posttest group. Data analysis using an independent test, namely the t-test, before the t-test, the test is carried out first by testing the normality and homogeneity of the data. For self-study data questionnaires, ordinal data were changed using Rasch model software into data intervals and then data analysis using SPSS. DR. HAMKA in the odd semester of 2021/2022 and the sample is two classes selected using purposive sampling technique. Data analysis used normalized test and gain test to see the results of the increasing problem solving abilities and learning independence. Based on the results of the study, it can improve mathematical problem solving abilities and learning independence of students who learn to use zoom with guided inquiry-based online Geogebra better than students who use guided inquiry zoom without online Geogebra. The results of increasing mathematical problem solving abilities of students in the online Geogebra class based on guided inquiry obtained an increase in the high category and the guided inquiry class without online Geogebra obtained an increase in the category. The results of increasing student learning independence in the online Geogebra class based on guided inquiry and guided inquiry class without online Geogebra obtained an increase in the low category.

Keywords: *Geogebra online; problem solving skills; self regulated learning.*

Abstrak

Penelitian ini bertujuan untuk menguji peningkatan kemampuan pemecahan masalah matematis mahasiswa dan kemandirian belajar menggunakan zoom dengan geogebra online berbasis *guided inquiry* lebih baik daripada kemampuan pemecahan masalah matematis mahasiswa menggunakan zoom dengan *guided inquiry* tanpa geogebra online. Metode yang digunakan adalah penelitian kuantitatif dengan design pretes postes group design. Analisis data dengan menggunakan uji independent test yaitu uji t, Sebelum uji t dilakukan uji prasyarat terlebih dahulu dengan menguji normalitas dan homogenitas data. Untuk data angket kemandirian belajar data, ordinal diubah dengan menggunakan software research model menjadi data interval kemudian analisis data dengan menggunakan shops..Populasi penelitian ini adalah semua mahasiswa prodi pendidikan matematika Universitas Muhammadiyah Prof. DR. HAMKA semester ganjil tahun 2021/2022 dan sampel adalah dua kelas yang di pilih menggunakan teknik *purposive sampling*. Analisis data menggunakan uji t dan uji gain ternormalisasi untuk melihat hasil peningkatan kemampuan pemecahan masalah dan kemandirian belajar. Berdasarkan hasil penelitian di dapat bahwa Peningkatan kemampuan Pemecahan masalah matematis dan kemandirian belajar mahasiswa yang pembelajaran menggunakan zoom dengan *geogebra online* berbasis *guided inquiry* lebih baik daripada mahasiswa yang menggunakan zoom dengan *guided inquiry* tanpa *geogebra online*. Hasil peningkatan kemampuan Pemecahan masalah matematis mahasiswa kelas *geogebra online* berbasis *guided inquiry* memperoleh peningkatan dalam kategori tinggi dan kelas *guided inquiry* tanpa *geogebra online* memperoleh peningkatan dalam kategori sedang. Hasil peningkatan kemandirian belajar mahasiswa kelas *geogebra online* berbasis *guided inquiry* dan kelas *guided inquiry* tanpa *geogebra online* memperoleh peningkatan dalam kategori rendah.

Kata kunci: *Geogebra online; kemampuan pemecahan masalah; kemandirian belajar.*



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INTRODUCTION

The ability to solve mathematical problems is the main goal of mathematics and one of the abilities that must be possessed by students in learning mathematics (Darma et al., 2016; NCTM, 2000; Netriwati, 2016). There are five main components to achieve mathematical problem solving abilities, including 1) concepts, 2) processing, 3) metacognition, 4) attitudes and 5) skills. (Darma et al., 2016).

If the 5 components can be mastered well then mathematical problem solving abilities can be achieved. Problem solving ability is also part of the higher order thinking skills (HOTS) question type, because students do not only use calculations or formulas but involve their reasoning and analytical skills in solving everyday problems (Suryapuspitarini, 2018). In addition, it is important that problem solving skills are developed both for students, especially for prospective teachers who will teach mathematics and have abilities in schools (Anisah & Lastuti, 2019). The way to develop mathematical problem solving skills is that students must get used to solving open-ended questions and choosing methods that can improve mathematical problem solving abilities (Anisah & Lastuti, 2019).

In fact, based on research results (Hadi & Faradillah, 2020) students still have difficulty solving problems related to mathematics and difficulties in understanding mathematical concepts. The most difficult stages for students in solving mathematical problems carry at the stage out plans and draw conclusions (Anisah & Lastuti, 2019). In addition to problem solving abilities, independent learning is needed in the process of solving problems in life. One of the factors that influence learning

independence is the willingness, motivation, emotion and focus of attention on solving problems (Subekti & Jazuli, 2020).

Independent learning also has something to do with mathematical problem solving abilities. Based on research results (Darma et al., 2016) that the higher a person's learning independence, the higher the problem-solving ability. This means that high learning independence can affect problem solving abilities and critical thinking skills (Indraswari et al., 2019; Miatun & Khusna, 2020). In addition, there is a positive relationship between problem solving ability and independent learning in student teacher candidates. Students as prospective mathematics education teachers have an important task in developing students' problem solving abilities in the future. Because it can make it easier for students to deal with problems in student life now and future. In higher education, students experience phases of learning that lead to the development of knowledge, a logical and realistic mindset, as well as habituation are more independent. (Setiawan et al., 2021). Student learning independence plays a role in expressing ideas to a problem in order to create superior students (Saputra et al., 2019).

Another factor that influences independent learning is the skills of lecturers in teaching and establishing relationships with students and in creating a supportive environment. The characteristics of people who have independent learning are: (1) have the ability to determine their own destiny; 2) creative and initiative; 3) be responsible; 4) able to restrain themselves; 5) make their own decisions; and 6) able to solve problems with their abilities. According to Desmita (Subekti & Jazuli, 2020). The lecturer's skill in

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drawing can be seen from how the lecturer is able to convey material information properly using the right learning model. Various kinds of learning models that can improve problem solving skills and independent learning include Guided Inquiry.

Guided Inquiry is a learning model that seeks to instill scientific foundations in students, so that in this learning process, students learn more on their own, develop creativity in understanding concepts and solving problems with the help of the teacher (Komalasari, 2015). Based on previous research, the Guided Inquiry model is more dominant and gives a positive attitude towards mathematics (Kadir et al., 2017). We need a learning that can provide opportunities for students to transform independent learning in solving the problems they face.

Currently, the conditions of learning in Indonesia, both in schools and campuses, are still using the online process, there is no face-to-face teaching. Face to face will be replaced with an online process using an LMS such as Google Classroom, psychology, Moodle, and so on. As for video conferencing, there are zoom meetings and google meet to support online teaching and learning activities. UHAMKA already has its own LMS in online learning, namely Online Learning Uhamka (OLU). Online learning requires students to be able to learn on their own regarding the courses they will take. Limited space and time make it difficult for lecturers to monitor student work or assignments. An alternative to seeing student work is to use LMS Online Geogebra. The application is the same as Geogebra in general. It is different in terms of online activities by using their respective accounts that are connected to student

emails. Geogebra Online contains worksheets called Applets. Lecturers can see directly the results of student activities in terms of drawing and solving problems. GeoGebra Online is one of the LMS media that is interactive enough to be used in learning mathematics (Velichová, 2011). GeoGebra can increase student learning independence in mathematics courses (Saputra et al., 2019).

With online learning, students are more independent in learning and not dependent on others, setting learning goals, diagnosing learning needs, having self-confidence, responsibility and conducting self-evaluations (Sobri et al., 2020). Using GeoGebra online will also make motivation, independence better in the teaching and learning process (Saputra et al., 2019). Another research shows that students who use GeoGebra on mathematics learning have higher conceptual and procedural knowledge than students who learn Mathematics through conventional methods (Zulnaldi & Zamri, 2017).

GeoGebra is able to improve mathematical abilities and higher order thinking (Faradillah et al., 2018; Murti et al., 2018; Septian, Darhim, et al., 2020; Septian, Inayah, et al., 2020; Supriadi et al., 2014; Zengin, 2017; Zulnaldi & Zamri, 2017). The formulation of the problem in this study is whether the increase in problem solving skills and student learning independence in learning using zoom with online GeoGebra based on guided inquiry is better than students obtaining learning using zoom with guided inquiry without online Geogebra.

METHOD

This type of research is a quasi-experimental research. This research was carried out in the odd semester of

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2021/2022 in the mathematics education study program at the University of Muhammadiyah Prof. DR. Hamka (UHAMKA). The population in this study was odd semester, students in the mathematics education study program, FKIP, UHAMKA. The sampling technique in this study was using purposive sampling. The main instruments for data collection in this study were a problem-solving ability test and a learning independence questionnaire which had previously been validated by experts.

The problem-solving ability test consists of ten descriptive questions with indicators adapted by Polya (1983). These indicators include: 1) understanding the problem, 2) planning the problem, 3) implementing the problematic strategy, and 4) re-examining the results obtained. The learning independence questionnaire consists of 35 statements with four answer choices, namely strongly agree, agree, disagree and strongly disagree. The learning independence questionnaire was adapted from the results of Sumarmo's research (Badjeber, 2020) namely 1) initiative and intrinsic learning, motivation, 2) the habit of self-diagnosing learning needs, 3) setting learning goals/targets, 4) monitoring, regulating and controlling learning, 5)

viewing difficulties as challenges, 6) utilizing and finding relevant sources, 7) choose and apply learning strategies, 8) evaluate learning processes and outcomes, and 9) self-ability.

Learning independence questionnaire was given before treatment with google form media. Furthermore, after being given a questionnaire, the two groups were given online learning treatment using the Zoom Meeting application. The learning experiment class was carried out with the help of online Geogebra based on guided inquiry ($n = 19$). The control class with learning with zoom meetings uses guided inquiry without the help of Geogebra online ($n = 19$), while the problem-solving ability test is also carried out online with the method of issuing questions one by one and each question has processing time. This is done to anticipate cheating when taking the test.

The design of this study used a pretest and posttest group design. Before the research hypothesis was tested, the analysis, prerequisite tests were carried out, namely (1) normality test using Shapiro Wilk; 2) homogeneity test for the sample group using 3) test the difference in the average increase with no-gain. In Figure 1 shows the data analysis chart.

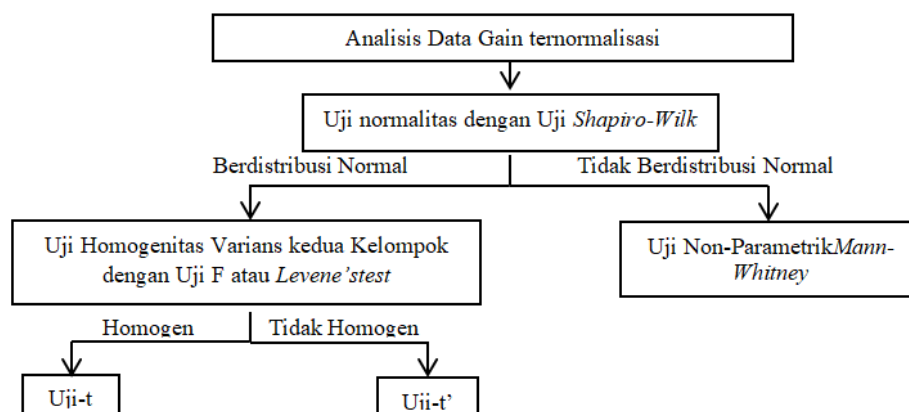


Figure 1. Data analysis chart

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In this study there are two hypotheses to be tested:

- H₀ : There is no difference in the improvement of problem solving ability and independent learning between treatments
- H₁ : the improvement of problem solving ability and learning independence of the experimental class is better than the control class

RESULTS AND DISCUSSION

Prior to the t-test, a prerequisite test was conducted to improve the problem-solving ability of the experimental class and the control class. Based on the results of the SPSS calculation, the significance values for the Shapiro-Wilk test of experimental class and control class students were 0.007 and 0.842 respectively, for problem solving abilities and the experimental class and control class were 0.720 and 0.000 respectively for student learning independence. This shows that the two data are not

normally distributed, then a non-parametric test is carried out using Mann Whitney. The formulation of the statistical hypothesis of the difference between the two averages of posttest data with the ability to solve mathematical problems with the one-sided test is:

H₀ : $\widehat{\mu}_1 = \widehat{\mu}_2$ There is no significant difference between the rank of normalized gain results Problem solving ability and mathematical learning independence of experimental class and control class students

H₁ : $\widehat{\mu}_1 > \widehat{\mu}_2$ The rank of normalized gain results The ability of students' mathematical problem solving and learning independence of the experimental class is significantly better than the rank of normalized gain results of mathematical problem solving ability of the control class

The results of the difference test of the two average post-test data on students' mathematical solving abilities are presented in Table 1.

Table 1. Difference test of two averages of normalized gain data on mathematical problem solving ability and student independent learning

Description	Problem Solving Ability	Student Learning Independent
Mann-Whitney U	104.000	95.000
Wilcoxon W	294.000	285.000
Z	-2.234	-2.496
Asymp. Sig. (2-tailed)	.025	.013
Exact Sig. [2* (1-tailed Sig.)]	.025 ^b	.012 ^b

From Table 1 it can be seen that the significance value of the one-sided (1-tailed) Mann-Whitney test is 0.0125 for problem-solving ability and 0.0065 for student learning independence. Values of 0.0125 and 0.0065 are less than 0.05. It means that

The rank of the normalized gain results of the mathematical problem-solving ability and learning

independence of the online Geogebra class students based on guided inquiry was significantly better than the normalized gain ranking of the guided inquiry class without online Geogebra.

Based on the results of experimental research, it was found that online Geogebra is a very helpful learning medium in improving problem solving skills and increasing student

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learning independently. The results of increasing problem-solving abilities are in the highest category in the experimental class and the moderate category in the control class, while the independent learning of students in both the experimental class and control class is in the lowest category.

Learning in the experimental class focuses more on the use of online Geogebra so that students can independently solve problems in the online Geogebra task. Students are very enthusiastic in completing the tasks that exist in GeoGebra online so that this can improve problem solving skills to be high in the experimental class, in contrast to the control class using guided inquiry without using GeoGebra online, so students are less motivated in

solving the questions given by the teacher. Lecturers, thereby increasing the problem-solving ability of the control class to be in the moderate category.

The learning independence of the two classes in the low category is because the number of meetings that are not too long is only eight meetings so that it has not been able to maximize the increase in learning independence of students in both the experimental class and the control class. Even though in the same low category, the experimental class learning independence is better than the control class learning independence due to differences in the use of online Geogebra media. Figure 2 is a student activity in online Geogebra.

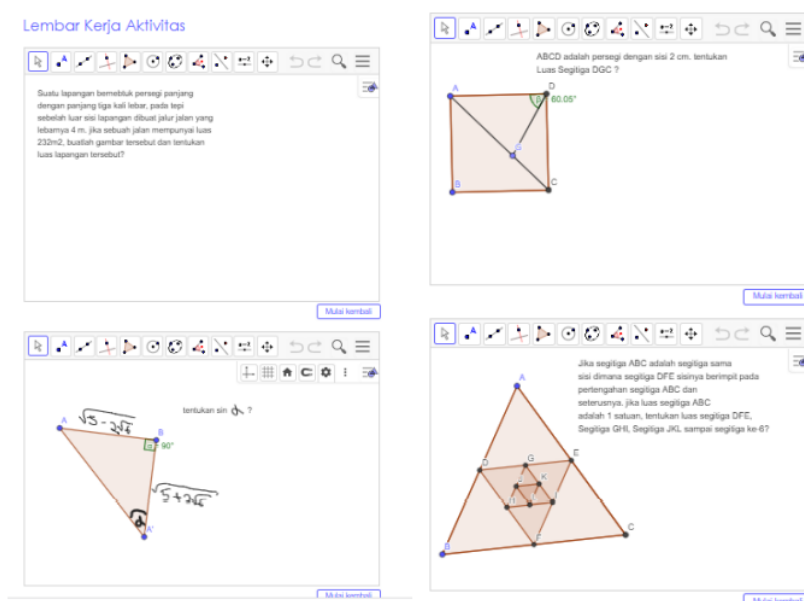


Figure 2. Student activities on geogebra online

Figure 2 shows that experimental class students do more activities using online Geogebra than the control class and can explore problems using online Geogebra. Thus making students challenged in solving problems such as drawing, and so on (Hadi & Handayani, 2021). Geogebra merupakan alat bantu sangat baik dalam mengembangkan

pemikiran matematis (Khalil et al., 2019). This proves that the higher the learning independence, the higher the student's problem solving ability (Darma et al., 2016) and during online learning activities, student learning independence increases where more than 70% of students have set learning goals, learning strategies, are able to

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manage time and conduct self-evaluation of the learning process that is followed (Makur et al., 2021). In addition, there is also a positive relationship between learning independence and student learning motivation (Fitriani et al., 2020) it means that students who are independent in learning have good learning motivation. Independent learning needs to be a priority in the learning process (Subekti & Jazuli, 2020).

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that the improvement in mathematical problem solving abilities and learning independence of students using zoom with online Geogebra-based guided inquiry is better than students using zoom with guided inquiry without online Geogebra. Geogebra online is an alternative learning medium that is effective, efficient, practical in current learning in the post-covid-19 pandemic and is the latest technology in classroom learning. Geogebra online and guided inquiry are a combination of media and appropriate learning models to improve problem solving skills and student learning independence. Suggestions for researchers is to use online Geogebra media as a tool in the teaching and learning process in the classroom because it can make it easier for lecturers and students to solve problems and make students able to explore what they want.

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