SELF-REGULATED LEARNING USING GEOGEBRA ASSISTED PROJECT-BASED LEARNING MODEL

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ABSTRACT

The purpose of this study is to analyze the achievement of self-regulated learning between students who obtain a project-based learning model assisted by GeoGebra and students who get a project-based learning model. The research method used in this study is quasi-experimental with a pretest-posttest nonequivalent multiple group design. The subjects in this study were students of the Department of Mathematics Education in the second semester of the academic year 2018-2019 at Universitas Suryakancana. The research instrument used was a questioner of self-regulated learning. Analysis of the data used is the normality test, the homogeneity test, the independent sample t-test, and the percentage of achievement indicators. As a result, the achievement of self-regulated learning who obtained a project-based learning model assisted by GeoGebra was better than students who obtained a project-based learning model, the achievement of self-regulated learning who obtained a project-based learning model assisted by GeoGebra was good categorized, and the achievement of self-regulated learning who obtained a project-based learning model was good categorized.

Keywords: self-regulated learning, Geogebra, project-based learning model

INTRODUCTION

Student Self-Regulated Learning has not been optimally applied in lectures (Ana & Achdiani, 2017). Students still depend on instructions from lecturers in their study. It is appropriate for students to learn independently and not depend on others. In fact, students have not been optimal in achieving Self-Regulated Learning (Hidayati & Listyani, 2010). Students have not done their assignments or studied the material provided by the lecturer if they are not reminded. Independence is a major factor in determining student learning outcomes themselves (Fauzi, 2011; Isnaeni, Fajriyah, Risky, Purwasih, & Hidayat, 2018). The importance of Self-Regulated Learning for students so that students become Self-Regulated Learning and evaluating their shortcomings (Putri & Wardika, 2020). Students must be familiar with the concept of Self-Regulated Learning, both individually and in groups (Novikasari & Fauzi, 2019).

Bandura defines Self-Regulated Learning as the ability to monitor one's own behavior, and is the hard work of human personality (Bandura, 2012). There are three steps in implementing Self-Regulated Learning, namely: (1) observing and supervising oneself; (2) comparing one's position with certain standards; and (3) give their own response (positive response and negative response). The strategy includes activities of self-evaluation, organizing and transforming, setting goals and designs, seeking information, recording and monitoring, structuring the environment, seeking self-consequences, repeating and remembering, seeking social assistance, and reviewing records.

Previous studies on Self-Regulated Learning have provided important findings, including that if the independence of learning is high, it affects a person's insight and knowledge (Setyansah & Suprapto, 2017). Likewise with other findings, namely Self-Regulated Learning can improve the ability of mathematical representation and mathematical connections (Amalia, Damayanti, & Lestari, 2018; Fauzi, 2011). Therefore, in this study, students' Self-Regulated Learning must be improved and their attainment maximally.

The learning method used by lecturers is currently oriented towards student center learning (SCL) or what is called student-centered learning that is carried out in every university.

Student center learning (SCL) provides opportunities for students to do activities, be creative, develop ideas, and so that the learning carried out varies (Maskur et al., 2020). Therefore, it is important in developing student Self-Regulated Learning in this integral calculus course.

There is a need for an innovative learning model in each integral calculus course, one of which might be a Geogebra-assisted project-based learning model. Geogebra-assisted project-based learning model is a learning model that provides the opportunity for lecturers to manage classroom learning by involving project work assisted by Geogebra software. Project work contains complex tasks based on problems (problems) as a first step in collecting and integrating new knowledge based on their experiences in real activities and requires students to carry out activities to design, solve problems, make decisions, carry out investigative activities, and provide student opportunities to work independently or in groups. The end result of the project work is a product in the form of a project result in the form of a Geogebra. The advantages of the GeoGebra-assisted project-based learning model are that they can make students more Self-Regulated Learning, explore skills in technology, facilitate problem solving, and help represent mathematical representation and connection skills (Caligaris et al., 2015; Machromah, Purnomo, & Sari, 2019; Suherman et al., 2020).

In this study, the Geogebra application is used as a tool, and Integral Calculus material in each lecture is rarely delivered and researched by lecturers. Research using the Geogebra application is still rarely used by teachers / educators (Arbain & Shukor, 2015; Supriadi, 2015). Likewise, lecturers rarely provide material with Geogebra. The difference between this study and previous research is that it uses a project-based learning integration with the help of Geogebra. The material studied about integral calculus is still rarely studied. Geogebra's advantages include: (1) graphs, algebra and tables that are connected and very dynamic; (2) easy to use but many powerful features; (3) authoring tool to make interactive learning materials as web pages; (4) available in many languages for our millions of users worldwide; and (5) open source software that is freely available to non-commercial users (Hohenwarter, Kreis, & Lavicza, 2008; Septian, Darhim, & Prabawanto, 2020a).

Research on Self-Regulated Learning has also been carried out by several researchers such as Tsany, Septian, & Komala (2020), that their research is focused on the effect of learning with macromedia flash 8 media on Self-Regulated Learning. Research by Ana & Achdiani (2017) focuses on Self-Regulated Learning using the internet in the Learning Media course. Research by Setyansah & Suprapto (2017) focuses on how to improve student Self-Regulated Learning in the Differential Calculus course. Research by Supianti (2016) focuses on the impact of using e-learning on students' Self-Regulated Learning. Research by Ayuningtyas & Setiana (2018) with a focus on achievement and interest in learning in terms of Self-Regulated Learning in the simplex method material.

Several studies related to the project-based learning model assisted by Geogebra have been conducted. Research by Octariani & Rambe (2018) with a focus on making teaching materials based on project-based learning assisted by Geogebra. Research by Sucipta, Candiasa, & Sukajaya (2018) with a focus on measuring the effect of project-based learning assisted by Gegebra on problem solving abilities in flat-sided building materials. Research by Suherman et al. (2020b) with a focus on analyzing the effect of higher order thinking skills using Geogebra-assisted project-based learning.

Based on several previous studies related to Self-Regulated Learning and Geogebra assisted project-based learning models, the focus of this research was not on achieving student Self-Regulated Learning in the Integral Calculus course. In addition, research on student Self-Regulated Learning using the Geogebra-assisted project-based learning model has not been widely used. The urgency of pre-existing research has not led to its relevance to the achievement of student Self-Regulated Learning through the Geogebra-assisted project-based learning model. Therefore, this research focuses on filling in the parts of knowledge that have not been studied.

Based on the problem, the urgency of the research, other aspects such as the learning model, the target of this research is to produce analysis and in-depth study related to the achievement of student Self-Regulated Learning through the project-based learning model assisted by Geogebra.

METHOD

The type of research used is quantitative methods. The research method used in this research is Quasi-Experimental. Quasi-experimental is used because not all variables can be controlled (Creswell, 2007). This research is a quasi-experimental study on the achievement of student Self-Regulated Learning through a project-based learning model assisted by Geogebra. The quasi-experimental research design used in this study was in the form of "Pretest Posttest Nonequivalent Multiple Group Design" which involved two groups of students, namely the experimental group 1 and the experimental group 2 (Wiersma, 2006). The difference between the two groups was the treatment in the learning process. In the experimental group 1, students received treatment with the Geogebra-assisted project-based learning model (Geogebra-assisted PjBL), while in the experimental group 2 received treatment with the project-based learning (PjBL) model only.

The population in this study were all students of the Mathematics Education Study Program. The sample in this study were students of the Mathematics Education Study Program level 1 semester 2 of the 2018- academic year. There are 2 classes, namely the experimental class 1 (Class 1A) and the experimental class 2 (Class 1B). The sampling technique used purposive sampling, which is a sampling method that refers to a specific objective.

The data in this study are quantitative data. Quantitative data were obtained through analysis of students' answers to tests of mathematical representation and connection abilities, as well as data on student Self-Regulated Learning. Quantitative data is tabulated and analyzed through several stages, namely testing the required parametric statistical analysis requirements as a basis for hypothesis testing. Testing the requirements of the analysis in question is the data normality test and the overall variance homogeneity test of quantitative data. Then, perform descriptive analysis of the data and calculate achievement data using posttest data. Through this stage, it can be seen that the achievement of student Self-Regulated Learning from before to after getting learning in class can be seen. Both those who use a geogebra-assisted project-based learning model or those who only receive a project-based learning model.

FINDINGS AND DISCUSSION

Achievement of student self-regulated learning

Table 1. Descriptive statistics of self-regulated learning score

Group	N	Ideal Score	Mean	Deviation Standard	Minimum Score	Maximum Score
Experiment 1	22	150	121.86	10.96	103	142
Experiment 2	23	150	113.17	7.45	98	128

Based on Table 1, it can be seen that the mean score of the Self-Regulated Learning questionnaire for the experimental group 1 was 121.86 with a standard deviation of 10.96. Whereas for the experimental group 2, it was obtained a mean of 113.17 with a standard deviation of 7.45. The experimental group 1 achieved the lowest score 103 and the highest score 142. Meanwhile, the experimental group 2 reached the lowest score 98 and the highest score 128.

The normality test in this study used the Kolmogorov-Smirnov test with SPSS 24. Based on the results of the normality test, a significance value was obtained for the experimental group 1 and experimental class 2 of 0.200. Because the significance value of the experimental group and experimental group 2 > 0.05, H_0 is accepted. Thus, it can be concluded that the experimental group 1 and experimental group 2 samples come from a normally distributed population. Furthermore, because the Self-Regulated Learning data from the experimental group 1 and the experimental group 2 came from a normally distributed population, the data analysis was continued with the

homogeneity test using SPSS 24. Based on data processing, the significance value of the Levene Statistic test results was 4.142 and has a value significance = 0.080> 0.05, then H_0 is accepted. Thus it can be concluded that the two groups have the same or homogeneous variance. The results of the data processing of the two difference test mean data for Self-Regulated Learning with independent sample t are presented in Table 2.

Table 2. Results of the independent samples t test data on self-regulated learning

t	df	Sig. (2-tailed)
3.122	43	0.003

Based on table 2, the results of the independent sample t test obtained a significance value of 0.003 <0.05. Thus it can be concluded that there is a difference between the mean achievement of Self-Regulated Learning in the experimental group 1 and the experimental group 2. The data in table 1 shows that descriptively, the experimental group 1 and experimental group 2 have different means, namely 121.86 and 113.17. Thus, it can be concluded that the achievement of student Self-Regulated Learning in the experimental group 1 is better than that of the experimental group 2.

The findings in this study indicate that the mean value of the achievement of student Self-Regulated Learning who applies the project-based learning model assisted by Geogebra is higher when compared to the average value of achievement of student Self-Regulated Learning who applies the project-based learning model. The results of testing using the independent sample t test on Self-Regulated Learning data, it is concluded that there is a difference between the achievement of student Self-Regulated Learning who applies the project-based learning model assisted by Geogebra and students who only apply the project-based learning model. In addition, based on the mean score from the Self-Regulated Learning data, it can also be concluded that the increase in Self-Regulated Learning of students who apply the Geogebra-assisted project-based learning model is better than students who apply the project-based learning model only.

This is caused by the Self-Regulated Learning of students depending on the influence of the learning process given in the classroom. The project-based learning model assisted by Geogebra has a positive impact on student Self-Regulated Learning. In line with previous studies, that student Self-Regulated Learning can be increased with the application of interactive media (Ana & Achdiani, 2017). In the process, the project-based learning model assisted by Geogebra has 6 stages, namely determining basic questions, designing project implementation, compiling schedules, monitoring students and project progress, testing results, and evaluating experiences. Independence is formed in the second, third, and fifth stages. In the second stage, namely designing project implementation, students design plans to determine phenomena and topics related to folding integrals in everyday life, time, resources or materials, laptop devices, Geogebra software using a form that has been made by the lecturer. In the third stage, students create a timeline (time allocation) to complete the project and make a deadline (deadline) for project completion. In the fifth stage, students make presentations on phenomena and topics related to folding integrals in everyday life (Septian, Darhim, & Prabawanto, 2020b). In this assessment, there are several assessment indicators, such as: suitability of the selection of phenomena and topics, theoretical explanations according to folding integral material with modeling and calculations, the process of making presentation materials in the form of Geogebra, and products in the form of Geogebra files.

Student Self-Regulated Learning is formed from their experience in carrying out the learning process (Hidayati & Listyani, 2010). In accordance with the direction of the lecturer, students always carry out projects with a predetermined time, so that experience in working on projects at each lecture meeting and supported by Geogebra makes students more motivated and motivated. In line with previous research, that Geogebra becomes a medium for students who make it easier to solve geometric problems, so that motivation is encouraged in working on projects (Hohenwarter & Lavicza, 2009; Suherman et al., 2020). Learning interest that grows when learning takes place because of the freedom to determine ideas but is still focused through the guidelines on student worksheets which are filled in in groups has an impact on student Self-

Regulated Learning. Regarding Self-Regulated Learning, students must be able to self-organize, self-evaluate, design, have goals, find teaching materials or sources independently, monitor academic achievement, and evaluate their learning. So in essence, students must control themselves from their learning activities (Bandura, 1991).

Self-Regulated Learning, of course, must be done independently by students. However, a small proportion of students have not developed their Self-Regulated Learning. Lecturers must always remind and guide students so that students become used to it. Students have not done their assignments or studied the material provided by the lecturer if they are not reminded. Independence is a major factor in determining student learning outcomes themselves (Fauzi, 2011; Isnaeni, Fajriyah, Risky, Purwasih, & Hidayat, 2018).

Achievement of student self-regulated learning indicators

Table 3. Results of self-regulated learning indicator achievement

No.	Indicators	Experiment 1	Experiment 2
1,10,19,30	Self-Evaluation	80 %	74 %
2,11,,20	Organize and Transform	82 %	74 %
3,13,21	Setting Goal and Designs	76 %	74 %
4,13,22,27	Seeking Information, Recording and Monitoring	80 %	74 %
5,14,23	Creating the Environment	82 %	77 %
6,15,24	Seeking Consequences On Your Own	87 %	77 %
7,16,25,28	Repeating and Remembering	80 %	75 %
8,17,26,29	Seek Social Assistance	68 %	62 %
9,18	Reviewing Notes	76 %	76 %
	Overall	79 %	74 %

Table 3 shows that the experimental group 1 student has the highest percentage on the sixth indicator, which is looking for the consequences themselves. Meanwhile, the lowest percentage is achieved in the future indicator, namely seeking social assistance. Students in the experimental group 2 had the highest percentage on the fifth and sixth indicators, namely arranging the environment and looking for the consequences themselves. Meanwhile, the lowest percentage is achieved in the eighth indicator, which is seeking social assistance.

The findings in this study are the achievement of the Self-Regulated Learning indicators of students who apply the project-based learning model assisted by Geogebra and students who apply the project-based learning model only overall are in good category. Almost all indicators of Self-Regulated Learning for students who apply the project-based learning model assisted by Geogebra have a higher achievement than students who apply the project-based learning model only. The highest achievement of student Self-Regulated Learning who applies the project-based learning model assisted by Geogebra, is in the sixth indicator, which is looking for their own consequences. Meanwhile, the highest achievement was for students who only applied the project-based learning model, on the fifth and sixth indicators, namely compiling the environment and looking for their own consequences. Students who apply the project-based learning model assisted by Geogebra or who only apply the project-based learning model are still low in indicators of seeking social assistance.

Achievement of Self-Regulated Learning for students who apply the project-based learning model assisted by Geogebra or even those who apply the project-based learning model alone have good Self-Regulated Learning. This is due to the application of the two learning models used to have a positive impact on student Self-Regulated Learning. In line with the research findings of Jatiariska et al. (2020) which state that the project-based learning model makes students more independent, collaborates, communicates with each other, and transfers knowledge between students and lecturers and students and students. Likewise with Isnaniah's (2017) research findings which state that the project-based learning model affects student Self-Regulated Learning and creativity. The achievement of students' Self-Regulated Learning reached 79.44% or in a good category.

In addition, Self-Regulated Learning is formed from the existence of peer learning activities which also affect the achievement of student Self-Regulated Learning where students work together and are motivated in doing their assignments and projects. The occurrence of communication and collaboration with peers motivates students to learn independently. Self-Regulated Learning is not defined as learning independently without cooperation. This concurs with Elida et al. (2017) who state that peer interaction in learning has a good influence on Self-Regulated Learning. In the process, the learning model used allows peers to develop social skills, common interests, and help each other in overcoming difficulties in order to achieve Self-Regulated Learning. Findings from other studies also support the findings in this study, a project-based learning model assisted by GeoGebra can make students more Self-Regulated Learning, explore abilities in technology, facilitate problem solving, and help improve their ability to improve mathematical representation skills. (Caligaris et al., 2015; Machromah et al., 2019; Suherman et al., 2020).

CONCLUSION

Based on the descriptions and explanations in the results and discussion sections, it can be concluded that regarding the achievement of Self-Regulated Learning, students who get the Geogebra-assisted project-based learning model is better than students who only get the project-based learning model. The achievement of the Self-Regulated Learning indicators for students who apply the project-based learning model assisted by Geogebra and students who apply the project-based learning model are in good category.

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