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The Ability of Mathematical Reasoning and Self Efficacy Students in Learning Project Based Learning Assisted Moodle

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Abstract

This study aims to find out students' mathematical reasoning abilities in Moodle-assisted Project Based Learning in terms of self-efficacy of class XI students at SMA Negeri 5 Semarang. This research is a mixed method type of concurrent embedded design. The subjects of this study were determined based on self-efficacy scores using a self-efficacy questionnaire for class XI students at SMA Negeri 5 Semarang. The results showed that students with high self-efficacy were able to master all indicators of mathematical reasoning: (a) able to analyze problems, (b) able to apply strategies, (c) able to find and use relationships from different mathematical domains, different contexts, and representations. different, (d) interpreting solutions and ways to answer problems, well. Students with moderate self-efficacy category can master three indicators of mathematical reasoning well. Meanwhile, students who have low self-efficacy are only able to master one indicator of mathematical reasoning well.

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INTRODUCTION

The characteristics of mathematics as a science that is deductive, logical, axiomatic, symbolic, hierarchical-systematic, and abstract (Priatna & Ricki, 2018), if two properties are taken, namely logical and abstract, then these properties are closely related to reasoning abilities. Reasoning is a thinking activity that has certain characteristics to find the truth. Certain characteristics in question are logical thinking patterns and analytical thinking processes. Mathematics and the process of reasoning are two things that cannot be separated. Mathematics can be understood through the process of reasoning, and reasoning can be trained through learning mathematics.

Students with good reasoning skills will easily understand the material being studied and directly improve student learning outcomes. Likewise, students who have low reasoning abilities will find it difficult to understand the material being studied. As stated by Rohmad (in Afif, AMS, Suyitno, H., & Wardono, W. 2017) if reasoning skills are not developed in students, then for students mathematics will only become material that follows a series of procedures and imitates examples without knowing the meaning. According to Mik Salmina (in Konita, Asikin, & Asih. 2019), mathematical reasoning ability is the ability to connect problems into an idea so that they can solve mathematical problems. Agustin (2016) argues that reasoning is a special thinking activity, where a conclusion is drawn, where the statement is concluded from several premises.

Rizqi & Surya (in Shora, R. Y., & Kartono, K. 2020) argue that mathematical reasoning ability is an activity, reasoning process and thinking ability to get a conclusion or make a new statement truth. Ball and Bass (in Kusumawardani, Wardono, & Kartono. 2018), mention that reasoning is a mathematical "basic skill" and is needed for a number of purposes: to understand mathematical concepts, to use mathematical ideas and procedures flexibly, and to reconstruct mathematical knowledge.

The importance of having students' mathematical reasoning abilities is basically in line with the vision of mathematics, especially to meet future needs (Hendriana, Rohaeti & Sumarmo, 2017). Based on the results of TIMSS 2011, in the algebraic content domain with the cognitive domain of reasoning, only 18% of students answered correctly, while in the geometry content domain with the cognitive domain of reasoning, 0% of students answered correctly (Hadi & Novaliyosi, 2019). Similarly, the results of the 2015 TIMSS evaluation. Based on the international survey, the average math achievement score of students in Indonesia is still significantly below the international average. The lowest average percentage achieved by Indonesian students is in the cognitive domain at reasoning level 3, which is 20% (Kusumawardani, Isnarto, & Junaedi, 2018). So the school curriculum should emphasize more on reasoning skills (Fauziah, I., Mariani, S., & Isnarto, I. 2017).

The student's reasoning ability can also be influenced by the student's self-efficacy. Self-efficacy which means self-ability is a person's view of his abilities. This is in accordance with the opinion of Hergenhahn & Olson (in Ardiyani, Hartanti, & Isnarto. 2019), Self-efficacy is a person's belief about his ability to do something, which arises from various sources including personal achievements and failures that he has experienced, while according to Hamidah (in Zulfa, A., Kartono, K., & Nur Cahyono, A. 2021) the higher the self-efficacy, the better a person's ability to formulate concepts, convey ideas, and hone ideas to convince others.

The need for self-efficacy is supported by the results of Betz & Hackett's research (in Yunitasari, & Zaenuri. 2020) reporting that with high self-efficacy, in general a student will be easier and more successful in surpassing the math exercises given to him, so that the final result of learning This is reflected in their academic achievement which also tends to be higher than students who have low self-efficacy, in line with this opinion, Pajers and Miller (in Cahyani, H., Suyitno, H., & Junaidi, I. 2019) state that Self Efficacy plays a role in in solving problems.

Bandura & Adams (1977) stated that there are three dimensions to self-efficacy, namely the dimensions of magnitude, strength, and generality. To measure students' self-efficacy, an appropriate instrument was used. The self-efficacy instrument that will be used in this study was developed based on Bandura's theory of self-efficacy dimensions.

To improve students' reasoning abilities and self-efficacy in learning mathematics, an appropriate

mathematical model is needed and also adapted to current conditions, one of the models that can be used is the Project Based Learning model. PjBL can be viewed as a model with a constructivist approach based on project tasks in optimizing problem solving (Prabawa, E., & Zaenuri, Z. 2017). Meanwhile, according to Klein (in Satria, Waluya & Siswanto. 2018) project-based learning is an instructional strategy to strengthen the teaching and learning process of knowledge and demonstrate new understanding with various methods. In this case, Sudiana stated that E-learning is information and communication technology to enable students to learn anytime and anywhere. E-Learning is one of the web-based application technologies, portals, and software in the field of education for the benefit of an educational process (in Asih, K., Isnarto, I., & Sukestiyarno, S. 2019).

The learning activities in this research use the Project Based Learning model which is carried out electronically or digitally. In this case the media used is Moodle. According to Surjono (2009) Moodle is an opensource software that supports the implementation of e-learning with an integrated paradigm with various learning support features that can easily be accommodated in an e-learning portal. In line with the basic principles of constructivism, students actively build their own knowledge based on their cognitive maturity. Meanwhile, Sampurno (in Herayanti, L., Fuaddunnazmi, M. and Habibi, H., 2017) revealed that Moodle serves as an effective tool in providing learning facilities. The formulation of the problem in this study is how the mathematical reasoning ability in terms of the self-efficacy of class XI students at SMA N 5 Semarang in learning the Project Based Learning model assisted by Moodle?

METHODS

This study uses a combination method (mixed methods). The combination research design used is Concurrent Embedded Design. The method is used together, at the same time, but independently to answer the formulation of similar problems (Sugiyono, 2013).

The research was carried out at SMAN 5 Semarang with the research population being class XI MIPA students in the 2020/2021 academic year. From the XI MIPA classes in SMAN 5 Semarang, 2 classes were taken randomly as samples, namely class XI MIPA 7 as the control class, and class XI MIPA 2 as the experimental class.

The data sources in this study were students obtained from the results of the Mathematical Reasoning Ability Test (TKPM), the results of the self-efficacy questionnaire, and the TKPM interview result sheet. TKPM results as a source of quantitative research data, while data sources for qualitative research are student TKPM answer sheets, student self-efficacy questionnaire results, and TKPM interview results. Quantitative data were tested using normality test, homogeneity test, average test, learning completeness test, average TKPM difference test and different TKPM proportion test. Meanwhile, qualitative data analysis was carried out by validating data, making verbal data transcripts, reducing data, presenting data, and verifying data.

RESULTS AND DISCUSSIONS

The quality of Moodle-assisted Project Based Learning learning is measured using three stages, namely planning the learning process, implementing the learning process, and assessing learning outcomes. The results of the validation of learning devices and instruments are listed in table 1 below.

Table 1. Learning Tool Validation Results

Learning Tool	Average Score	Category
Syllabus	4.4444	Very Good
Lesson Plan	4.4920	Very Good
Worksheet	4.4667	Very Good
Text Book	4.4444	Very Good

From table 1, it can be concluded that the average score for all assistance devices is 4.46 with a very good category, so that the mentoring tools that have been prepared are suitable for use in research.

The results of the validation of the research instrument are presented in table 2 below.

Table 2 Results of Validation of Research Instruments

Learning Tool	Average Score	Category
Self Efficacy Questionnaire	4.42	Very Good
Mathematical Reasoning Ability Test Questions	4.5	Very Good
Interview guidelines	4.5	Very Good
tudent Response Questionnaire	4.6	Very Good
Learning Implementation Observation Sheet	4.6	Very Good

From table 2, it can be concluded that the average score of the instrument is 4.52 with a very good category, so that the instrument that has been prepared is suitable for use in research. The results of the self-efficacy questionnaire obtained that the percentage of high self-efficacy, moderate self-efficacy, and low self-efficacy were 20%, 63%, and 17%, respectively.

For the implementation stage of the learning process, the quality of learning is measured by observing the implementation of learning and being given a student response questionnaire. Based on observations, the average score of teachers in managing learning is 4.25. This means that learning is included in the very good category and according to the lesson plan. Based on the analysis of student response data obtained an average score of 2.96 or 80.98%, meaning that students assess the learning carried out 80.98% as good.

At the stage of assessing the implementation of learning, several tests were carried out, which included testing hypothesis 1 using the right-hand side hypothesis test which was used to determine that the mathematical reasoning ability of class XI students at SMA Negeri 5 Semarang who obtained material with the Project Based Learning learning model assisted by Moodle achieved completeness of 75%. From the test calculations, the value of zcount is 2.63493. For the significant level = 5%, the value of z(0.45) is 1.64. Because 2.63493 > 1.64 then zcount > z(0.45), meaning that H0 is rejected. So, the proportion of students with the Moodle-assisted Project Based Learning learning model who has achieved completeness is more than 75%.

Hypothesis 2 test was conducted to determine whether the average mathematical reasoning ability of class XI students of SMA Negeri 5 Semarang who received Moodle-assisted Project Based Learning was more than or equal to the Minimum Completeness Criteria, which was 70. The test used was the average test with the Student t distribution. From the test calculation, the tcount value is 8.015105. For the significant level (α) = 5% and degrees of freedom = 35 – 1 = 34, the value of t(0.95)34 is 1.68957. Because 8.015105 > 1.68957, it means that H0 is rejected and H1 is accepted. So, the average mathematical reasoning ability of students who receive Moodle-assisted Project Based Learning is more than 70.

Hypothesis 3 test was conducted to determine whether the proportion of students' mathematical reasoning abilities in class XI SMA Negeri 5 Semarang who received Moodle-assisted Project Based Learning was more than the proportion of students' mathematical reasoning abilities with scientific learning. The test used is the similarity test of two proportions of the right side. From the above test calculations obtained zij = 2.537081. For the significant level (α) 5%, the value of z(0.45) is 1.64. Because 2.537081 ≥ 1.64 then zcount ≥ z(0.5-α), meaning that H0 is rejected or H1 is accepted. So, the proportion of mastery students who receive Moodle-assisted Project Based Learning is more than the proportion of students' mastery with scientific learning.

Hypothesis 4 test was conducted to determine whether the average mathematical reasoning ability of class XI students of SMA Negeri 5 Semarang who received Moodle-assisted Project Based Learning was more than the average mathematical reasoning ability of students with scientific learning. The test used statistical test t. From the calculation, the value of tcount is 3.605517. For = 5% and dk(n1+n2-2) = 68 , the value of t_((0.95)68) is 1.66757. Because 3.605517 > 1.66757, then tcount > t(1-α),dk, meaning that H0 is rejected or H1 is accepted. So, the average mathematical reasoning ability of students who receive Moodle-assisted Project Based Learning is more than the mathematical reasoning ability of students with scientific learning.

From the three results, namely at the planning, implementation, and assessment stages, it can be concluded that the quality of learning using Moodle-assisted Project Based Learning is included in the good category. This is in accordance with research from Junghee Choi, Ju-Ho Lee, Booyuel Kim (2019) which states that PjBL produces more positive results in the learning experience among students.

Analysis of mathematical reasoning abilities in terms of students' self-efficacy in Moodle-assisted Project Based Learning. Students with high self-efficacy are very good at solving problems that require reasoning abilities.. All indicators of mathematical reasoning are (a) able to analyze problems, (b) able to apply strategies, (c) able to find and use relationships from different mathematical domains, different contexts and different representations, (d) interpret solutions and how to answer problems , well, it can be achieved by students with high self-efficacy well and completely. The following is an example of student work related to the reasoning abilities of students with high self-efficacy.

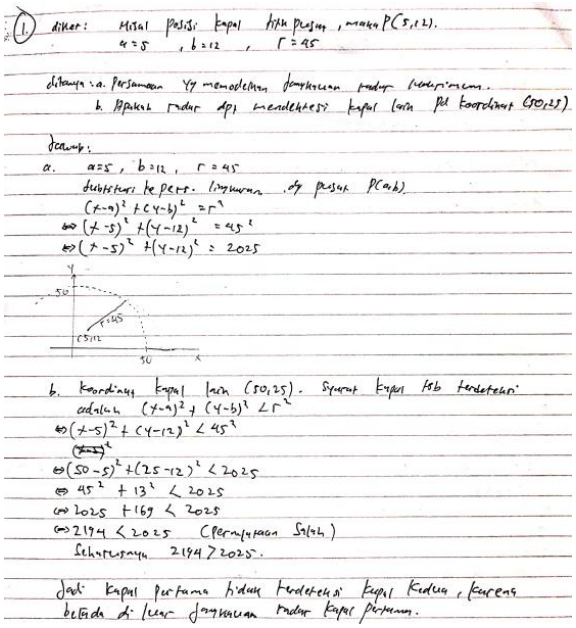

Figure 1 Student Work Results with high self-efficacy

Figure 1 shows that students are able to analyze existing problems, are able to apply strategies and can determine solutions appropriately, according to the indicators of mathematical reasoning.

Of the four indicators of mathematical reasoning, students with moderate self-efficacy are quite good at solving problems that require reasoning abilities. It's just that students with moderate self-efficacy often feel nervous so they are unable to concentrate when they encounter difficulties in solving a math problem. In addition, they also often feel hesitant when solving difficult math, or that they have never encountered before. So that the TKPM value is not in accordance with the level of self-efficacy.

Meanwhile, students who have low self-efficacy have not been able to master aspects of mathematical reasoning correctly, precisely, and completely. Students still make many mistakes, even though half of their abilities from these aspects are correct, and students have not been able to master them well, and tend to be careless. Therefore, it can be concluded that students who have low self-efficacy have low mathematical reasoning abilities.

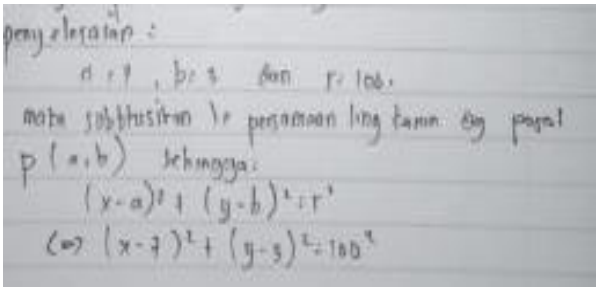

Figure 2 Student Work Results with low self-efficacy

From Figure 2 above, it can be seen that students with low self-efficacy immediately try to work on the problems at hand, meaning that students are able to apply strategies, but still have not applied other mathematical reasoning indicators.

The effect of self-efficacy on the mathematical reasoning ability of class XI students at SMA N 5 Semarang in Moodle-assisted Project Based Learning was analyzed using a simple linear regression test. Based on the results of the regression calculation, it was found that self-efficacy has a linear relationship or positive influence with students' mathematical reasoning abilities. This is in accordance with the opinion of Zhang D, Chan W (2020) which states that by increasing their self-efficacy to a certain extent, it can help them get better achievements. Based on the comparison between the results of the TKPM and the results of the student self-efficacy questionnaire, there are some students who have low

self-efficacy but have high TKPM scores, and there are also students who have moderate and high self-efficacy who get low TKPM scores.

CONCLUSION

Based on the results of previous studies and discussions, the conclusion of this study is that students with high self-efficacy are able to master all indicators of mathematical reasoning: (a) able to analyze problems, (b) able to apply strategies, (c) able to find and use relationships from domains. different mathematics, different contexts and different representations, (d) interpreting solutions and ways of answering problems, well. Students with moderate self-efficacy category are able to master three indicators of mathematical reasoning well. Meanwhile, students who have low self-efficacy are only able to master one indicator of mathematical reasoning well

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