

## **Analysis of Mathematical Reasoning Ability in View of Self Confidence in the Project Based Learning Model with Performance Assessment**

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### **Abstract**

This study aims to determine the effectiveness of the Project Based Learning model with performance assessment to improve mathematical reasoning abilities and to determine mathematical reasoning abilities in terms of self-confidence of students in the Project Based Learning model using performance assessment. Based on the results of the study it was found that (1) the Project Based Learning Model uses an effective performance assessment to improve mathematical reasoning abilities. (2) Subjects who have high self-confidence fulfill all indicators of mathematical reasoning abilities, namely presenting mathematical statements, making conjectures, mathematical manipulation, drawing conclusions, checking the validity of arguments, and finding patterns of a mathematical phenomenon. (3) Subjects who have Confidence are fulfilling three indicators of mathematical reasoning ability, namely presenting mathematical statements, making conjectures, and mathematical manipulation. (4) Subjects who have low self-confidence fulfill one of the mathematical reasoning abilities, namely presenting mathematical statements.

**Keywords:** Mathematical Reasoning, Self Confidence, Project Based Learning, Performance Assessment

### **1. Introduction**

*Program for International Student Assessment(PISA) 2015 inOECD (2018)mentions that there are 7 fundamental mathematical abilities that underlie the occurrence of mathematical processes, namely communication, mathematization, representation, reasoning and, formulating strategies to solve, using symbolic, formal, and technical language and operations, and using*

mathematical teaching aids. Based on these seven abilities, reasoning ability is oneabilitymathematics which has a central role in achieving the goals of learning mathematics. National Council of Teachers Mathematics(NCTM, 2000)revealed that reasoning ability is the ability to do mathematics, will not be separated from mathematical activities, meaning that someone who does mathematics, will not be separated from reasoning activities.

Reasoning is a very important mathematical ability, but the achievement level of Indonesian students in this ability is still low. Based on the results of a study conducted by the 2015 Trend in International Mathematics and Science Study (TIMSS), Indonesia was ranked 45th out of 50 participants in mathematics from various countries with a score of 397 and a maximum TIMSS score of 700.(Rahmawati, 2016). TIMSS 2015 resultsshowthat the ability of Indonesian students who are the weakest at the content and cognitive level is reasoning or reasoning. In addition, international reasoning is also weaker than content and other cognitive levels. So that the fact is obtained that students' mathematical reasoning abilities are still low and require special attention.

It was proven in the preliminary study by giving initial ability test questions to 72 students at SMAN 7 Semarang, Semarang City, the result was that students were able to solve problems in the questions, but the student's answers only wrote down the results of their calculations using the appropriate concept. Students also do not provide clear arguments to make conclusions from the questions given. One of the students' work which shows low mathematical reasoning ability states that indicators of mathematical reasoning ability, namely compiling evidence, giving reasons or evidence for several solutions, and drawing conclusions from statements are still lacking. There are still many students who cannot compile evidence, provide reasons or evidence for several solutions, and draw conclusions from the problems that have been done.

Students' mathematical abilities are not only influenced by mathematical reasoningasaspectcognitive, but also influenced by self-confidence or self-confidence as one of its affective aspects(Ahmad et al., 2018).Abdallah & Gasm (2015)provides information that self-confidence affects oral communication and successacademicstudent. This can be seen from the students who scored high in the self-confidence questionnaire and also scored high in the verbal test of oral communication and academic achievement.StudySyam & Amri (2017)also mentioned that self-confidence can support students' motivation and success in learning mathematics, because self-confidence influences learning achievement.This statement is supported by Yates inHendriana (2017)who argued that self-confidence is very important for students to be successful in learning mathematics. With self-confidence, students will be more motivated and prefer to study mathematics, so that in the end it is hoped that the mathematics learning achievement achieved will also be more optimal.

Based on this study, it is necessary to pay attention to learning activities that can support the development of students' mathematical reasoning abilities. The success of learning activities can be influenced by the selection of appropriate learning models. One of the learning models that can be used is project-based learning or Project Based Learning (PjBL). PjBL is a learning model that uses contextual learning, students play an active role in solving a problem, making decisions, researching, presenting, and making documents(Sauri, 2017). PjBL can affect students' mathematical abilities because students are directly involved in designing, making, and

displaying products that are used to solve real-world problems (Yunita et al., 2021). Students are given a project which is complex and quite difficult but complete and realistic which can then be given sufficient assistance so that students can complete the task (Berhita et al., 2020). The use of PjBL provides opportunities for students to explore realistic problems and gain in-depth knowledge so that students' reasoning abilities will increase (Ismaya et al., 2018). PjBL is a recommended learning model for use in the independent curriculum (Goddess, 2022).

Based on the learning guide and independent curriculum assessment in Ministry of Education and Culture (2022) Implementation of learning in addition to having to provide quality, interactive and contextual learning experiences to students, throughout the learning process assessments must also be carried out to determine the extent to which learning objectives have been achieved by students. One of the appropriate assessments for PjBL learning is a performance assessment. Performance assessment is an assessment that requires students to demonstrate and apply their knowledge in various contexts according to the desired criteria. Performance assessment can be in the form of practice, producing products, doing projects, or creating portfolios (Kemdikbudristek, 2022). In line with that, Susilo & Earth (2015) also states that performance assessment is a procedure for giving assignments to students in order to gather information about the extent to which students have just learned. It is also supported by Tejeda & Gallardo (2021) which reveals that by using performance assessment it can be seen whether students can relate their knowledge to real life situations. Besides that assessment makes it easier for teachers in the learning process to measure all student competencies (Safitri et al., 2017). Performance assessment can also reflect students' learning attitudes, understanding of subjects and learning difficulties (Sorour et al., 2015). Performance assessment-based instruction enhances abilities that must be mastered by students as well as increasing students' self-confidence because they will feel more competent in working on math problems (Omidi & Sridhar, 2012). This is one of the teachers' reasons mathematics should integrate task-based performance appraisal into their students' practice (Svihla et al., 2019).

Pay attention to background, abilities reasoning mathematical in terms of self-confidence in Project Based Learning using performance assessment is very necessary.

## 2. Research Problems

Based on the background above, the research problem is formulated as follows: Is learning *Project Based Learning* using performance assessment effective in mathematical reasoning abilities in terms of students' self-confidence? How is mathematical reasoning ability in terms of students' self-confidence in *Project Based Learning* using performance assessment?

## 3. Methodology of Research

The type of research used was a mixed method with quantitative research as the primary method while qualitative research as a secondary method. The research design used was a pretest-posttest control group design. In this study two classes were taken, namely the experimental class and the control class. The experimental class will be applied to the Project Based Learning learning model using Performance Assessment and the control class will be applied to Project Based Learning learning.

#### 4. Sample and Data Collection

The population in this study were all class X students of SMAN 7 Semarang for the 2022/2023 academic year. The sample in this study was randomly selected using Cluster Random Sampling. The research sample is class X-10 as the experimental class that applies the Project Based Learning learning model with Performance Assessment and class X-9 as the control class that applies the Project Based Learning learning model. The subject taking technique in this study used a purposive sampling technique.

#### 5. Finding/Results

Classification of self confidence was carried out on 36 students in the experimental class (X-10) using a self confidence scale that had been validated by experts and tested for validity and reliability. The self-confidence scale consists of 40 statements. Based on the interpretation of the self-confidence scale scores, students who obtain scores are classified as students with a high level of self-confidence, 107-156 moderate self-confidence levels, and low self-confidence levels. Based on the results of this classification, there are 5 students with a high level of self-confidence, 25 students with a moderate level of self-confidence, and 6 students with a low level of self-confidence.  $\geq 156 < 107$

Six students were selected as subjects for interviews to describe the KPM of experimental class students in terms of self-confidence. The research subjects consisted of 2 students with a high level of self-confidence, 2 students with a moderate level of self-confidence, and 2 students with a low level of self-confidence.

##### 5.1 Mathematical Reasoning Ability in High Self Confidence

Based on the results of students' work on mathematical reasoning questions, it was found that the subject's answers had demonstrated mathematical reasoning abilities. This is shown by the subject being able to understand the problem and solve the problem appropriately. able to answer questions using tables to look for possible answers correctly so that indicators of presenting mathematical statements orally, in writing, pictures, and diagrams are fulfilled. The subject was able to make the steps for the solution process correctly, this was seen to look for the possibility of winning the dice. The subject counted using a sample point table so that the indicators proposing conjectures were fulfilled. The subject can accurately explain problem solving in the questions so that the indicators of manipulating mathematics are met. The subject can determine the dice with the probability of winning based on the highest number so that the indicator finds a pattern from the mathematical phenomena. The subject uses probability theory to check the validity of the question statements by utilizing sample point tables. This shows that the Subject meets the indicators of presenting mathematical statements, making conjectures, manipulating mathematics, finding patterns of mathematical phenomena, and checking the validity of arguments. When the results of students' work are triangulated by interviews, in answering each question, ensure the results of the work that students have written clearly and in detail. This shows that the Subject meets the indicators of presenting mathematical statements, making conjectures, manipulating mathematics, finding patterns of mathematical phenomena, and checking the validity of arguments. When the results of students' work are triangulated by interviews, in answering each question, ensure the results of the work that students have written clearly and in detail. This shows that the Subject meets the indicators of presenting mathematical statements, making conjectures, manipulating mathematics, finding patterns of mathematical phenomena, and checking the validity of arguments. When the results of students' work are triangulated by interviews, in answering each question, ensure the results of the work that students have written clearly and in detail.

## 5.2 Mathematical Reasoning Ability in Moderate Self Confidence

Based on the results of students' work on mathematical reasoning questions, it was found that the subject's answers had demonstrated mathematical reasoning abilities. This is shown by the subject being able to understand the problem and solve the problem appropriately. able to answer questions using tables to look for possible answers correctly so that indicators of presenting mathematical statements orally, in writing, pictures, and diagrams are fulfilled. The subject was able to make the steps for the solution process correctly, this was seen to look for the possibility of winning the dice the subject counted using the sample point table so that the indicators proposing conjectures were met. The subject can accurately explain problem solving in the questions so that the indicators of manipulating mathematics are met. The subject can determine the dice with the probability of winning based on the highest number so that the indicator finds a pattern from the mathematical phenomena. The subject uses probability theory to check the validity of the question statements by utilizing sample point tables. Subjects can provide conclusions correctly on questions based on problem solving. This shows that the subject meets the indicators of presenting mathematical statements, making conjectures, manipulating mathematics, finding patterns of mathematical phenomena, checking validity, and drawing conclusions. When the results of students' work are triangulated by interviews, on indicators checking the validity of arguments, finding patterns of a mathematical phenomenon, and drawing conclusions becomes unfulfilled because the subject is unable to provide a detailed explanation, while the answers are written based on consideration of the answers of his friends. Thus, subjects in the moderate self-confidence category only fulfill three indicators of mathematical reasoning ability, namely the indicators of presenting mathematical statements, making conjectures, and mathematical manipulation.

## 5.3 Mathematical Reasoning Ability in Low Self Confidence

Based on the results of students' work on mathematical reasoning questions, it was found that the subject's answers showed mathematical reasoning abilities only on one indicator. It can be seen that the subject can understand the questions well and is able to answer questions 4a and 4b correctly. Subjects can present statements in questions 4a and 4b using the appropriate venn diagram. Subjects can determine the venn diagram for mutually exclusive events and events that are not mutually exclusive. So that the indicators presenting mathematical statements are fulfilled. While the other four indicators were not fulfilled, because the subject only wrote answers from his friends without being able to explain when triangulation was carried out.

## 5.4 The Effectiveness of the Project Based Learning Model Using Performance Assessment in Improving Mathematical Reasoning Ability

The PjBL Learning Model with performance assessment is said to be effective against student KPM if it fulfills the three predetermined hypothesis tests. Before testing the hypothesis, it is necessary to carry out a prerequisite test, namely the normality test using the Chi-Square Test and the different variance test using the Lavene Test with the help of Rstudio as follows.

### a. Normality test

Test for normality using the help of the Rstudio application. Normality test criteria if the value is significant means the data is normally distributed and vice versa.  $> 0,05$

```

> pearson.test(HASIL_TES$`Posttest Eks`)

Pearson chi-square normality test

data: HASIL_TES$`Posttest Eks`
P = 9.5, p-value = 0.1473

> pearson.test(HASIL_TES$`Posttest Kontrol`)

Pearson chi-square normality test

data: HASIL_TES$`Posttest Kontrol`
P = 12.5, p-value = 0.0517

```

Figure 1. Normality Test Results

Based on Figure 1 it can be seen that the significant value in the experimental class (X-10) = and the control class (X-9) = . Therefore, it can be concluded that the experimental class and control class data are normally distributed.  $0,1473 > 0,050,0517 > 0,05$

#### b. Variance Test

The homogeneity test is used to determine whether the variance of the initial sample value is homogeneous or not. Testing the homogeneity of the data using the Lavene test with the RStudio application. Homogeneity test criteria if the value is significant means the data comes from a population that has a homogeneous variance and vice versa.  $> 0,05$

```

> leveneTest(HASIL_TES$Nilai, HASIL_TES$Kelas, center=mean)
Levene's Test for Homogeneity of Variance (center = mean)
  Df F value Pr(>F)
group 1  2.8541 0.09559 .
    70
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Figure 2. Homogeneity Test Results

Based on Figure 2 it can be seen that the significant value of the lavender test. Therefore, it can be concluded that the sample comes from a population that has a homogeneous variance.  $0,09559 > 0,05$

#### c. Classical Completeness Test

The first hypothesis in this study is the classical completeness test which is calculated using the one sample proportion test (right side) assisted by RStudio. Classical completeness in this study if more than 75% of students who received PjBL learning with performance assessments scored a minimum limit of 70. Based on the calculations, it was obtained that the p-value was  $0.006177 < 0.05$ , so it was rejected and it can be concluded that the KBKM received learning PjBL performance assessment with a minimum of 70 completeness criteria achieves classical completeness.  $H_0$

#### d. Mean Difference Test

The average similarity test (right side) is used to test whether the average KPM of students who receive PjBL learning performance assessment is higher than the average KPM of students who receive PjBL learning. Based on the calculation, the p-value is  $0.003163 < 0.05$ , so it is rejected. It means average ability  $H_0$  reasoning mathematics students with learning PjBL with better performance assessments than the average ability results reasoning mathematics students use learning PjBL.

#### e. Proportion Difference Test

The different proportion test was used to determine the difference in the number of students who achieved completeness of mathematical reasoning abilities who were taught using PjBL performance assessment and the number of students who achieved completeness of mathematical reasoning abilities who were taught using PjBL. Based on the calculation, the p-value is  $0.001855 < 0.05$ , so  $H_0$  rejected. It means the proportion of ability reasoning mathematically students who have completed learning to use PjBL with better performance assessments than the proportion of abilities reasoning mathematical students who complete learning using PjBL learning.

PjBL learning with an effective performance assessment of students' KPM because the learning syntax applied in class is able to guide students to get used to doing mathematical reasoning in solving given problems. Research result Hasibuan et al., (2022) PjBL learning models are able to improve students' mathematical reasoning abilities and mathematical dispositions, as well as students' responses to positive PjBL learning. According to Arivina et al., (2017) learning using performance assessment can improve students' mathematical reasoning abilities.

## **6. Discussion**

### **6.1 Category Student Mathematical Reasoning Ability High Self Confidence**

Based on the results of the study, in general students with high self-confidence categories are able to solve problems related to mathematical reasoning abilities. Students with high self-confidence have excellent reasoning abilities in all indicators of mathematical reasoning ability. This is evident from the results of the work of students who are able to fulfill all indicators of mathematical reasoning abilities, namely (1) presenting mathematical statements orally, in writing, pictures, and diagrams, (2) making conjectures, (3) performing mathematical manipulations, (4) check the validity of an argument, (5) find patterns or properties of all mathematics to make generalizations, and (6) draw conclusions. This is in accordance with the results of the study Kusumawardani (2018) and Faudziah et al., (2019) which states that self-confidence has a positive influence on students' mathematical reasoning abilities. These results are also in line with research Wahyuni et al., (2019) that is, subjects with high reasoning abilities are able to complete most of the questions given and are more agile in understanding what is meant in the questions.

### **6.2 Category Student Mathematical Reasoning Ability Medium Self Confidence**

Based on the results of the study, in general students with moderate self-confidence are able to solve problems related to mathematical reasoning abilities. Students with moderate self-confidence have good reasoning abilities in almost all indicators of mathematical reasoning abilities. Students who are able to meet several indicators of mathematical reasoning ability, namely presenting statements, making conjectures, and doing mathematical manipulation. As for other indicators, namely drawing conclusions, checking the validity of an argument and finding patterns or properties of all mathematics to make generalizations cannot be fulfilled because Subjects S-03 and S-04 have not been able to utilize information from what is known and what is asked to get solutions. (Setyaningrum et al., 2017).

### **6.3 Category Student Mathematical Reasoning Ability Low Self Confidence**

Based on the results of the research, in general students with low self-confidence categories have not been able to solve problems related to mathematical reasoning abilities. Students with low self-confidence have good reasoning abilities. There is only one indicator of mathematical reasoning ability, namely the indicator of presenting mathematical statements. The other five indicators have not been met because Subject S-05 and Subject S-06 solve problems by looking at the answers from their friends. So that the subject does not know and does not understand the results of the answers written on the answer sheet. When the results of students' work are triangulated by interviews, in answering each question ensure the results of the work that students have written, students can only explain in the section presenting mathematical statements clearly and in detail. According to Hidayati & Widodo (2015) In reasoning students can sequence accurate steps to solve problems based on their knowledge. If the student does not have sufficient knowledge needed to solve the problem, then the student finds it difficult to solve the given problem.

Basically the mathematical reasoning abilities achieved by students in the low category are influenced by indicators of self-confidence possessed by students, so that students have no confidence in their own abilities and students are passive so it is difficult to understand problems that result in students being lazy or unable to solve problems. So that students do not get optimal results and are not sure about the results they get.

## **7. Conclusion**

Based on the results and discussion of the research on class X students of SMA Negeri 7 Semarang, the following conclusions can be drawn: (1) PjBL learning model with an effective performance assessment of the Mathematical Reasoning Ability (KPM) of class X students of SMA Negeri 7 Semarang, and (2) subjects with high self-confidence are able to meet all KPM indicators, namely presenting mathematical statements, making conjectures, performing mathematical manipulations, checking the validity of arguments, and finding patterns of a mathematical phenomenon; subjects in the moderate self-confidence category only met the indicators of presenting mathematical statements, making conjectures, and performing mathematical manipulations; subjects with low self-confidence category were only able to meet the indicators of presenting mathematical statements.

## **8. Recommendations**

The recommendation that can be given is that PjBL learning with performance assessment is advised to continue to be developed and try to apply it to other materials because this learning is effective for students' KPM.

## **9. Limitations**

The researcher realizes that this research still has many limitations, namely this research only uses 6 samples of students.

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