



# Mathematical Reasoning Ability Based on Students Anxiety in STAD Learning With Performance Assessment

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## Abstract

Mathematical reasoning ability is very important for students in solving a problem, but the Indonesian student's mathematical reasoning ability is still not optimal. The purpose of this research is (1) to test student's mathematical reasoning abilities in Student Team Achievement Division (STAD) learning with Performance Assessment achieving learning completeness, (2) to describe mathematical reasoning abilities based on student anxiety in STAD learning with Performance Assessment. This research is a mixed methods research with concurrent embedded design. The population in this study were students of grade VIII Islamic Junior High School in Kendal Central Java in the 2018/2019 academic year. Random sampling technique is used as a sampling method and the subject is determined with a purposive sampling technique. The results showed that STAD learning with Performance Assessment achieved classical completeness, namely more than 75% of students who participated in STAD learning with Performance Assessment reached 70 scores. Mathematical reasoning ability of students with low anxiety described as very good in fulfilling all indicators of mathematical reasoning ability i.e. submitting guesses, doing manipulation/mathematical calculations, drawing conclusions, and giving reasons for solutions. Mathematical reasoning ability of students with medium anxiety described as fulfilling indicators submitting guesses, doing manipulation/mathematical calculations, and drawing conclusions. Description of mathematical reasoning abilities of students with high anxiety is only able to fulfill the indicator of submitting guesses. In other indicators of mathematical reasoning ability, students with high anxiety are less able to understand the problem well.

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## 1. Introduction

Mathematics is a branch of science that studies how to think and process logic, both qualitatively and quantitatively (Suherman, 2003). According to Chusna (2017), one of the goals of learning mathematics is to train how to think and reason. Reasoning activities must be carried out by students, because if reasoning ability is not developed in students, then for students, mathematics will only be material that follows a series of procedures and imitates examples without knowing the meaning.

One of the methods that can be used by teachers to improve students' mathematical reasoning skills is applying Student Team Achievement Division (STAD) learning. In this model, students are divided into several small groups in heterogeneous to help each other and work together for the success of their group members (Arisman & Anna: 2015).

Another affecting factor of student achievement is student anxiety in dealing with mathematics learning. Zakaria & Nordin (2008) states that there is a relationship between anxiety and student learning achievement. Das & Das (2013) also states that students who have high anxiety have low mathematics learning achievement.

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Based on the results of interviews with mathematics teachers of grade VIII Islamic Junior High School in Kendal Central Java in February 2019, it was obtained information that students' mathematical reasoning abilities were still not optimal. The class average of grade VIII rapping in the 2018/2019 academic year in the odd semester is 74,03 with the highest scores 81,00 and the lowest scores 69,00. The mathematics teacher at Islamic Junior High School in Kendal Central Java also stated that are still many students whose anxious when learning mathematics. Besides that in learning mathematics at Islamic Junior High School in Kendal Central Java, the writer found students who have not depth-understood mathematical concepts, whereas understanding mathematical concepts is very necessary. This can be caused by the lack of learning motivation of students, passive students in learning activities, moreover learning activities still using conventional learning models, as well as with the assessment. Assessment in Islamic Junior High School in Kendal Central Java is limited to writing tests, so if students have not yet reached the specified indicators, it will cause an inconsequent impression in giving scores or the validity of a "pulley" system. And the main Assessment is carried out on summative evaluation through semester tests.

In assessing students learning outcomes it would be nice if seen student performance when working on mathematics problems. In determining the results that have been achieved should not only be seen in the final result but also how the students find the final results. Therefore we need an assessment that able to measure student performance, namely the Assessment of performance or Performance Assessment.

According to Masrukan (2014), Performance Assessment is an authentic form of assessment that asks students to demonstrate and apply knowledge into various contexts according to desired criteria. Performance Assessment is suitable to be used in observing the students' completion process in the problem description. In other words, the performance assessment aims to see student planning and skills in solving problems.

Based on this background, this research aims to (1) test students' mathematical reasoning abilities in STAD learning with Performance Assessment achieving learning completeness, (2) describe students' mathematical reasoning abilities based on student anxiety in STAD learning with Performance Assessment.

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## 2. Method

The research design used in this study is concurrent embedded design, which is a research method used together at the same time but independently answers the statement of a similar problem (Sugiyono, 2015). In this research, it begins with a preliminary study, then the collection of quantitative as well as qualitative data followed by analysis and interpretation of the data. Quantitative research as a primary method while qualitative research as a secondary method. Qualitative research supporting data to analyze mathematical reasoning abilities based on student anxiety.

The population in this study are students of grade VIII Islamic Junior High School in Kendal Central Java in the 2018/2019 academic year. The sampling technique uses simple random sampling. This technique is done by randomly selecting one class from the population without differences of strata between each class. In this study, one class was selected as an experimental group, namely class VIII E who obtained STAD learning with Performance Assessment. Subjects are selected using a purposive sampling technique. The selection of subjects is based on the consideration of the teacher's explanation of students in expressing opinions or ways of thinking verbally.

The independent variable in this study is the STAD learning model with Performance Assessment. The dependent variable in this study is mathematical reasoning ability based on students' anxiety. Data collection techniques used in this study are (1) test method in the form of giving questions at the final meeting to obtain data about students' mathematical reasoning abilities; (2) mathematical anxiety questionnaire to classify students based on levels of anxiety; (3) interview used to get answers from respondents through unilateral questions and answer, in this case, students' answer on mathematical reasoning abilities test; (4) documentation used to obtain data related to research.

Techniques of quantitative data analysis that used to test whether STAD learning with Performance Assessment achieves classical completeness. While techniques of qualitative data analysis that used to obtain answers to the problem statement about the description of mathematical reasoning abilities based on student anxiety in STAD learning with Performance Assessment. This qualitative data was obtained

through interviews with six subjects who obtained STAD learning with Performance Assessment and had carried out tests of mathematical reasoning abilities. The six subjects are two subjects with a high anxiety category, two subjects with a medium anxiety category, and two subjects with a low anxiety category.

### 3. Results & Discussions

Based on the results of the initial ability normality test for VIII grade students, it shows that the data is normally distributed. Then the grade VIII rapport is carried out homogeneity tests, and the results showed that the data has the same or homogeneous variance. To find out whether the initial abilities of students are equal or not, mean similarity test was done, then the obtained results are the average of the initial ability of students is equal, then class VIII E is chosen as the experimental class.

Based on the results of the mathematical reasoning ability normality test, the data is normally distributed. Then to find out whether students with STAD learning with Performance Assessment achieving classical completeness, z test was done. Because  $z_{\text{count}} = 0,40825 > z_{\text{table}}$ , then  $H_0$  is rejected,  $H_1$  is accepted. This shows that the proportion of students who reach Maximum Completeness Criteria 70, is more than 75%. This shows that STAD learning with Performance Assessment is a supporting factor for students' mathematical reasoning abilities.

Discussion activities on the STAD learning model give good results on the achievement of students' mathematical reasoning abilities. This is the same with research Jubaida (2015), which states that group discussions provide opportunities for students to do social relations, help each other in solving problems, and add insight to students about the various ways of solving problems that can be done.

During the STAD learning process with Performance Assessment, students are given the freedom to do Worksheets and Tasksheet so that students become active. Students are also more motivated to show their performance in completing a series of Tasksheet because each student's performance is assessed by the teacher. This is the same with research Sadijah (2009), which states that learning using performance Assessments is more effective because it develops students' knowledge and expertise. This affects the results of students' mathematical reasoning ability tests so that the proportion of students who complete the experimental class is more than 75%.

After carrying out research and analysis of research results, the answer to the second problem statement is how the description of students' mathematical reasoning abilities based on students' anxiety in STAD learning with Performance Assessment. Classification of student anxiety based on the results of the anxiety questionnaire. While the selection of research subjects is done by selecting two students from each level of anxiety. Then the research subjects were depth-analyzed their mathematical reasoning abilities.

The results of the mathematics anxiety questionnaire analysis of 32 students of class VIII E at Islamic Junior High School in Kendal Central Java, 14 students had high mathematical anxiety, 16 students had medium mathematical anxiety, and 2 students had low mathematical anxiety. Furthermore, based on students' activity observation sheet data, the results of written answers, and the results of interviews with six research subjects, triangulation techniques can be done. The triangulation technique is done by collecting different data to get data from the same source.

#### 3.1. Analysis of Mathematical Reasoning Ability of High Anxiety Students

Based on the results of the research, it was obtained information that students with a high category of mathematics anxiety can achieve one indicator of mathematical reasoning ability that is presenting a conjecture. The strength of the two students on the indicators of mathematical manipulation/ calculation is that both subjects can solve problems and their processes even though some questions are still not quite right. Students have difficulty when solving a problem on indicators giving reasons for solutions and drawing conclusions. This difficulty is due to various factors. The factors identified by the researcher are errors in calculating, lack of understanding of the use of appropriate concepts and feeling nervous when working.

This is the same with the research of Isnaeni *et al.* (2018), which states that the cause of students' difficulties in solving problems of mathematical reasoning ability is caused by a lack of understanding of concepts. At the time of the interview, the subject seemed a little tense and afraid of answering each question from the researcher. This is the same with the opinion of Cooke *et al.* (2011) related to cognitive

indicators that students are afraid or tense when doing something so they cannot think clearly. In addition, the subject tends to answer questions raised by researchers with short answer and appear more passive. This is the same as Moyne's opinion in Yenilmes (2017), which states that passive behavior is a symptom of students who have a high level of mathematical anxiety.

### 3.2. Analysis of Mathematical Reasoning Ability of Medium Anxiety Students

Based on the results of the research, it was obtained information that students with medium mathematics anxiety levels could reach three indicators of mathematical reasoning ability, namely submitting guesses, making manipulations/mathematical calculations, and drawing conclusions. Students have a little difficulty in solving problems on indicators giving reasons for solutions. The advantages of both subjects on one indicator are not the achievement is that both subjects are able to give reasons, although not complete.

During the interview, the subjects explained that they forgot how to solve the problem. This is the same with the opinion of Cooke *et. al.* (2011) that one indicator of students having medium anxiety is that students become oblivious to things that are already remembered. This was also related by Blazer (2011) in his research which stated that anxiety can interfere with student performance which results in reduced memory and cannot use the information obtained to complete the test being faced.

#### *Analysis of Mathematical Reasoning Ability of Low Anxiety Students*

Based on the results of the research, it was obtained information that the indicators of submitting guesses, students were able to submit guesses correctly and precisely. When manipulating/ calculating mathematics, students were able to manipulate/ calculate mathematics properly. Students were also able to conclude precisely. In addition, students are able to give logical reasons for solutions precisely. Based on this, students with low mathematical anxiety can reach all indicators of mathematical reasoning ability.

The mathematical reasoning ability of students with low anxiety categories is better than the mathematical reasoning ability of students of medium or high anxiety categories. This is the same with research Fadlilah, *et al.* (2015), which states that students with low anxiety categories have better learning achievement than students with medium or high anxiety. Daneshamooz & Hassan (2012) also stated that students with low math anxiety showed higher learning outcomes than students with high math anxiety. Ratnasari, *et al.* (20125) in her research found that students with low mathematical anxiety had better learning achievement than students with medium or high mathematical anxiety.

During the interview process, the subjects answered questions from the researcher with a calm attitude and could explain the answers well. This is in accordance with that expressed by Cooke *et. al.* (2011) related attitudinal indicators that students feel confident and not hesitate to answer questions raised by the researcher regarding answers to mathematical reasoning tests. Test results obtained by students with low mathematics anxiety levels also show good results. This is consistent with the opinion of Mahmood and Khatoon (2010) that students with low mathematics anxiety levels will tend to obtain high or good learning outcomes.

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## 4. Conclusions

Based on the results of research and discussion, it can be concluded that : (1) STAD learning with Performance Assessment is complete on the achievement of students' mathematical reasoning abilities. This learning is complete because students who take STAD learning with Performance Assessment complete classical, is more than 75% of students who take STAD learning with Performance Assessment achieve a score of 70; (2) Subjects with high anxiety able to the submitting guesses indicator. Subjects with medium anxiety were fulfilling indicators able to submit guesses, able to do math calculations/ manipulations, and able to provide conclusions. Subjects with low anxiety were able to complete all indicators of mathematical reasoning ability that can submit guesses, able to do calculations/ manipulation of mathematics, able to make conclusions, and able to give logical reasons.

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