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Differences in Mathematical Reasoning Ability using the Discovery Learning Model and *Contextual Teaching and Learning Model for* Al-Asri Hessa Perlompongan Junior High School Students

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ABSTRACT

This type of research is semi-experimental. The purpose of this study was to determine if there was a difference in math proficiency among students using the discovery learning model and teaching and learning standards. Students of SMP Al-Asri Hessa Perlompongan. The population in this study were all VII SMP Al-Asri Hessa Perlompongan, totaling 6 classes, then sampling was done using random sampling technique. The samples taken were 2 classes, namely class VII-A and VII-B, each of which amounted to 29 students. The data collection tools used was pre-tests and post-tests in the questionnaire. Pre-tests are used to determine students' starting ability. On the other hand, post-hoc tests were used to determine differences in students' mathematical abilities after receiving different treatments. The hypothesis testing used is a 2-party t test with dk = 56 and α = 0.05, then the obtained t_{count} = 1.7623 and t_{table} = 1.67252 so that $t_{count} > t_{table}$ is 1.7623 > 1.67252 then H_0 is rejected, thus it can be concluded that there are differences in students' mathematical reasoning abilities taught with the Discovery Learning learning model and the *Contextual Teaching and Learning model Students of SMP* Al-Asri Hessa Perlompongan.

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INTRODUCTION

Skills that are mastered by students either naturally or who are occupied to do a certain activity phenomenally where students give positive or negative enthusiasm for the object by using their reasoning and thinking patterns that are logical, systematic, analytical, critical, creative and innovative and emphasizes the ability of algorithms and theory compared to problem solving skills is the basic concept of an early mathematical ability. The teacher should first know whether the students already know and understand the previous basic theory or not before the teacher provides new material. The students must be asked or detected their basic knowledge by their respective subject teachers. As the first step to learn, handle and fix problems that occur in the classroom, a teacher is obliged to ask or know the knowledge talents of students. Education is an effort to create an atmosphere of learning and learning, so that students actively develop their potential and skills in response to various problems in social life. (Sugiarti, N. 2022; Hidayat, M. 2020; Sesriani, Y. 2022; Husna, F. 2022)

Continuous efforts are carried out both formally and creatively in improving the quality of mathematical knowledge. However, in reality this can be seen from the students' mathematical abilities which are still low and this shows that the quality of education has not shown the expected development. In addition, students

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are only focused on counting and memorizing formulas, this makes students often face complexities in learning mathematics. Many incidents say that low mathematics proficiency is not caused by a lack of student achievement in learning, but because these students do not try to direct their abilities. The ability referred to in this study is the ability of mathematical reasoning.

Utami, et al (2020) stated that reasoning is an activity, a process, or a thinking activity that draws a conclusion or makes a new statement that is true which has been proven true. Meanwhile, Sari & Raditya (2017) Explain that needs can directly improve a student's academic performance. In other words, if students have the opportunity to exercise their thinking to guess the solution of a problem that occurs based on their own experience, making it easier for students to understand the concept. As an activity of thinking reasoning has certain characteristics. The first characteristic is the process of logical thinking, where logical thinking is defined as an activity of thinking according to a certain pattern or in other words according to a certain logic. The second characteristic is the analytical nature of the thought process. The nature of this thinking is a consequence of the existence of a certain pattern of thinking (Haryono, & Tanujaya, 2018). Reasoning ability is the basis of mathematics itself. Etymologically, mathematics means knowledge obtained from reasoning (Afri & Rahmadani, 2020).

According to Tambunan (2021) states that the abilities and activities in the student's brain that are mandatory and must be developed continuously through a context are mathematical reasoning possessed by a student. Reasoning is a way or pattern of thinking that unites two things or even more based on certain rules and characteristics that have been recognized and justified by going through the process or steps of proof so that a summary or conclusion is reached.

Every student must master reasoning skills in order to be able to solve mathematical problems, including high school students, it reminds us of the importance of mathematical reasoning skills in the process of learning math. But in reality, students' mathematical reasoning abilities are still low and this is shown according to the facts in the field. The lack of using logical reasoning in dealing with the questions given is the failure of a number of students in mastering the subject matter of mathematics and this is one of the tendencies that become the main subject in the daily lives of students in class. More work on questions expressed in mathematical language and symbols created in contexts far from the reality of everyday life, which is what most students in Indonesia generally do. As a result, unpleasant lessons are what students think about learning mathematics. They can't even apply the theory they get from school to solve their daily problems.

The results of reasoning abilities are still low in students based on the results of field observations conducted by researchers at Al-Asri Private Junior High School. This can be seen from the questions given by the researcher to the students, with questions namely: Mrs. Eka has a garden in the form of an equilateral triangle with a side length of 30 m. Ibu Eka plans to install lights around the garden with a distance of 5 m between the lampposts. How many lampposts does Mr. Eko need? The results can be seen from 30 students, who did not respond to the questions above, there were 12 students, 10 students answered the questions incorrectly, and the remaining 8 students answered the questions correctly. This shows that the students' mathematical reasoning ability is still low. It can be seen that many students experience various kinds of difficulties in determining the position of the story problem when students try to solve the problem, even though the basic material is an equilateral triangle and in the calculation process, students have difficulty. This is proven by the low mathematical reasoning ability of these students.

Seeing this problem, it is necessary to implement a learning innovation in the form of a model that involves students actively in learning in order to improve the low mathematical reasoning ability and provide encouragement to train students' reasoning abilities to be better than before. The learning model that will be used in this research is the learning model of *Discovery Learning and Contextual Teaching and Learning.*

Discovery learning is a learning model that requires teachers to be creative and invites students to find their own knowledge, involving involvement and principles. According to Iqbal (2018), the Discovery learning

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model is a model that can be developed by teachers in the teaching and learning process, as a tool to achieve educational goals, so that through this model students are able to develop their curiosity and the courage to participate in the teaching and learning process.

Sutrisno (2019) states that discovery learning is a learning process that emphasizes students in finding concepts so that students who can find concepts independently will have a positive impact on the ability to understand mathematical concepts. According to Rosdiana et al., (2017) the discovery learning model has the following advantages; 1) helping students to improve and enhance skills and cognitive processes; 2) students will understand basic concepts and ideas better; 3) causes students to direct their own learning activities by involving their minds and their own motivation; 4) foster a sense of pleasure in students, because of the growing sense of investigating and succeeding.

The relationship between the discovery learning model and the ability to understand students' mathematical concepts is in the third, fourth, and sixth steps. In the third step, namely data collection and after the data is collected which is expected to provide examples and not examples of a concept, the next stage students process the collected data which is expected to develop students' knowledge of the material being studied by providing various forms of problems, thus students can apply the concept of problem solving, and the last stage students are encouraged to draw conclusions about the material that has been obtained so that students can later restate a concept according to their own understanding.

Another learning model that is considered to be able to further improve students' mathematical reasoning abilities apart from the *Discovery Learning* model is the CTL model or other words *Contextual Teaching and Learning*. Contextual Teaching and Learning (CTL) is a holistic educational process and aims to motivate students to understand the meaning of the subject matter they are learning by relating the material to the context of their daily lives (personal, social, and cultural contexts) so that students have the knowledge/skills which flexibly can be applied (transferred) from one problem to another (Rahayu, 2012; Dewi & Primayana, 2019; Agnesti & Amelia, 2020).

Three things must be understood (Ratnawati & Nanang, 2014; Khusna & Ulfah, 2021): First, CTL emphasizes the process of student involvement in finding material, secondly CTL encourages students to find the relationship between the material being studied and real-life situations, third encourages students to apply in life. Johnson (2007) states that Contextual Teaching and Learning (CTL) learning are a system that stimulates the brain to compose patterns that embody meaning. Furthermore, contextual learning is a learning system that matches the brain that produces meaning by connecting academic content with the context of students' daily lives (Femisha & Madio, 2021; Dewi & Afriansyah, 2018; Muslihah & Suryaningrat, 2021). Thus, contextual learning is an attempt to engage students to actively develop their abilities without sacrificing the benefits of students trying to understand concepts as well as apply and relate them to the world.

With the application of *Discovery Learning and Contextual Teaching Learning* models which are predicted to increase mathematical reasoning abilities, because this model begins with problem solving so that students are motivated enthusiastically during the discovery and examination process based on the explanation or explanation above. In addition, in solving problems students can discuss with each other, so it is hoped that they will gain an increase in their reasoning abilities and problem-solving abilities when they occur one after another to help when the process of solving a problem occurs. Based on the above background, a research was conducted with the title “using the Discovery Learning Model and *Contextual Teaching and Learning for* Al-Asri Hessa Perlompongan Junior High School Students".

RESEARCH METHOD

This study uses a quasi-experimental type of research (quasi-experimental), namely research that is intended to determine whether there is a consequence of something imposed on the subject, in this case students. This research is said to be a quasi-experimental because various student conditions cannot be controlled as a whole. The research design used was Pretest-posttest Control Group Design, namely experiments carried out in two randomly selected groups. This study involved two classes, namely

experimental class 1 and experimental class 2. In this research design, before starting the second treatment, the sample group was given a pretest. To measure students' initial abilities and also become a benchmark used to determine hypotheses after being given a posttest in experimental class 1 and experimental class 2. Experimental class 1 was given treatment using the Discovery Learning model, meanwhile for experimental class 2 was given treatment using the model *Contextual Teaching and Learning*. The research instrument used in this study was in the form of a test. The test was used to determine the improvement of students' reasoning. This test was given before and after the study in the form of a test given in the form of a pretest and posttest. The pretest was given to students before the learning/treatment was carried out. This pretest aims to determine the students' initial abilities. The pretest can also be a benchmark used to determine the hypothesis after being given a posttest in experimental class 1 and experimental class 2. The pretest data must be tested for normality and homogeneity to determine whether the sample comes from data that is normally distributed and has the same initial ability. The test given is in the form of a description or essay test with 5 questions. The questions given are pre-requisites of the Triangle material. In this study, the data to be processed was the student's posttest. Then the data was analyzed using a hypothesis test, namely the 2- party T-Test. Before testing the hypothesis, the data normality and homogeneity of variance were tested first.

RESULTS AND DISCUSSION

After the two classes were given different treatment, they were given a posttest to determine the students' mathematical reasoning abilities. The questions used were essay questions, totaling 5 questions. The results of the posttest of mathematical reasoning abilities obtained in the experimental class 1 and experimental class 2 are briefly presented in Table 1 below.

Table 1. Posttest data for the two experimental classes

Descriptive statistics	Experiment Class 1	Experiment Class 2
Total students	29	29
Total Value	1480	1265
Average	51.03	43.62
variance	536.39	455,17
Maximum	90	85
Minimum	15	15

If you pay attention to Table 1 above, it can be seen that the average value of the experimental class 1 is 51.03 out of 29 students and the experimental class 2 is 43.62 out of 29 students. From the posttest results, it was found that there was an average difference in the two classes. In experimental class 1, the posttest average value is higher than the posttest experimental average 2. In addition, the highest student scores are in experimental class 1, which is 90, which means that the highest student's Mathematical Reasoning Ability is in experimental class 1.

Table 2 Classification of Posttest Mathematical Reasoning Ability Students in Experiment Class 1

Score	Qualitative value	Total students	Percentage of Number of Students
86 – 100	Very high	3	10.34%
71 – 85	Tall	6	20.69%
56 – 70	Currently	13	44.83%
41 – 55	Not enough	5	17.24%
0 – 40	Very less	2	6.90%
Amount		29	100%

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From the above table 2, it can be seen that the mathematical reasoning ability of experimental class 1 in the "very high" grade, has 3 students, in the "high" grade has 6 students, in the "medium" category. Average "has 13 students, rated "poor" has 5 students and rated "very bad" has 2 students. This shows that most of the results of Posttest 1 experimental class are mostly average.

Table 3 Classification of Posttest Mathematical Reasoning Ability of Experimental Class Students 2

Score	Qualitative value	Total students	Percentage of Number of Students
86 – 100	Very high	2	6.90%
71 – 85	Tall	4	13.79%
56 – 70	Currently	12	41.38%
41 – 55	Not enough	7	24.14%
0 – 40	Very less	4	13.79%
Amount		29	100%

From table 2 above, it can be seen that the mathematical reasoning ability of experimental class 1 is in the "very high" category, with 2 students, in the "high" category with 4 students, in the "average" category. Grade has 12 students, grade “poor” has 7 students and grade “very poor” has 4 students. This shows that most of the experimental results of class 2 are mostly in the average category.

The diagrams of the results of the posttest in experimental class 1 and experiment 2 are as follows.

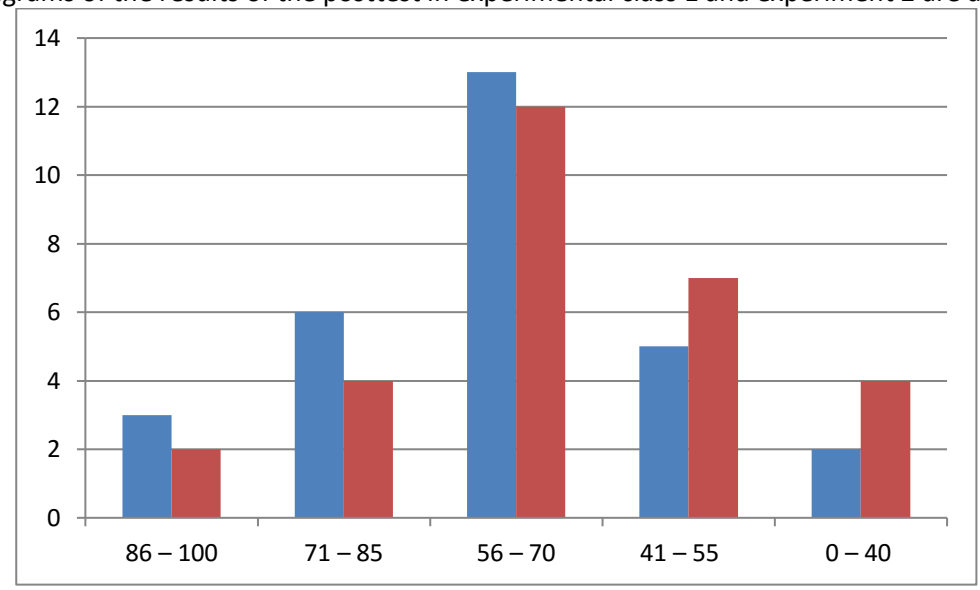

Figure 1. Frequency Distribution Diagram of Posttest Values for Experiment Class 1 (Blue) and Experiment Class 2 (Red)

Based on the chart above, it can be seen that for the "very high", "high" and "average" categories of Experiment 1 class, the average value of the following task in Experiment 1 class is higher than that of class. Test 2 and for the "very weak" category. Experimental class 2 outperformed experimental class 1. Based on the students' answer sheets after the test related to mathematical reasoning skills, we can see a general picture showing that there is a difference. Differences in post-test outcomes of students taught using the Discovery learning model and students taught to a contextual teaching and learning model.

This can be seen from the category of students' mathematical reasoning as follows:

a. Very High Category

In experimental class 1, there were 3 students (10.34%) achieving "Very High" grade, while in experimental class 2, 2 students (6.90%) achieved "Very High" grade. To find that the students' mathematical reasoning ability is in the "Very High" category, the post-study test results of the students taught by the exploratory learning model are higher than the students' test results. Students are taught using a contextual teaching and learning model.

b. High Category

In experimental class 1, there were 6 students (20.69%) achieving "High" while in experimental class 2 there were 4 students (41.38%) achieving "High". To find that the students' mathematical reasoning ability is in the "High" category, the post-test results of students using the exploratory learning model are higher than the post-test results of students using the teaching model. Contextual and learning models.

c. Category Moderate/Enough

In experimental class 1, there were 13 students (44.83%) achieving "Average" grade while in experimental class 2 there were 12 students (33.33%) achieving "Average" grade. To find that the students' mathematical reasoning ability was in the "Average" category, the test results of the students using the exploratory learning model were higher than the post-test results of the students using the exploratory learning method. Contextual teaching and learning models.

d. Less Category

In experimental class 1, there were 5 students (17.24%) achieving "Less" grade while in experimental class 2 there were 7 students (24.14%) achieving "Less" grade. To see that the students' mathematical reasoning ability is in the "Low" group, the post-test results of students using the discovery learning model are higher than the post-test results of students using the teaching and learning model.

e. Very Poor Category

In Experiment Class 1, there are 2 students (6.90%) who receive the "Very Bad" category, whereas in Experiment Class 2, there are 4 students (13.79%) who receive the "Very Bad" category. There is. To show that the student's mathematical reasoning skills are in a very bad category, the post-test scores of the students taught in the discovery learning model are the context lessons to be taught and the post-test of the students taught in the learning model.

After knowing that the two sample classes are normally distributed and have the same variance, both pretest and posttest and come from a homogeneous population, then a hypothesis test is carried out using the t test, this is done to determine whether the research hypothesis is accepted or rejected.

Hypothesis testing carried out on posttest data was tested with a one-party statistical test by comparing the average calculation of posttest data between experimental class 1 and experimental class 2. The research hypothesis is

H_0 : $\mu_1 = \mu_2$: There is no difference in the average mathematical reasoning ability of students using the Discovery Learning model with the *Contextual Teaching and Learning model on triangular material for students of SMP* Al-Asri Hessa Perlompongan.

Ha : $\mu_1 \neq \mu_2$: There is a difference in the average mathematical reasoning ability of students using the Discovery Learning model with the *Contextual Teaching and Learning model on triangular material for students of SMP* Al-Asri Hessa Perlompongan.

Table 4. Summary of Hypothesis Testing Results

Class	Average	t_{count}	t_{table}	Conclusion
Experiment 1	51.03	1.7623	1.67252	Ho rejected
Experiment 2	43.62			

Based on the table above, the test results at a significant level = 0.05 and dk = 29 + 29 – 2 = 56 with the results of t_{count} = 1.7623 and t_{table} = 1.67252 so it can be seen that $t_{count} > t_{table}$ is 1,7623 > 1.67252 which means that H_0 is rejected. So it was concluded that there were differences in students' mathematical reasoning abilities using the Discovery Learning learning model with the *Contextual Teaching and Learning learning model for* Al-Asri Hessa Perlompongan Junior High School students.

The results of this study are in line with previous research, namely research conducted by Astriani, et al. (2017) stated that the Discovery Learning model has a significant influence on mathematical problem solving abilities. Yuniara and Surya (2017) and Choir and Marsigit (2015) explained that the results of the calculations carried out resulted in t_{count} = 3.182 and t_{table} = 1.995. It was found that the value of $t_{count} > t_{table}$, it can be concluded that learning mathematics with the Discovery Learning approach is superior to the conventional approach in terms of mathematical reasoning abilities. Research conducted by Yohana Lubis (2015) concluded that students' reasoning abilities using discovery learning learning models were better than on the *Contextual Teaching and Learning* learning model. In this study, it was found that the average value of increasing students' mathematical reasoning ability test scores using the Discovery Learning teaching model was 20.85 while the average value of increasing students' mathematical reasoning ability test scores using the *Contextual Teaching and Learning model* was 10.23. From the discussion above and with the supporting theory and relevant research that has been explained, it can be concluded that there are differences in the mathematical reasoning abilities of students who are taught using the Discovery Learning and *Contextual Teaching and Learning models Students* of Al-Asri Hessa Perlompongan.

CONCLUSION

From the results of the analysis carried out in this study, it was concluded that there were differences in students' mathematical reasoning abilities that were taught using the Discovery Learning model and the *Contextual Teaching and Learning model Students* of Al-Asri Hessa Perlompongan. This is evidenced by the results of hypothesis testing obtained t_{count} = 1.7623 and t_{table} = 1.67252 with dk = 56 and significant level = 0.05 so it can be seen that t_{count} (1.7623) > t_{table} (1, 67252) which means that H_0 is rejected. So where the mathematical reasoning ability of students who are taught using the Discovery Learning learning model is better than using the *Contextual Teaching and Learning learning model* Al-Asri Hessa Perlompongan *Junior High School students* on triangle material.

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