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THE EFFECT OF USING MATHEMATICAL SOFTWARE IN UNDERSTANDING MATERIAL IN STATISTICS COURSES

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Abstract

This research was conducted at the Sembilanbelas November Kolaka University. This study aims to show the effect of the use of software in learning on the understanding of statistical material. The material discussed is the data normality test. To achieve that goal the researcher measures the understanding of student material before and after use of the software. Next, data analysis is done by comparing the results of the pre-test and post-test that have been obtained. The final result of the study shows that use mathematical software has a very significant effect of statistical material understanding, especially in data normality testing.

Key words: Mathematical software, learning media, Statistics

A. Introduction

Statistics Learning (3 credits) at the Sembilanbelas November Kolaka University which only relied on theory caused the students’ understanding of this subject still lowest, whereas this is one of the most important course. The knowledge gained from this course will be used when writing scientific papers or writing a final assignment report (thesis). The theory (2 credits) that is equipped with practice (1 credit) will make students more understanding of the material provided.

As a mathematics student who wants to make a final assignment (proposal/thesis), the basic concepts of data analysis, both descriptive analysis and inferential analysis must be understood so that the conclusions made are correct. Before till the inferential stage, there are several data requirements that usually must be fulfilled, consist of: the data must be normal distributed, the data must be homogeneous, and the data must be linear. In quantitative study or experimental studies in the field of education often use the average parameter to get a
conclusion. Because the average parameter is not robust, it requires normal data assumptions for data analysis. Therefore the concept of data normality testing must be truly understood.

In fact, almost all of the final year students at the Sembilanbelas November Kolaka University mathematics education department did not understand the concept of testing the normality of the data itself. There are many ways that can be done to data normality test, among others using the Kolmogorov-Smirnov test, Chi-Square test, Anderson Darling test, Cramer Von Mises, Lilliefors, Shapiro Wilk and much more (Yap & Sim, 2011). In practice they only use the Kolmogorov-Smirnov test and Chi Square in SPSS. They test the data normality using statistical software (SPSS, Minitab, Easy Fit, Geogebra) but do not know what the normality test concept was like.

To overcome this problem, researchers want to use these software in learning to help an understanding of the concept of data normality test. Each software has advantages and disadvantages, therefore all the software will be used to complement each other. Hopefully to be achieved the understanding of the students about the concept of normality testing to be better.

Based on the description above, the researcher will propose research with the title "The Effect of Using Mathematical Software in Understanding Material in Statistics Courses". This research is important to be carry out so that data analysis in the preparation/creation of student research reports (Thesis) becomes better.

B. Literature Review

Normal data is one of the requirements that must be fulfill to perform statistical inference if using parametric statistics. In educational research it is often reveal that the data of a student group forms a normal curve (Sundayayana, 2015). This normal data assumption must be tested to find out whether the empirical data obtained in the field corresponds to a particular theoretical distribution. In this case the distribution is normal.

Data Normality Test can be done by various methods such as Anderson Darling test, Kolmogorov-Smirnov test, Chi-Square test, Lilliefors, Sahapiro-Wilk, Kuiper, Ajne and the others (Yazici & Yolakan, 2007). These methods each have different differences and abilities in detecting deviations from normal distribution. Apart from that, the principles used in testing a data with normal distribution also vary. The following will explain two methods from the above methods, namely the Kolmogorov-Smirnov method, and the QQ-Plot.

1. Kolmogorov-Smirnov Method

The principle of the test for normality using Kolmogorov-Smirnov is to find the biggest deviation from the cumulative distribution function of observation data (empirical) on the theoretical cumulative distribution function. If the biggest deviation is not too large (\( D < D_{\text{tab}} \)) then the observation data can be categorized as normal distribution. Conversely, if the maximum deviation is very large (\( D > D_{\text{tab}} \)) then observation data said not normally distributed. The steps to test for normality using Kolmogorov Smirnov are follows:

1. Sort observation data from the smallest to the largest;
2. Create a list of cumulative data frequencies and then specify the cumulative proportion \( F_n(x) \);
3. To facilitate the calculation as well as the list \( F_{n,i} (x) \);
4. Convert the value of \( x \) value to \( z \) value:
5. Determine the area of the curve below the normal curve \( F(z_i) \) (Theoretical Cumulative Distribution Function Value);
6. Find the value of \( a_i = |F(z_i) - F_{n,i} (x)| \) and the value of \( b_i = |F(z_i) - F_n(x)| \)
7. Specify a value of \( D = \max_{1 \leq i \leq n} (a_i, b_i) \)
8. Make conclusion

(Nasrum, 2018)

2. QQ Plot Method

An easy way to test data normality is to use the graph method. The Quantil-Quantil normal plot or common abbreviation as QQ-Plot is the most common and effective diagnostic tool for checking data normality (Razali & Wah, 2011). The normal criteria for whether or not the data is based on the shape of the observe points according to the quintiles. If the points formed tend a straight line, then it can be said that the data is normally distributed. But line straightness is
the subjectivity of the examiner. To be more convince, a correlation test was used between the observation data and the standard normal quantil data. The steps are follows:

1. Formulating Hypotheses
   \( H_0 \): The sample comes from a normal distribution population
   \( H_1 \): The sample comes from a abnormal distribution population

2. Sort the initial observation data \( x_1, x_2, x_3, \ldots, x_n \)

3. Determine the probability value \( \frac{1-0.5}{n}, \frac{2-0.5}{n}, \ldots, \frac{(n-0.5)}{n} \)

4. Calculates the normal standard of quantiles \( q_{(1)}, q_{(2)}, \ldots, q_{(n)} \)

5. Plot the pair of observation data \( (q_{(1)}, x_{(1)}), (q_{(2)}, x_{(2)}), \ldots, (q_{(n)}, x_{(n)}) \) and test the significance of the lines formed through the correlation coefficient test

6. Determine Critical\( r \) according to sample size \( n \)

7. If \( r_{hit} > r_{tab} \) then \( H_0 \) is accepted or the sample comes from a normal distribution population
   Otherwise if \( r_{hit} \leq r_{tab} \) then \( H_0 \) rejected.

(Kadir, 2015)

3. Mathematical Software
   The use of mathematical software is one of learning media form. Learning media is an educational tool that can be used as an intermediary in the learning process to enhance effectiveness and efficiency in achieving teaching goals (Nasrum, 2012).

   The use of learning media provides many benefits. According to Kemp and Dayton (in Nasrum, 2012) there are several benefits of media in learning, including the following:
   1. Submission of material can be uniformed.
   2. The learning process becomes clearer and more interesting.
   3. The learning process is more interactive.
   4. Efficiency in time and energy.
   Teachers often spend a lot of time explaining a subject matter.
   5. Improve the quality of student learning outcomes.
   6. The media allows the learning process to be carry out anywhere and anytime.
   7. Media can grow each student towards the material and learning process.
   8. The role of the teacher adding to be more positive and productive.

   By utilizing the media well, the teacher is no longer the only source of learning for students, he can shares the role with media so that it will be easy for him to pay attention to other aspects of education such as helping students' learning difficulties, forming and motivating student learning.

   Software that will be used as learning media in this study includes Geogebra, SPSS, Minitab, Easy fit, and Microsoft Excel.

C. Methodology

1. Research Design
   The research method used is quantitative research methods because the research data is in numbers form and the analysis uses statistics. The type of research is pre-experimental design. The research design used was the pre-test post-test of one group design as follows:
   \[
   O_1 \quad X \quad O_2
   \]
   \( O_1 \) = the value of pre-test
   \( O_2 \) = The value of post-test

   (Sugiyono, 2014)

   This research will be conducted for one year starting from June 2017 to June 2018 located at the Sembilanbelas November Kolaka University. The population in this study were all students of the Sembilanbelas November University of Kolaka mathematics education in sixth semester consist of two classes. This population collection is based on the consideration that they have obtained several statistical courses while studying at the Nineteen November University of Kolaka. Based on the experience of researchers during being a mentor in preparing the final project, most high-level students who are undergoing the thesis-making process do not understand the normality test.

   To illustrate the ability of students' understanding of the concept of data normality, there are several indicators that are used as a measure tools, namely:
   1. Students understand the usefulness of the data normality test
   2. Students are able to write a hypothesis formula for testing data normality.
3. Students are able to use one of these two methods (Kolmogorov Smirnov, or QQ-Plot) to data normality test.
4. Students skill in using statistical software such as SPSS, Minitab, Microsoft Excel and others in performing data normality tests.
5. Students are able to explain the interpretation of the output of the software.
6. Students are able to draw conclusions from the software output.
7. Students can explain the differentiation between the two methods above.

Because the study population is quite large, researchers will only work on samples. Sampling is done by using Simple Random Sampling technique by taking a fairly representative amount.

2. Technique of Data Analysis
The type of data in this study is quantitative data. Data collection is done by giving a test. The test questions are given, written or developed based on indicators of learning achievement. Data obtained from the test results will be analyzed descriptively and to draw the conclusions on the population followed by inference stages.

The statistical inference that will be conducted is hypothesis test. It will be tested whether students’ understanding of the normality data after using media is better than before? The statistical hypothesis can be written as follows:
\[ H_0 : \bar{x}_d \leq 0 \]
\[ H_1 : \bar{x}_d > 0 \]

where \( \bar{x}_d \) is the average of the difference between the post test and the pre test.

Because the data will be process is pair data, then corresponding test statistics are t test statistics for paired data, namely:
\[ t = \frac{\bar{x}_d}{s_d / \sqrt{n}} \]
(Sudjana, 2005, p. 242)

With criteria accept \( H_0 \) if \( t < t_{lab} \) and in the other cases \( H_0 \) rejected.
Acceptance or rejection criteria for \( H_0 \) can also conduct with the help of software. If the P-Value result of the software output more than the significance level \( (\alpha = 0.05) \) is used, then \( H_0 \) is accepted, otherwise \( H_0 \) is rejected.

D. Finding and Discussion
1. Findings
In this section the results of the research that have been obtained will be presented. The level of understanding of students for the material given in the study was measured by giving the pre test and the post test. Pre tests are conducted so that researchers obtain data on student knowledge / understanding before the experiment conduct while the post test is conduct to measure the ability of students after the experiment. From the results of the pre test and post test data1 is obtained in Appendix 1.

Differentiation in understanding / ability before and after the use of mathematical software can be seen by compare the obtain results. Statistics from the data are present in the form of numerical extracts which can be seen in table 1 below:

<table>
<thead>
<tr>
<th></th>
<th>x1</th>
<th>x2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Valid 31</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Missing 0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>10.0403</td>
<td>73.7903</td>
</tr>
<tr>
<td>Median</td>
<td>6.2500</td>
<td>75.0000</td>
</tr>
<tr>
<td>Mode</td>
<td>6.25</td>
<td>71.25</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>11.5717</td>
<td>14.6049</td>
</tr>
<tr>
<td>Skewness</td>
<td>2.047</td>
<td>-1.102</td>
</tr>
<tr>
<td>Std. Error of Skewness</td>
<td>.421</td>
<td>.421</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.915</td>
<td>-4.36</td>
</tr>
<tr>
<td>Std. Error of Kurtosis</td>
<td>.821</td>
<td>.821</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
<td>41.25</td>
</tr>
<tr>
<td>Maximum</td>
<td>51.25</td>
<td>100.00</td>
</tr>
</tbody>
</table>
From table 1 it can be seen that students' understanding ability before using teaching media and after using teaching media is very different. This can be seen from the size of the data concentration, namely the average, mode, or middle value. The average obtained from the pre test is only 10 while the average post test is 73.79. In the pre test data, most students scored 6.25 while in the post test data most students scored 71.25. The median value gives the meaning that before the use of media, 50% of students only get a value below 6.25 and the remaining above 6.25. While after using the media 50% of students get a score of 71.25 and the rest above 71.25. From the three measures of data concentration, namely the mean, mode and median, the difference in the content of material that was very far before the use of the media and after the use of media was seen. The average value, median and mode in the pre test data is very small because the scale used is a scale of 100 while in the post test data, the values of data central values have met the desired standards.

In addition to measures of data centralization, differences can also be seen from the maximum and minimum values obtained by students before and after the use of media. During the pre test, there were eight students from 31 students who could not answer all the questions so that there were eight people whose value was 0. Certainly this was the lowest score. Whereas in the post test the lowest value is 41.25. The highest score obtained by students before the use of media is 51.25 while after using the media there are two students who get a perfect score of 100.

From these statements, it is clear that differences arise due to the use of mathematical software in learning statistics, especially in data normality testing. Student grades are much better after using math software than before. To generalize the results obtained, further testing is needed. The following will test the hypothesis whether the results obtained also apply to the entire population or not.

**Inferential statistics**

In this section the following hypothesis will be tested:

\[ H_0 : \bar{x}_d \leq 0 \]

\[ H_1 : \bar{x}_d > 0 \]

By using SPSS assistance, the following results are obtained:

Tabel 2. Paired Sampel Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 X2 - X1</td>
<td>63.75000</td>
<td>18.98464</td>
<td>3.40974</td>
<td>18.696</td>
<td>30</td>
<td>.000</td>
</tr>
</tbody>
</table>

From the table above can be seen the value of Sig. or P-Value in the last column. This value is less than \( \alpha = 0.05 \) so that \( H_0 \) is rejected. Thus it can be concluded that there are significant differences regarding students' understanding of data normality test material before and after the use of mathematical software. From the results of the descriptive analysis, it is clear that the understanding of students after the use of the software is much better than before the use of the software.

2. Discussion

Empirically the data supports the hypothesis proposed because the average understanding of material after use the media is greater than before (73.79 > 10.04). Besides that the hypothesis testing shows that significantly understanding the material about testing the normality of data after using mathematical software is higher than before using the software.

This learning outcomes increased shows the level of success gained by the research team. The learning outcomes increase are influenced by many factors, but these factors are thought to arise due to the use of software. By using mathematical software when learning takes place, students become more enthusiastic and more motivated because learning becomes more interesting. The theories explained with the help of software can become clearer. The things that was abstract became more real when explained with the help of software. The use of software as assistance is one of learning media. Uniquely, this media is also a practical tool that can be used by students. Students can visualize, simulate or practice directly using this software.

Practicum in statistics courses should be exist. The theories taught without practice have a greater chance of being forgotten than learning with practice. Practicums that can more often strengthen the memory of the theory being taught. It does not possibility that the practice can think out a theory.
In this study researchers tried to balance theory and practice. Sometimes in the explanation of the theory students are less understanding but after practice, they just understand what was explained before. In the course of Statistics, there are a lot of things that cannot be explained only by theory. For example, when explaining the area under the normal curve, if only explained with pictures on the whiteboard, there are still many do not understand, especially if only preaching on lectures. The illustrations depicted on the blackboard can make students understand if the images provided interesting / good. The problem is not all lecturers have art in drawing. Here is the role of learning media. With this software, you can explain in detail how to find the area under the normal curve with various forms of curves or wide several of area. One example is the following picture.

Figure 1. Example of how to calculate the area under a normal curve using GeoGebra. Students can practice repeatedly. With their repetitive practice, they will automatically understand the concepts in the textbook.

The learning process in the classroom when using this software is better, more interesting and more interactive. Students who are less active in learning before using the software become more active after using the software. Their activeness triggers the curiosity that is their within so that the understanding of the material being taught becomes better.

E. Conclusions
From the results of the study obtained several conclusions, namely:
1. In general, the results of this study indicate that the use of mathematical software as a media of learning as well as a practical tool has a significant influence on understanding statistical materials.
2. Empirically, the average test results after using mathematical software are much better than before using software.
3. The average understanding of the material after using the software has a significant difference compared to before using the software.

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F. REFERENCES


IMPROVING STUDENT LEARNING RESULTS THROUGH THE APPLICATION OF THE QUANTUM TEACHING MODEL

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Abstract
Improving Student Mathematics Learning Outcomes through the Application of the Quantum Teaching Model. This study aims to improve the mathematics learning outcomes of students using the TANDUR type Quantum Teaching learning model with the assisted discussion method of Student Worksheets (LKS). This study is a classroom action research conducted in two cycles. The subject of this study were all students of class VIII.9 SMP Negeri 1 Maros totaling 38 students. Data sources came from students and teachers. Data collection techniques used observation, documentation and tests. The analysis technique used in this study was quantitative analysis techniques. The results showed that the application of the TANDUR type Quantum Teaching method can improve student learning outcomes in learning Mathematics in class VIII.9 1 Public High School Maros. In addition there is an increase in student activity and teacher performance.

Keywords: Quantum teaching, learning outcomes, mathematics

A. Introduction
Education is a conscious effort made so that students or students can achieve certain goals. For students to achieve educational goals that have been determined, it takes a vehicle that can be described as a vehicle (Soedjaji, 2000). In this case the learning process of mathematics as one vehicle to achieve the stated goals.

Mathematics as one of the lessons in education is known as a lesson that is not too easily understood and followed by students. In fact, some students feel afraid of mathematics, so learning is not happy, especially understanding and mastering it. Many factors cause students' low ability to solve Mathematics problems, including lack of understanding of materials,
inappropriate use of methods, less attractive media or less varied teaching and learning processes. If the teacher is less creative in choosing learning strategies / methods, surely the teaching and learning activities that take place will become monotonous and less varied.

Based on information from the junior high school math teacher, 1 Maros, student achievement in class VIII.9 mathematics is not as expected. This is because students still have many difficulties in solving questions. Information from class VIII.9 SMP Neg. 1 Maros that some of them do not like Mathematics because they think that Mathematics is a difficult thing, complicated with a dizzying count. They consider that mathematics is difficult to learn because of how to teach teachers who only provide material descriptions (lectures) so that it causes saturation in the students themselves as a result they become dislike of mathematics, so their mathematics learning outcomes are low. Judging from the daily test scores of class VIII.9 students of the 2013/2014 class the lowest value is 20.00 and the highest value is 70.00. Only a few students who achieved the Minimum Completion Criteria (KKM) score of 70.00 were still low. With these reasons, it is very important for the teacher to understand the characteristics of the material, students and the learning methodology in the learning process, especially related to the selection of modern learning models.

According to Rohani (2004), managing teaching more effectively, dynamically, efficiently, and positively is the main task and responsibility of a teacher / instructor characterized by active awareness and involvement between two teaching subjects, the teacher as the initial initiator and the director and mentor, are currently students as those who experience and are actively involved in gaining changes in teaching. Thus the learning process will be more varied, innovative, and constructive in reconstructing knowledge insights and their implementation so as to increase student activity and creativity. Thus, students’ views on mathematics as a difficult and frightening lesson can be refuted. In addition, understanding a clear concept will help students to be more enthusiastic in following the lessons delivered by the teacher, so that in the end students are able to re-express the concepts they have received. To overcome this, researchers took steps, namely by improving the mathematical learning model.

The model to be used is the Quantum Teaching learning model with Student Worksheet Assisted Discussion Method (LKS), where the Quantum Teaching used is the TANDUR type Quantum Teaching, because this type is a Quantum Teaching learning design framework that can help students grow their interest by providing an explanation material taught for his life.

### B. Literature Review

In Husamah (2013) it was stated that one learning model that allows students to learn optimally is the TANDUR type Quantum Teaching learning model. Framework for learning Quantum Teaching known as TANDUR (Grow, Natural, Name, Demonstrate, Repeat, Celebrate). Grow interest satisfactorily "What are the Benefits of My Heart" (AMBAK), and take advantage of student life (Husamah, 2013). Experience or create or bring a common experience that can be understood by all students. Bring students to learn in a real atmosphere so that students are able to experience concrete experiences (Mahfudz, 2013). Name it by providing keywords, concepts, models, formulas, strategies; an "input" (Bobbi, 2013). Demonstrate by providing opportunities for students to show that they know. Repeat in the form of showing students how to repeat the material and emphasizing, "I Know and Indeed Know It". Celebrate by giving recognition for completion, participation, and acquisition of skills and knowledge (Husamah, 2013).

In Susanti (2016) it was revealed that the Quantum Teaching learning model aims to create a more interesting learning atmosphere, stimulate and provide student learning experience so that it is more meaningful, especially in its application in junior high school that requires teaching that can bring students in pleasant interactions. Interactions and learning processes that are created will have a major influence on the effectiveness and enthusiasm of learning in students.

The Quantum Teaching model can be supported by a method of discussion in learning, allowing students to listen to each other, argue, and work together. Discussion is the exchange of information, opinions, and elements of experience that are carried out regularly with the intention to get the same understanding of something or to prepare and resolve joint decisions. In discussions everyone is expected to contribute. In order for the discussion to run smoothly and conducively during learning, a worksheet made by the teacher is needed which is intentionally designed to guide students in a teaching and learning process to improve their learning achievement or known as Student Worksheet (LKS), students, assignments easily identified by the teacher, mathematically correct and the tasks clearly formulated. Teachers use
this worksheet also to understand the order of the organization and its development: "student sheets allow us to understand the whole sequence and to see the content and purpose" (Jana et al., 2010). Thus, in addition to being a teaching material that facilitates students to understand the material provided, student worksheets (LKS) can also facilitate the implementation of teacher teaching to students.

C. Methodology

This research was conducted at SMP Neg. 1 Maros in the second semester of the 2014/2015 academic year. The subjects of this study were teachers and students of class VIII.9, with 38 students.

The data sources of this study are teachers and students of class VIII.9 SMP Neg. 1 Maros. The type of data in this study is quantitative data in the form of test results and qualitative data in the form of data on student activity taken from observation sheets and data on the implementation of teacher learning.

Student ability data collection is taken from the test results, data on student activity are taken from the observation sheet, data on the implementation of learning by the teacher are taken from the observation sheet. The instruments used in this study are documentation, observation sheets, and tests.

This research is a classroom action research conducted in two cycles, each cycle carried out according to the objectives to be achieved. Both cycles are a series of interrelated activities, meaning that the implementation of the second cycle is a continuation of the first cycle by correcting errors and shortcomings in the first cycle. Cycle I is held for 3 meetings, 2 meetings are used as teaching learning processes and 1 meeting is used as a test. Cycle I and Cycle II were also held for 3 meetings, where 2 meetings were used as a teaching and learning process and one meeting was used as a cycle II test.

The implementation of the first cycle of research starts from the planning stage, namely teachers and researchers collaboratively identify problems, determine the material to be taught, plan the making of learning plans as a guide in teaching and learning activities, compile student worksheets and observation sheets of student activities in quantum teaching learning with discussion method, designing the formation of heterogeneous small groups, designing competency test questions as a means to find out the level of success of students in mastering the subject matter presented. Implementation of Action by conducting Quantum Teaching type TANDUR carried out by steps (1) Grow, teacher foster student interest in the material being taught so that students know the benefits in their lives, (2) Natural, students are guided by given LKS to experience themselves, and students get experience by discussing in study groups, (3) Name, this student can get the concept from the material that is taught, (4) Demonstration, teacher gives opportunity to one of group to convey result of LKS in front of class by demonstrating / explaining result of discussion, (5) Repeat, at this stage teacher explains again about the material taught earlier, (6) Celebrate, celebrate if students can do the exercises by giving applause, so students will be more enthusiastic in learning.

The next stage is observation carried out by researchers as collaborators by observing students and teachers. Observations of students are conducted by researchers by observing communication between students in learning, observing teacher and student communication, observing students’ activeness in discussions to solve problems. Observation of research teachers by observing the teacher in managing quantum teaching learning using the discussion method.

After the action and observation are carried out, the results of observations and evaluations are analyzed to guide the implementation of the second cycle. This action is referred to as reflection.

The stages in cycle II are the same at the stage of cycle I, namely: planning (planning), implementation of action (action), observation (observation) and reflection (reflection). By making improvements according to the results of reflection on cycle I.

The indicators of the success of this class action research include the percentage of student learning outcomes on average 70%, the activity and cooperation of students in learning as much as 70% and the implementation of learning by teachers in a good category with an achievement of at least 76%.

D. Findings and Discussion

1. Findings

The results of the observations on student activity were 61.44%, which means that the level of student activity was quite good but less than the success percentage of 70%.
In the teaching process the teacher gets a score of 16 with a percentage of 66.67%, so overall that the teacher in the teaching process includes a fairly good category. For the percentage of each score on score 1 or score less, the teacher gets 0%, for score 2 or score is good enough the teacher gets a percentage of 25%, for score 3 or score for both teachers gets 25% and for score 4 or very good, teacher got 16.67%. Because the percentage as a whole has not been in accordance with the indicators of success, the observation of the performance of teacher teachers is carried out again in cycle II.

Cycle I evaluation test results that students who get a value of ≥ 70 or complete learning there are 23 students and those who do not complete learning there are 15 students with an average score of 66.84 percent of the number of students who complete learning 60.53%. So, classical learning completeness has not been achieved because it is not in line with the expected success of 70%. Therefore, activities in the cycle need to be repeated so that student learning outcomes increase. The results of observations and reflections on the first cycle can be used as a basis for planning and implementing the second cycle.

After carrying out observations on the actions taken, the results of the reflection of the first cycle, among others, that student activity is not fully evenly distributed throughout the class. That is, there are still some students who have not been able to work on the questions that have been given. In order for students to better understand the material, it is better that in the learning process the teacher provides explanations related to daily life and tells students to study at home before learning is carried out. In addition, most students are still afraid to ask the teacher if they encounter difficulties. To overcome this, teachers are encouraged to motivate students to dare to ask questions and provide opportunities for students to ask questions.

The result of another reflection found was that some students were still reluctant to display the results of their work. To overcome this, the teacher is encouraged to give encouragement to the courage of courage so that all students dare to display the results of their work. In addition, the performance of teachers in the first cycle has not had a good impact on students, so that in the second cycle is expected to be better.

Basically this learning process has been going pretty well but needs improvement in the next learning, namely in the second cycle so that the shortcomings in the previous cycle can be improved.

Cycle II was held 2 meetings, where the first meeting was held on Friday, February 13, 2015 and at the second meeting held on Tuesday, February 17, 2015. The results of the observations on student activity obtained a percentage of 71.44%, which means the level of student activity is good so that it can be said to be successful the percentage of success is 70%. This shows there is an increase of 10% when compared to the percentage of student activity in the first cycle, which is 61.44%. In detail can be seen in table 1.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Cycle I Total students</th>
<th>Percentage</th>
<th>Cycle II Total students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>1</td>
<td>2.63</td>
<td>11</td>
<td>28.95</td>
</tr>
<tr>
<td>Well</td>
<td>10</td>
<td>26.31</td>
<td>14</td>
<td>36.84</td>
</tr>
<tr>
<td>Pretty good</td>
<td>11</td>
<td>28.95</td>
<td>11</td>
<td>28.95</td>
</tr>
<tr>
<td>Not good</td>
<td>16</td>
<td>42.10</td>
<td>2</td>
<td>5.26</td>
</tr>
<tr>
<td>Failed</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>total</td>
<td>38</td>
<td>100</td>
<td>38</td>
<td>100</td>
</tr>
<tr>
<td>Success (70%)</td>
<td>Not successful (61,44)</td>
<td></td>
<td>Succeeded (71,44)</td>
<td></td>
</tr>
</tbody>
</table>

Increasing student activeness during the teaching and learning process has fulfilled the success indicators of the first cycle which initially reached 61.44%, increasing to 71.44% in cycle II. Increased activity of students because in learning activities students are involved directly so students become more active in the learning presented and the teacher only acts as a facilitator and guides students if needed so students are encouraged to think for themselves to be able to find general principles based on the problems given by the teacher. With the involvement of students directly in learning activities, the new knowledge gained by students will stick and last longer.

In the teaching process the teacher scores 19 with a percentage of 79.17%, so overall that the teacher in the teaching process is in the good category. For the percentage of each score on score 1 or score less, the teacher gets 0%, for score 2 or score is good enough the teacher gets a percentage of 0%, for score 3 or the score for both teachers gets a percentage of 62.5% and for
percentage score 4 or very well, the teacher gets 16.67%. Overall, the teacher in the teaching process is included in the good category, so that the teacher’s activities in the second cycle have met the indicators of success. The following comparison of teacher activities is presented in table 2.

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Score obtained</th>
<th>Percentage</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle I</td>
<td>24</td>
<td>66.67%</td>
<td>Teachers’ Ability to Teach is Good</td>
</tr>
<tr>
<td>Cycle II</td>
<td>19</td>
<td>79.17%</td>
<td>Ability to Teach Good Teachers</td>
</tr>
</tbody>
</table>

2. Discussion

Based on the results of the study, quantum teaching models were obtained with the LKS-assisted discussion method that could improve students’ mathematics learning outcomes. This is indicated by the increase in teacher performance in the circle material learning process by applying the quantum teaching model with the LKS-assisted discussion method from the first cycle to the second cycle of 66.67%, increasing to 79.17%. In teaching, the teacher is good in his performance, because the teacher can provide examples of solving problems related to daily life, and the material conveyed can be understood by students, the questions given are in accordance with the indicator of success that is 76% and in concluding all material. The teacher can create a more active learning atmosphere for students. This is because in student learning is involved and if there are students who experience difficulties the teacher always guides him. In addition, the teacher can master the class well and is more able to motivate students to learn.

Cycle II evaluation test results that students who get a score of ≥70 or complete learning there are 28 students and those who do not complete learning there are 10 students with an average score of 70.39 percent of the number of students who complete 73.68%, so that it has met the indicator of success, namely 70% of students who complete study. The percentage of completeness of student learning outcomes each cycle can be seen in table 3 below.

<table>
<thead>
<tr>
<th>Value</th>
<th>Cycle I</th>
<th>Cycle II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total students</td>
<td>Percentage</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>23</td>
<td>60.53%</td>
</tr>
<tr>
<td>&lt; 70</td>
<td>15</td>
<td>39.47%</td>
</tr>
<tr>
<td>Completeness</td>
<td>Not completed (66.84)</td>
<td>Complete (70.39)</td>
</tr>
</tbody>
</table>

The results of the evaluation cycle I test students who got a score of ≥70 or completed learning there were 23 students and those who did not complete the study there were 15 students with an average score of 66.84 the percentage of students who finished learning 60.53%. So classical learning completeness has not been achieved because it is not in line with the expected success of 70%. While the results of the cycle II evaluation test that students who got a score of ≥70 or completed learning there were 28 students and those who did not complete the study there were 10 students with an average score of 70.39 the percentage of students who finished learning 73.68%. so that it has met the indicator of success, namely 70% of students who complete study.

After carrying out observations on the actions taken, the results of reflection of the second cycle include that student activity has increased compared to the first cycle, because students have been motivated to learn actively and the teacher has provided guidance well. Teacher performance has also increased, can be seen from its ability to guide students, motivate students and manage classes. In addition, students’ responses in the application of quantum teaching learning with discussion methods are very good, this can be seen from the courage of students in solving problems in front of the class and in expressing opinions.

Broadly speaking, the implementation of the quantum teaching learning model with assisted discussion methods Student Worksheets (LKS) in cycle II was successful.

Quantum teaching learning with LKS-assisted discussion method can be applied because it can increase learning outcomes and can develop students’ creativity in learning mathematics, and can help students to find and raise problems so that the instructional goals where students as the subject of education can be realized in carrying out tasks and obligations as students. In
addition, the role of the teacher as a facilitator and at the same time as a companion in the learning process can be realized.

E. Conclusion

Based on the results of the study it can be concluded that learning by applying the quantum teaching model with the LKS-assisted discussion method can increase student activity, teacher performance, and cognitive abilities of students in understanding mathematics in class VIII.9 Semester II of Maros 1 Middle School in 2014 / 2015. This is indicated by the increased activity of students in teaching and learning which initially obtained a percentage of 61.44% with sufficient assessment qualifications and in the second cycle increased to 71.44% with good assessment qualifications, increased results of students’ cognitive abilities in the material circle shows the number of students who complete in the first cycle as many as 23 students with an average score of 66.84 percent 60.53% with assessment qualifications have not achieved success that is 70%, and students who complete the second cycle increase to 28 students with an average score 70.39 percent, 73.68%, and the increase in teacher performance in quantum teaching learning with discussion method assisted by LKS on mathematics subjects in the first cycle obtained a percentage of 66.67% with quite good assessment qualifications, and in the second cycle it increased to 79.17% with good assessment qualifications.

Based on the implementation of classroom action research on class VIII.9 Maros 1 Public Middle School 2014/2015 Academic Year, the researcher proposes suggestions that teachers should apply quantum teaching models with discussion methods assisted by LKS on mathematics so that students can improve cognitive abilities, increase student activity, increase motivation student learning, train students to work together in discussions with friends in terms of solving questions so that they can improve teacher performance in learning activities.

F. References

RELATIONSHIP OF ACHIEVEMENT MOTIVATION WITH MATHEMATICAL LEARNING ACHIEVEMENTS IN CLASS VIII OF SMP 6 PALOPO

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Abstract
This study aims to (1) obtain an overview of the level of achievement motivation of class VIII students of SMP 6 Palopo (2) Know the level of mathematics learning achievement of class VIII students of SMP 6 Palopo. 6 Palopo. The method used in this study is a questionnaire and test of learning outcomes. The results showed that the average score of student achievement motivation was 20.05 from the ideal score of 26 and the standard deviation of 2.27 including the medium category, the average score of students' mathematics learning achievement 75.81 from the ideal score of 100 with a standard deviation of 6.26 including the medium category. It can be concluded that there is a positive relationship between achievement motivation and mathematics learning achievement of class VIII Palopo 6 SMP with a correlation coefficient of 0.72 and efficiency determination of 0.52 (52%).

Keywords: motivation, achievement motivation, learning achievement

A. Introduction
Related to the world of education, to create high-quality and high-achieving human beings students must have good learning achievements. Learning achievement will be the maximum benchmark that has been achieved by students after conducting learning activities during a predetermined time. In an educational institution, learning achievement is an important indicator to measure the success of the teaching and learning process. However, it is undeniable that many high and low student achievements are influenced by other factors besides the teaching process itself (Arikunto, 2006).

There are several factors that influence student learning achievement, namely internal and external factors. Internal factors include intelligence, motivation, habits, anxiety, interests and
so on. While external factors include family environment, school environment, community environment, socio-economic conditions, and so on (Ahmadi and Supriyono, 2004). In this study the researcher focused on the relationship of one of the internal factors, namely achievement motivation that existed in students with student achievement.

Motivation is a very important factor in the learning process in order to achieve the expected achievement. This is because motivation is the driver and driver of individuals who can cause and provide direction for individuals to carry out certain activities to achieve their goals. The standard of learning and graduation completeness value set nationally which must be achieved by students can increase students’ motivation in learning and achievement. And make students sued to change their learning habits in a better direction. Related to this, the researcher wanted to give a significant picture to find out the effect of achievement motivation on the learning achievement of the eighth grade students of SMP Negeri 6 Palopo. For this reason the researcher formulated the research theme at:

"The Relationship between Achieving Motivation and Mathematics Learning Achievement of Class VIII Students of SMP Negeri 6 Palopo”.

Based on the background stated earlier, the formulation of the research problem is as follows:

1. What is the achievement motivation of Grade VIII students of SMP Negeri 6 Palopo?
2. How big is the level of mathematics learning achievement of the eighth grade students of SMP Negeri 6 Palopo?
3. Is achievement motivation positively related to mathematics learning achievement of eighth grade students of SMP Negeri 6 Palopo?

B. Literature Review

The essence of Learning Mathematics

Mathematics is not solitary knowledge that can be perfect because of itself, but the existence of mathematics is mainly to help humans understand and master social, economic, and natural problems. Mathematics is a language that uses definitive terms carefully, clearly, and accurately in the form of symbolic representations of ideas rather than sounds.

Various reasons for the need for schools to teach mathematics to students in essence can be summarized because of the problems of everyday life. It seems that there is no doubt that mathematics is one of the pinnacles of intellectual glory. Aside from the knowledge of mathematics itself, mathematics gives language, processes, and theory. Mathematics is the basis for engineering design. In learning mathematics an active role is needed, mentally involved, namely by finding relationships between concepts and mathematical structures using learning methods to find, so that the intellectual potential of learning individuals can develop.

According to Behavioristic theory, learning is a change in behavior as a result of the interaction between stimulus and response. In other words, learning is a form of change experienced by students in terms of their ability to behave in new ways as a result of interactions between stimulus and response. Someone is considered to have learned something if someone can show changes in his behavior. Learning mathematics means studying abstract ideas that are given symbols and arranged hierarchically with deductive reasoning. Therefore, learning mathematics is a high mental activity that involves various abilities. The form of learning mathematics is a process of thinking reflective, creative, and appropriate in gaining new experience or knowledge in the field of mathematics (Tiro, 2000). True or false values are determined by existing laws. Various symbols in mathematics are generally still empty of meaning, meaning the symbols can be given a certain meaning in accordance with the universe of conversation.

Based on the description above, then the essence of learning mathematics is a mental activity to understand the meaning of structures, relationships, symbols then applied in concepts produced to real situations that cause a change in behavior.

Learning achievement

To measure the extent to which the level of success of students in mastering the learning material they are learning requires a measuring instrument. The measuring instrument commonly used is a test. But the test is one form of measuring instrument that is often used to measure the level of success of students in mastering the subject matter. According to Supriyanto (2010) learning outcomes or learning achievements are patterns of changes in values, attitudes, appreciation and skills. According to Purwanto (2009) learning outcomes are quantitative measures that represent students’ abilities. Furthermore Abdurrahman (1999)
suggested that learning achievement is the ability obtained by children after learning activities. As according to Keller (Abdurahman, 1999) learning achievement is the actual achievement displayed by the child through the effort to complete learning tasks.

Based on several definitions above, it can be concluded that learning achievement is the result of learning efforts achieved by a student in the form of a skill from academic field learning activities in school at a certain period of time recorded at the end of each semester in a report book called report cards. A student can be said to be accomplished if he has obtained an advance on the effort he has done. Achievement of these achievements often must be accompanied by a hard effort.

The ideal learning achievement according to Bloom’s Taxonomy (Daryanto, 2001) is required to fulfill 3 aspects at once namely cognitive, affective, and psychomotor aspects.

**Motivation**

The term motivation refers to all the symptoms contained in the stimulation of actions towards a particular goal where previously there was no movement towards that goal. Motivation can be in the form of basic or internal impulses and incentives outside the individual self or gifts (Hamalik, 1990). Whereas in the Large Indonesian Language Dictionary (MONE 2008) Motivation is an impulse that arises in a person consciously or unconsciously to carry out an action with a specific purpose, in line with that, according to Nasution (1993) motivation is a psychological condition that encourages someone to do something. Whereas according to Malayu (2003) motivation is the provision of driving force that creates the enthusiasm of one’s work, so that they will cooperate, work effectively, and be integrated with all their efforts to achieve satisfaction. Motivation is a change of energy in a person’s person that is characterized by the emergence of effective (feelings) and reactions to achieve goals (Sumanto, 1990). Motivation is an effort to provide conditions so that the child wants and wants to do something (Nasution, 2000). Motivation is anything that encourages someone to act something (Purwanto, 2007).

Seeing the various opinions above, it can be concluded that motivation is anything that encourages and directs individual behavior to carry out an action caused by influences from both inside and outside the individual to achieve certain goals. In general, it can be said that the function of motivation is to encourage, move or arouse someone to arise the desire and willingness to do something so that they can get results or achieve certain goals (Purwanto, 2007).

**Achievement motivation**

Humans as living things have various kinds of needs, both material and psychological. One of the psychological needs is the need for achievement. According to Muhkal (Fitriani, 2009) explained that someone is considered to have achievement motivation if the person has the desire to do something work that achieves better than the work performance of others. Also said that people have high achievement motivation, work very hard, do something more than they have done before, work more efficiently and faster. Whereas Wainer (Fitriani, 2009) suggests that people who have high achievement motivation see themselves as more capable than people who have low achievement motivation, and also try to do more tasks for that achievement. Thus achievement motivation is needed in order to improve mathematics learning achievement for a student. By paying attention to these matters, indicators of achievement motivation can be formulated, namely working hard, hoping for success, worrying about failure and competition.

**C. Methodology**

This study is a correlational Ex-Post Facto study consisting of two variables, namely achievement motivation as independent variables and mathematics learning achievement as the dependent variable. The instruments in this study were achievement motivation questionnaires and learning outcomes tests. The sample of this study was the eighth grade students of Palopo 6 Junior High School who were randomly selected as many as 20% representatives from each class.

The steps in the research process are:

1. The researcher selects samples randomly from each class in class VIII of SMP 6 Palopo to be given instruments and test results.
2. The selected samples were 34 people who were subsequently given an achievement motivation questionnaire to obtain data on achievement motivation of Grade VIII students of Palopo 6 Middle School.

3. Providing learning outcomes tests to selected samples to obtain data on the learning achievement of class VIII students of SMP 6 Palopo.

4. After the data is collected in full, then the data is tested for truth using statistical formulas, with stages: preliminary analysis, hypothesis test analysis, further analysis to obtain valid data.

5. Interpret and conclude the results of the study.

D. Findings and Discussion

1. Findings

The results of the study were processed using SPSS. V.20. Of the 34 number of respondents obtained the highest score of 24, the lowest score of 16 and a range of scores of 8 and an average score of 20.05 of the ideal score of 26 with a standard deviation of 2.27 and variance of 5.18. These achievement motivation scores are grouped in frequency distributions in the following table.

Table 1. Frequency distribution of achievement motivation

<table>
<thead>
<tr>
<th>Interval</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 – 18</td>
<td>Low</td>
<td>10</td>
<td>23.30</td>
</tr>
<tr>
<td>19 – 21</td>
<td>Moderate</td>
<td>19</td>
<td>44.10</td>
</tr>
<tr>
<td>22 – 24</td>
<td>High</td>
<td>14</td>
<td>32.60</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>43</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: results of primary data analysis (2014)

Based on Table 1 shows that the achievement motivation of Grade VIII students of SMP Negeri 6 Palopo is mostly in the medium category with a percentage of 44.10% with a frequency of 19, and 32.60% of students who have high achievement motivation with a frequency of 14, then 32.60% students who have low achievement motivation with a frequency of 10.

The results of the study were processed using SPSS. V.20. Of the 34 respondents, the highest score was 89, the lowest score was 60 and the score was 29 and the average score was 75.81 from the ideal score of 100 with a standard deviation of 6.26 and variance of 39.25. These scores on mathematics learning achievement are grouped in frequency distributions in the following table 2.

Table 2. Frequency distribution of mathematics learning achievements

<table>
<thead>
<tr>
<th>Interval</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 – 69</td>
<td>Low</td>
<td>6</td>
<td>13.80</td>
</tr>
<tr>
<td>70 – 79</td>
<td>Moderate</td>
<td>22</td>
<td>51.30</td>
</tr>
<tr>
<td>80 – 89</td>
<td>High</td>
<td>15</td>
<td>34.90</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>43</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: results of primary data analysis (2014)

The normality test of the data in this study uses the assumption of the Limit Central Theorem (TLC). Tiro (2008) suggested that n values that are large (n ≥ 30) are distributed t close to the standard normal distribution. This is in line with the opinion of Slakter (Fitriani, 2009) who suggested that the number of samples 30 or more would provide the appropriate approximation (normal data). Even though we set limits on the normality of data, the number of samples of 30 or more has met the standards of educational research. Because the number of samples in this study were 43 students and more than 30 samples, it can be said that the data in this study were normally distributed and had met the standards of educational research.

The hypothesis testing of the research conducted by researchers first was to find a correlation between achievement motivation (X) and students' mathematics learning achievement (Y). As for the correlation between achievement motivation (X) and student mathematics learning achievement (Y) can be seen in the following table.
Table 3. Correlation between achievement motivation and student mathematics learning achievement

<table>
<thead>
<tr>
<th>Achievement motivation</th>
<th>Achievement motivation</th>
<th>Learning achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>.708**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>Pearson Correlation</td>
<td>.708**</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>1</td>
</tr>
<tr>
<td>N</td>
<td>43</td>
<td>43</td>
</tr>
</tbody>
</table>

Source: results of primary data analysis (2014)

Based on table 3 shows that the correlation coefficient between achievement motivation (X) and mathematics learning achievement (Y) is 0.70. Based on the results of hypothesis testing, the probability value \( \rho = 0.00 \) is obtained compared with the value of \( \alpha = 0.05 \) so that \( \rho < \alpha \) means that \( H_0 \) is rejected and \( H_1 \) is accepted. This indicates that the correlation between the two variables is significant. Thus the proposed hypothesis is accepted so that it can be concluded that achievement motivation has a positive and significant relationship to mathematics learning achievement of class VIII students of SMP Negeri 6 Palopo with a correlation coefficient \( r = 0.70 \) and a coefficient of determination \( r^2 = 0.52 \) (52%).

2. Discussion

The results showed that the achievement motivation of Grade VIII students of SMP Negeri 6 Palopo in the 2014/2015 academic year included the medium category. This can be seen from the average score of achievement motivation questionnaire obtained which is 20.05 from the ideal score of 26 and the mathematics learning achievement of the eighth grade students of SMP Negeri 6 Palopo in the 2014/2015 academic year including the medium category, this is seen from the average score of achievement students' mathematics learning is 75.81 from the ideal score of 100. The things that cause it are there are still students who are less happy about the lesson so that the student is lazy to take lessons and even tends to avoid lessons that he considers difficult and lazy to complete the task given by the teacher so that the child is underachieved.

In addition, there are still students who feel afraid of failure so they do not have high aspirations resulting in these students not wanting to excel. There are also students who do not want to be the smartest students in school so that the desire for achievement is lacking. However, there are also students who are very happy with the lesson, doing schoolwork tirelessly to improve their performance so that they become the smartest students in the school, and even those students prefer to hang out with people who excel and these students like to take part in the activities held in school it shows that the achievement motivation possessed by students is high so that their learning achievement is high.

Another thing that causes achievement motivation and learning achievement of class VIII students of SMP Negeri 6 Palopo includes the category that the researcher can see when the researcher conducts the research, there are students who are enthusiastic in answering the questions given, there are even students who ask questions about things they consider not understood. However, there are also students who answer only a few questions and some even cheat on their friends' jobs.

Based on the descriptions above and based on the results of hypothesis testing, it shows that achievement motivation has a positive relationship with mathematics learning achievement of class VIII students of SMP Negeri 6 Palopo with a determination coefficient of 0.52. The results of this study reinforce the theoretical study presented in CHAPTER II that achievement motivation possessed by students includes being independent in learning mathematics, having a great willingness to solve mathematical questions, being passionate, active and passionate in completing mathematical tasks so that they play a large role in improving achievement learn math.
Likewise expressed by Firtiani (2009) that achievement motivation has a positive relationship to mathematics learning achievement of eighth grade students of SMP Negeri 4 Palopo. The results of this study also support the research conducted by Kadir (2008) which revealed that achievement motivation has a positive relationship to the learning achievement of mathematics in grade VII MTs Junaidiyah Burau East Luwu. Thus it can be concluded that achievement motivation has a positive relationship to students' mathematics learning achievement so students who have high achievement motivation are also high learning achievement and vice versa, students whose achievement motivation is low then their learning achievement is low.

The advantage of this research is that when the research of all students is ready in the classroom so that no students are late into the room, the prepared questionnaire exceeds the number of students so that no student does not get a questionnaire, students can solve all questions on time. The weaknesses that researchers get when carrying out research is the presence of students who are difficult to regulate, when researching it during the second lesson so that the concentration of students is reduced due to hunger and fatigue so that students' thoughts go to the canteen, there are also students who who are not complete write it so that it is too late to solve the problem and there are also students who always leave the room with excuses to the toilet so that it reduces order in the class and disrupts the concentration of other students, also there are students who cheat on their work.

E. Conclusion

Based on the results of data analysis and the results of the discussion, the conclusions from this study are as follows:

1. Achievement motivation of Grade VIII students of SMP Negeri 6 Palopo in the 2014/2015 school year included in the medium category with a percentage of 44.10%. The average score achieved by respondents was 20.05 from the ideal score of 26 and the standard deviation of 2.27.

2. Mathematics learning achievement of students of class VIII of SMP Negeri 6 Palopo in the 2014/2015 academic year included the moderate category with a percentage of 51.30%. The average score achieved by respondents was 75.81 from the ideal score of 100 and standard deviation of 6.26.

3. Motivation for mathematics achievement has a positive relationship to mathematics learning achievement of class VIII students of SMP Negeri 6 Palopo with a determination coefficient of 0.52 (52%).

F. References


THE EFFECT OF COOPERATIVE LEARNING MODELS ON INCREASING LEARNING RESULTS AND STUDENT ACTIVITIES IN MATHEMATIC LESSONS

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Abstract

This study aims to determine the effect of cooperative learning models on improving learning outcomes and student learning activities in mathematics. This type of research is quantitative. The research design used was quasi-experimental by taking three sample classes. Two as the experimental class that received the treatment of cooperative learning model type Team Assisted Individualization (TAI) and Think Pair Share (TPS) type. One control class received conventional method treatment. The sample was taken from class X Kosgoro Vocational School Karawang Regency with a sample size of 90 students. Data was taken by post test by using objective test instruments with 25 multiple choice items for learning mathematics matrix material and for student learning activity data using a questionnaire consisting of 30 items in the Likert point 5. The results of data analysis showed that TAI learning was better than Conventional, can be proved statistically (LSD table) that the mathematics learning outcomes are Sig = 0.002 and for learning activities Sig = 0.000, both are smaller than α = 0.05. This proves that TAI learning is better than conventional seen from the results of learning and student learning activities. Learning TPS is better than Conventional, can be proven statistically (LSD table) that for mathematics learning outcomes obtained Sig = 0.684 greater than α = 0.05 and for learning activities obtained Sig = 0.002 smaller than α = 0.05. This proves that TPS learning is better than Conventional seen from student learning activities even for student learning outcomes there is no difference. Based on the data analysis, it can be concluded that the application of cooperative learning models can influence the increase in mathematics learning outcomes and student learning activities.

Keywords: Cooperative Learning, Mathematics Learning Results, Student Learning Activities
A. Introduction

The world of education is currently concentrating on the quality of education in improving teaching and learning activities (KBM) in which there are teachers and students as human elements which in fact have many human elements such as abilities, skills, philosophy of life, motivation, etc. that differ from one to another. In the learning process, students learn from their experience, construct knowledge, then give meaning to that knowledge. Mathematics which are axiomatic deductive and depart from abstract things, tend to be difficult to be accepted and understood by students. If students are faced with a certain material while he is not ready to understand it, then he will not only fail to learn but learn to scare, hate, and avoid lessons related to the material. Most students have not been able to connect the material learned with the knowledge used.

According to Mullis et al (2011) the results of a study conducted by Trends in International Mathematics and Science Studies (TIMSS), released at the end of 2011, found that the mathematics achievement of students in Indonesia was 38 of 42 countries with average scores of students in Indonesia is 386 where the overall average score is 500. The scores of Indonesian students fell by 11 points from 2007. Indonesia's position is much lower than Korea (613) in the first position. Low quality of students in mathematics Mathematics education in Indonesia is experiencing a paradigm shift, where positive transformation takes place in the Mathematics education curriculum in elementary and secondary schools. In addition to curriculum development, various efforts have been made by the government to improve the quality of learning in schools. The government is also assisted by various parties concerned with mathematics education. Among these efforts are: (1) teacher training, (2) teacher education qualifications, (3) planting new models or teaching and learning methods, (4) study of student difficulties and errors in learning mathematics, however, these efforts have not yet produced optimal results.

In learning various types of learning models are known, one of the learning models that allows students to interact with each other is the cooperative learning model. The cooperative learning model will be able to provide new nuances in the implementation of learning by all fields of study or subjects taught by the teacher. Because cooperative learning and some results of research both education experts inside and outside the country have had a broad impact on success in the learning process. The impact is not only on the teacher but also on the students, and educative interaction arises and shows the roles and functions of the teacher and students. The role of the teacher in cooperative learning as a facilitator, moderator, organizer, and mediator is clearly visible. This condition was once and the student's function was seen, the involvement of all students would be able to provide an active atmosphere and learning seemed democratic, and each student had a role and would provide his learning experience to other students.

According to Trianto (2007) there are two reasons why cooperative learning is the choice, first, some research results prove that the use of cooperative learning can improve student learning achievement while increasing the ability of social relations, fostering an attitude of accepting self-deficiencies and others, and increasing self-esteem. Second, cooperative learning can realize students' needs in learning to think, solve problems, and integrate knowledge with skills. Lasmawan in Dimyati, (2006) states that cooperative learning (cooperative learning) is a learning model where students learn and work in small groups collaboratively whose members consist of six people, with a cooperative heterogeneous group structure that can realize students' needs in learning think, solve problems, and integrate knowledge with skills.

The cooperative learning model that will be applied in this study is the TAI type of cooperative learning model and TPS cooperative learning model. The cooperative learning model of the Team Assisted Individualization (TAI) type has a rationale which is to adapt learning to individual differences related to ability and student achievement. This method is included in cooperative learning. In the TAI learning model, students are placed in small groups (4 to 5 students) that are heterogeneous and then followed by giving individual assistance to students who need it. this learning designs a form of group learning in a comprehensive way the students work in groups. TAI cooperative learning students are trained to be responsible for solving problems and motivating each other for achievement. Think Pair Share is a cooperative learning model that gives students time to think and respond and help each other. This model introduces the idea of “wait or think time” on the interaction elements of cooperative learning which is currently one of the powerful factors in increasing students' responses to questions. The benefits of TPS include: (1) allowing students to work alone and work with others; (2) optimize student participation; and (3) provide opportunities for students to show their
participation in others. Skills that are generally needed in this strategy are sharing information, asking questions, summarizing other people's ideas, and paraphrasing. Think-Pair-Share has procedures that explicitly give students time to think, answer, help each other. Thus, students are expected to be able to work together, need each other, and interdependent on small groups cooperatively.

Team Assisted Individualization (TPA) and Think-Pair-Share (TPS) are suitable for use in high schools and vocational schools because the condition of students who are still in their teens makes them like new things for them and are more open to peers in solving problems they face.

B. Literature Review

Slavin (2008) argues that cooperative learning can be explained and several perspectives, namely motivational perspective, social perspective, cognitive development perspective, and cognitive elaboration perspective. The motivational perspective means that the rewards given to groups allow each group member to help each other. Thus, the success of each individual is basically the success of the group. This kind of thing will encourage each group member to fight for the success of the group.

The TAI type cooperative learning model was developed by Slavin (2008) in his Cooperative Learning: Theory, Research and Practice. When the teacher delivers a lesson to students with diverse backgrounds, it is likely that some students do not have the ability to learn the lesson and will fail to benefit from the method. Other students may even know the material, or can learn it very quickly so that the time spent learning for them is just a waste of time. Slavin made this model for several reasons; (1) this model combines cooperative efficacy and individual teaching programs, (2) this model puts pressure on the social effects of cooperative learning, (3) TAI is structured to solve problems in teaching programs, for example in terms of individual student learning difficulties. Team members use answer sheets that are answered together. Discussions occur when students question each other’s answers to their teammates. Think Pair Share (TPS) was developed by Frank Lyman and his colleagues from the University of Maryland. Think Pair Share is a cooperative learning model that gives students time to think and respond and help each other. This model introduces the idea of "wait or think time" on the interaction elements of cooperative learning which is currently one of the powerful factors in increasing students’ responses to questions (Jumananta, 2011). Whereas according to Shoimin (2014) Think-Pair-Share has procedures that explicitly give students time to think, answer, help each other. Thus, students are expected to be able to work together, need each other, and interdependent on small groups cooperatively.

According to Ruseffendi (1990) mathematics learning activities in schools begin with the presence of a number of stimuli that intentionally or unintentionally will cause an emotional response in the individual concerned. This response stimulus will be the continuation of mathematics learning activities to the highest type, namely learning problem solving. Gagne further argues that "each learning occurs in four phases, namely understanding, mastery, memory and re-disclosure.

Activities in learning have great benefits for students. The following is the principle of benefit according to Hamalik (2008) as follows: (1). Students look for their own experience and immediately experience themselves (2). Doing it yourself will develop all personal aspects of students. 3). Fostering harmonious cooperation among students which in turn can facilitate group work. (4). Students learn and work based on their own interests and abilities. (5). Foster cooperation between students both in learning and organization. (6) Learning and learning are carried out in a realistic and concrete manner, so as to develop critical and dynamic thinking.

C. Methodology

The method used is quantitative by using the Quasi Experiment design (quasi-experiment) that is research that cannot provide full control. The sample size is 90 respondents consisting of three cluster random classes from four classes X AP Kosgoro Vocational School Karawang Regency. The three sample classes are divided into two experimental classes given treatment by using the TAI learning model and TPS in a control class given treatment using lecture and question and answer (conventional) methods.

The data taken in this study is a post test of mathematics learning outcomes of students, the subject matter of matrix operations using objective test instruments 25 items of multiple choices and for learning activities students use questionnaires totaling 30 items using a 5-point Likert scale. The collected data is then carried out a prerequisite test of data analysis on
normality test and homogeneity test. To test the statistical hypothesis using a one-way ANOVA test.

D. Findings and Discussion

1. Findings

The test results of data analysis of mathematics learning outcomes and student activities using one-way ANOVA and SPSS.20 help can be seen in the following table output.

| Table 1. Mathematics Learning Outcomes and Student Learning Activities due to Conventional Treatment, TPS and TAI |
|-------------------------------------------------|-----------------|-----------------|----------|-----|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Learning outcomes | Between Groups | 151,089 | 2 | 75,544 | 7,583 | .001 |
| | Within Groups | 866,700 | 87 | 9,962 | | |
| | Total | 1017,789 | 89 | | | |
| Activity Students | Between Groups | 3294,289 | 2 | 1647,144 | 16,334 | .000 |
| | Within Groups | 8773,000 | 87 | 100,839 | | |
| | Total | 12067,289 | 89 | | | |

Based on the results of the one-way ANOVA test (table 1), the value of the Sig of learning outcomes is smaller than α or (0.001<0.05). This means that there are significant differences in students’ mathematics learning outcomes from the three treatments (Conventional, TPS and TAI). And for the value of the Sig activity, the scars are smaller than α or (0.000<0.05). This means that significant differences in learning activities from the three practices (Conventional, TPS and TAI).

| Table 2. Differences in the results of Conventional Treatment, TPS and TAI for Mathematics Learning Outcomes and Learning Activities |
|-------------------------------------------------|-----------------|-----------------|----------|-----|
| | (I) PERLAKUAN | (J) PERLAKUAN | Mean Difference (I-J) | Std. Error | Sig. |
| Hasil belajar | KONVENSIONAL | TPS | -2,567* | .815 | .002 |
| | KONVENSIONAL | TAI | -3,333 | .815 | .684 |
| | TPS | KONVENSIONAL | -2,900* | .815 | .001 |
| | TAI | KONVENSIONAL | 2,567* | .815 | .002 |
| | TPS | TAI | 2,900* | .815 | .001 |
| Aktivitas siswa | KONVENSIONAL | TPS | -8,467* | 2,593 | .002 |
| | KONVENSIONAL | TAI | -14,767* | 2,593 | .000 |
| | TPS | KONVENSIONAL | 8,467* | 2,593 | .002 |
| | TAI | KONVENSIONAL | -6,300* | 2,593 | .017 |
| | TPS | TAI | 14,767* | 2,593 | .000 |

Based on the results of the Post Hoc test (LSD) as in table 2. the findings are as follows:

a. Student Mathematics Learning Results

* Conventional and TPS are Sig = 0.684> 0.05. This means there is no difference in student learning outcomes between those treated with conventional and TPS.
* Conventional and TAI are Sig = 0.000> 0.05. This means that there are differences in student learning outcomes between those treated with conventional and TAI.
* TPS and TAI are Sig = 0.017 <0.05. This means that there are differences in student learning outcomes between those given treatment with TPS and TAI.

b. Student Learning Activities

* Conventional and TPS are Sig = 0.002> 0.05. This means that there is no difference in student learning activities between those treated with conventional and TPS.
* Conventional and TAI are Sig = 0.002> 0.05. This means there is no difference in student learning activities between those given conventional treatment with conventional and TAI.
* TPS and TAI are Sig = 0.000> 0.05. This means there is no difference in student learning activities between those treated with conventional TPS and TAI.
2. Discussion

The parameter of mathematics learning outcomes in this study is the ability of students to be measured cognitively during the learning process of the matrix which includes the achievement of the indicators so that students are expected to be able to: (1) determine the sum and subtraction results of two or more matrices, (2) determine the results of two or more matrices, (3) carefully and carefully solve the counting operations on the matrix. While the parameters for measuring student learning activities in this study are the activities of students in learning and learning both physically and spiritually which are related to the duties and obligations of the school including visual activities, oral activities, listening activities, writing activities, metric activities, mental activities, and emotional activities.

Think-Pair-Share (TPS) is one type of cooperative learning that has procedures that are set explicitly to give students more time to think, answer, and help each other. This type of learning model provides opportunities for students to express ideas and consider the most appropriate answers, and encourage students to improve cooperation between students. Application of cooperative learning type Think-Pair-Share (TPS) ability of students both individually and in groups can develop and provide a different atmosphere from conventional learning. TPS learning has given a new color to students’ learning experiences from the saturation of students to be excited, and from fascists to be more active. Based on the results of this study found TPS learning, students individually and in groups are more active than conventional learning. This can be proven from the LSD table where the Sig value is 0.002 which is smaller than \( \alpha = 0.05 \) or (0.002 <0.05). This finding is in line with the opinion of Imas Kurniasih and Berlin Sani (2015), many sides of the advantages of the TPS learning model, including: (1) provide many opportunities for students to think, answer, and help each other, (2) increase student participation in the learning process, (3) ease of interaction among students, (4) help each other with each other, make conclusions (discussions) and present in front of the class, (5) facilitate the teacher in monitoring students in the learning process, (6) the learning process becomes dynamic, more active in finding problems and finding answers.

The two alternative variations of the learning model (TAI and TPS) are learning models that can give a non-boring impression on learning mathematics in the classroom. The results of the study prove that TAI learning is better than Conventional learning and TPS. In addition, students are more active students and are also more motivated and responsible individually and in groups for the assignments given by the teacher. Statistically, the TAI learning outcomes reta far exceed TPS and Conventional (19.33 16.23 16.67). And the average student learning activity is (110.33 104.03 95.97). This is reinforced from the ANOVA test results obtained Sig = 0.001 smaller than \( \alpha = 0.005 \) (0.001 <0.05). This shows that there are significant differences between the mathematics learning outcomes that are conventional treatment, polling stations and TAI. For student learning activities also obtained Sig = 0.000 smaller than \( \alpha = 0.05 \) (0.000 <0.05) This proves that there are differences in student activities between those that are conventional, TPS and TAI. The differences from each of the three treatments will be proven from table 4. LSD as follows: (1) For mathematics learning outcomes, TAI is better than TPS and Conventional. This is obtained from the Sig = 0.001 and 0.002 values smaller than \( \alpha = 0.05 \). For student learning activities TAI is also superior from TPS and Conventional. This is obtained from Sig = 0.017 and 0.000 smaller than \( \alpha = 0.05 \). (2) For the results of the mathematics learning between TPS and Conventional there is no difference, this is obtained from the Sig value = 0.684 smaller than \( \alpha = 0.05 \). However, for student learning activities TPS is better than Convention, this is obtained from Sig = 0.002 smaller than \( \alpha = 0.05 \).

E. Conclusion

1. From the results of the observations during the study found the findings that cooperative learning (TAI and TPS) can increase student motivation and activity during learning, seen their solidity and cooperation in their respective groups.
2. Learning TAI is better than Conventional, can be proven statistically (LSD table) that for mathematics learning outcomes there are Sig = 0.002 and for learning activities Sig = 0.000, both are smaller than \( \alpha = 0.05 \). This proves that TAI learning is better than Conventional seen from the results of \( \alpha = 0.05 \) learning and student learning activities.
3. Learning TPS is better than Conventional, can be proven statistically (LSD table) that for mathematics learning outcomes obtained Sig = 0.684 greater than \( \alpha = 0.05 \) and for learning activities obtained Sig = 0.002 smaller than \( \alpha = 0.05 \). This proves that TAI learning is better
than Conventional seen from student learning activities even for student learning outcomes there is no difference

F. References
The purpose of this study is to find out how effective the Realistic Mathematics Education (RME) approach is. The research method used in this study is the experimental method. The sampling technique uses simple random sampling technique. The instrument for collecting data in this study is an essay test consisting of 8 items. The data analysis technique used is the t-test, and based on the t-test calculation shows t-count = 10,098 and t-table = 2,002 at the significant level of 5% or (α = 0.05) and the degree of freedom (dk = 58) which means t-count > t table (10,098 > 2,002) then H0 is rejected and H1 is accepted. The conclusion is that the average mathematical problem solving ability of students given the Realistic Mathematics Education (RME) approach is higher than the mathematical problem solving abilities of students who are given an expository approach. And the effectiveness calculation for the Realistic Mathematics Education (RME) approach is quite high, which is 2,605. Thus, there is an influence and effectiveness of the Realistic Mathematics Education (RME) approach in the teaching and learning process.

Keywords: Realistic Mathematics Education Approach, RME, Problem Solving
Permendiknas, Cockroft (Putri and Rusgiantoheri, 2015: 262) suggest that the need for mathematics is taught to students because it is used in life and is needed in all other fields of study. And according to Rosdianwinata (Wulandari, 2017: 326) argues that mathematics also affects the structuring of ways of thinking, especially in the formation of the ability to analyze, make synthesis, conduct evaluations to the ability to solve problems and apply them in everyday life. From the above opinion, one of the important roles of mathematics is to solve problems. Therefore, students must have mathematical problem solving abilities. Problem solving ability is a basic ability that must be possessed by students and this ability must be improved.

With the increase in problem solving capabilities, it is expected to help students solve mathematical problems and daily life in any situation. But in reality students' mathematical problem solving abilities in Indonesia are still low. Based on observations of researchers during the practice of field experience (PPL) found that students' problem solving abilities were still low. The low problem solving ability is shown from the table of results of the average daily test scores and midterm tests of class X students at Amaliyah Vocational School.

<table>
<thead>
<tr>
<th>Kelas</th>
<th>UH ke 1</th>
<th>UH ke 2</th>
<th>UH ke 3</th>
<th>UTS</th>
<th>KKM</th>
</tr>
</thead>
<tbody>
<tr>
<td>X – AK</td>
<td>73,84</td>
<td>69,10</td>
<td>57,97</td>
<td>63,63</td>
<td>75</td>
</tr>
<tr>
<td>X – PM</td>
<td>39,35</td>
<td>72,58</td>
<td>70,94</td>
<td>57,32</td>
<td>75</td>
</tr>
<tr>
<td>X – KP</td>
<td>64,21</td>
<td>70,22</td>
<td>70,83</td>
<td>68,11</td>
<td>75</td>
</tr>
</tbody>
</table>

(Source: mathematics teacher value data at Amaliyah Vocational School)

In addition to the results of the survey or observation during PPL there are also results from research conducted by Fakhruddin (Nataliasari, 2014) on junior high school students, in general the results of junior high school mathematical problem solving abilities have not been satisfying around 30.67% of ideal scores. Just as Fakhruddin, Hastuti Febrianti et al (2013) conducted observations conducted in class VIII of SMP N 9 Padang on 24-27 September 2012, it was seen that students were less able to solve questions in the form of problem solving, especially those related to students' real lives. Only about 25% of students are able to finish well.

The weak mathematical problem solving abilities of students in Indonesia are also shown in the results of a survey conducted by the JICA Technical Cooperation Project for Development of Science and Mathematics in 2000 in the city of Bandung which found that one of the activities in mathematics that are considered difficult by students in learning and teachers in teaching are mathematical problem solving. In line with that, Yeo (Arviani and Tatag, 2014: 150) in his research found that the difficulties experienced by students in solving problems were the lack of students' ability to choose the right procedures or strategies to solve the problems they faced. Based on the facts and results of previous studies, a learning approach is needed in the hope that students' mathematical problem solving abilities can grow and develop better.

One approach that can be used is the Realistic Mathematics Education (RME) approach. RME is a learning approach that places real/real problems that are known and experienced by students and can also be imagined by students as the starting point of learning. A realistic approach provides a clear understanding of the relevance of mathematics to everyday life. This is clearly seen in the questions or problems presented relating to real world life in the learning process. From the characteristics of the Realistic Mathematics Education approach, it is expected to direct students to solve mathematical problem solving in their daily lives. So the authors are interested in conducting research on realistic mathematics learning, with the title "Effectiveness of the Realistic Mathematics Education (RME) Approach on Mathematical Problem Solving Abilities".

B. Literature Review

Mathematical Problem Solving Ability

Problem solving ability is an ability in which a person chooses a way or strategy in solving the problem at hand. According to Polya (Taufik, 2014: 58), defines problem solving (problem solving) as a conscious effort to find a way out of a difficulty, but that goal is not immediately achievable. Furthermore, NCTM (Husna et al., 2013: 81) suggests that problem solving is the process of applying the knowledge previously obtained to new and different situations. According to Kesumawati (Mawwadah and Hana, 2015: 166) states mathematical problem solving ability is the ability to identify the elements that are known, asked, and the adequacy of
the elements needed, able to make or compile mathematical models, can choose and develop strategies for solving, able to explain verify the answers obtained.

Meanwhile, According to Sudjimat (Aini, 2016: 29) states that learning problem solving in essence is learning to think or learning to reason, which is thinking or reasoning applying the knowledge previously obtained to solve new problems. And according to Dahar (Netriwati, 2016: 181) problem solving is a human activity that combines concepts and rules that have been obtained previously, and is not a generic skill that can be obtained instantly. Furthermore, according to Polya (Juanda, 2014) in solving problems there are four aspects of problem solving skills, namely by understanding the problem, making a problem solving plan, implementing a problem solving plan and seeing (checking) again.

**Realistic Mathematics Education (RME) Approach**

**Definition of Realistic Mathematics Education (RME)**

The first RME was introduced by mathematicians from the Freudenthal Institute at Uttecht University in the Netherlands for over thirty years ago, right in 1973. According to Frudenthal (Wijaya, 2012: 20) mathematics is a form of human activity. This idea shows that RME does not place mathematics as a finished product, but rather a process often referred to as guided reinvention. Therefore, RME becomes an alternative in learning mathematics in this study.

Besides that, one of the reasons for taking this approach is that the mathematics subject matter is abstract, so mathematics learning should start from concrete to abstract. This explanation supports RME as a specific learning approach to mathematics that bases learning starting from concrete things. According to De Lange and Den Heuvel Panhuizen (Fathurrohman, 2015: 189) RME is learning that refers to social constructivists and is devoted only to mathematics education. Meanwhile, according to Zulkardi (Fathurrohman, 2015: 189) Realistic Mathematics Education is a mathematical learning theory which one of the learning approaches uses real world context.

Another opinion, Bennu said that the realistic approach is an approach that uses real-world situations or concepts as a starting point in teaching and learning. Realistic or Realistic Mathematics Education (RME) approach can also be interpreted as a way of teaching by providing opportunities for students to investigate and understand mathematical concepts through a problem in real situations or in everyday life. This is meant so that learning is meaningful for students.

RME theory emphasizes process skills (Of Doing Mathematics) discussing and collaborating, arguing with classmates so that they find themselves solving problems given to the teacher, so that eventually students use mathematics to solve problems both individually and in groups. The realistic approach to context with the real world, what is meant by the real world is the student experience that can be imagined by the students themselves not necessarily with real objects. Based on the opinion above, it can be interpreted that the Realistic Mathematics Education (RME) approach is an approach that starts from the real things and experiences of the students themselves. This learning students are invited to shape their own knowledge based on the experiences they have had before.

**Characteristics of the Realistic Approach to Mathematics Education (RME)**

According to Traffers (Wijaya 2012: 21), there are five characteristics of the RME learning model, namely first, using contextual problems or realistic problems. Through the use of context, students are actively involved in carrying out exploration activities. Another benefit of using contextual problems at the beginning of learning is to increase students' motivation and interest in learning Mathematics. The second, uses a model for progressive mathematicians. The use of a model functions as a bridge (bridge) from a concrete level of mathematical knowledge to formal mathematical knowledge.

Furthermore, the third is to use the results and construction of the students themselves. In learning activities, students are given the opportunity by the teacher to find mathematical concepts in their own way. The fourth characteristic, there is interaction between students and teachers. And the last characteristic is linkages. In mathematics learning it does not consist of stand-alone parts, but mathematical material interrelated with each other. So the previous material taught will be useful for future material.

**Steps of the RME Approach**

Referring to the principles and characteristics of the RME learning model above, according to Riwatati (2012: 1) the steps in the core activities of the realistic Mathematics learning process
are as follows: First step, understanding contextual problems. The teacher gives contextual problems to students. Next, students are asked to understand the problem first. The second step, explains the contextual problem. The teacher explains the situation and condition of the problem by giving instructions / suggestions as needed (limited) to certain parts that have not been understood by students. The third step, resolving contextual problems. Students individually solve contextual problems in their own way. The teacher motivates students to solve problems in their way by giving instructions / suggestions. The fourth step, comparing and discussing answers. The final step is to conclude or draw conclusions about a procedure or problem solving concept that has been built together.

C. Methodology

The research method used in this study is the experimental research method. According to Setyosari (2016: 48), "experimental research is a research activity that aims to assess the influence / action / treatment of education on student behavior about the presence or absence of the influence of the action when compared with other actions". The general objective of experimental research is to examine the effect of a particular treatment on the symptoms of a particular group compared to other groups that use different treatments.

Experimental research is a fairly typical research approach, namely experimental research directly testing the effect of a variable on other variables, and testing the cause and effect hypothesis. In this method two classes were used, namely the control class and the experimental class. The control class was treated using conventional learning models and the experimental class used the Realistic Mathematics Education (RME) approach. The independent variable in this study is the Realistic Mathematics Education (RME) (X) approach, while the dependent variable in this study is the mathematical problem solving ability (Y).

The study design was compiled to compare the results of mathematical problem solving abilities of the students of the two groups after being given different treatments. The research design that will be used is to divide the subjects into two groups, namely the control group and the experimental group. Next is the research design table used.

Table 2. Research Design

<table>
<thead>
<tr>
<th>X₁</th>
<th>X₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y₁</td>
<td>Y₂</td>
</tr>
</tbody>
</table>

Information:
X₁: Students taught with the RME learning approach
X₂: Students taught with an expository approach
Y₁: Mathematical problem solving abilities of students taught using the RME approach
Y₂: The ability to solve mathematical problems is taught using the expository approach

D. Findings and Discussion

This research was carried out approximately two months at Amaliyah Vocational School in class X where students were placed in class evenly with the same abilities without any class classification (superior and ordinary classes). During the learning process carried out in this study, researchers used two classes as the experimental class and the control class. In the experimental class learning about trigonometric comparisons using the Realistic Mathematics Education (RME) learning approach, while in the control class using the expository learning approach.

Based on the results of the study, it was found that the Realistic Mathematics Education (RME) learning approach applied in the learning process showed that the level of mathematical problem solving ability had an average value of 94.967. Whereas in the expository learning approach, students are seen from the level of mathematical problem solving ability having a value with an average of 75.667. This shows that the mathematical problem solving ability of the experimental class students is better than the control class students.

And then the researchers tested the effectiveness of the teaching and learning process using the Realistic Mathematics Education (RME) approach. The results of testing the teaching and learning process using the Realistic Mathematics Education (RME) approach that there is effectiveness of problem solving abilities on mathematical problem solving abilities of 2.605 which are high. Then from the results of the statistical hypothesis test the value of t_count = 10.098 and t_table = 2.002 at a significant level of 0.05 means that t_count> t_table. The
following results show that H_0 is rejected and H_1 is accepted, thus the average findings of mathematical problem solving abilities in the experimental class are higher than the average mathematical problem solving abilities of students in the control class.

E. Conclusion

Based on the results of research on the effectiveness of the Realistic Mathematics Education (RME) approach to Mathematical Problem Solving Ability 2017/2018 academic year, it was concluded that the value of students' mathematical problem solving abilities on trigonometry in the experimental class was taught using the Realistic Mathematics Education (RME) approach in the high category. This is evidenced by the average value of the experimental class higher than the average value of the control class.

Meanwhile, students' mathematical problem solving abilities on trigonometry in the control class that were not taught using the Realistic Mathematics Education (RME) approach, but were taught an expository approach, were in the low category compared to the results of the experimental class mathematical problem solving abilities. This is evidenced by the lower average value of the control class. The results of the hypothesis indicate that there is a significant influence on the application of the Realistic Mathematics Education (RME) approach to students' mathematical problem solving abilities and the Realistic Mathematics Education (RME) approach including an effective approach in the learning process.

F. References


MISTAKE ANALYSIS OF CLASS X STUDENTS IN HANDAYANI SUNGGUMINASA HIGH SCHOOL IN COMPLETING THE PROBLEMS OF EQUATION AND EQUALITY EQUATION SQUARE

SUGGESTION FOR THE CITATION AND BIBLIOGRAPHY

Citation in Text:

Bibliography:

Abstract

This type of research is descriptive qualitative research that presents the percentage of students' errors in solving mathematical problems, especially the questions of quadratic equations and squared inequalities. The research subjects were 22-grade students of SMA Serayani Sungguminasa, as many as 22 people. This study aims to determine the level of error made by class X SMA Handayani Sungguminasa students in solving quadratic equation problems and squared inequalities, especially conceptual errors, principle errors, and algorithmic errors. Data collection is done by providing an instrument in the form of a diagnostic test consisting of 6 items in the class essay with the intention to obtain the score of each type of error level. From the results of the analysis, the percentage of concept error rates was 39.77% (high), the principle error rate was 44.63% (high), and the algorithm error rate was 64.35% (very high). While in general, the level of error of class X students of Handayani Sungguminasa High School in completing the questions of quadratic equations and inequality squares is 54.85% or in the category, the level of error is very high.

**Keywords:** Error Analysis Solving Problems, Quadratic Equation, and quadratic inequality
A. Introduction

Mathematics is The Queen of Science translation (Mathematics is the queen of science) which is one of the basic lessons at every level of formal education that has relevance to various other sciences or life. Realizing the importance of the role of mathematics, it is desirable that high school students master mathematics subjects in accordance with the demands of the curriculum, but a fact that cannot be denied is that until now students' mastery of mathematics subject matter is still relatively low. This is due to the lack of the ability of the concept and principle of identifying data, interpretation of the language, drawing conclusions, procedures / algorithms and technical, where this capability is very much needed in solving quadratic equation problems and quadratic inequalities.

One of the underlying causes of difficulties in solving quadratic equation problems and quadratic inequalities is the mastery of material that is not optimal. To find out the difficulties of students it is necessary to conduct a search for errors made by students.

On the basis of the above thinking, the author is motivated to conduct a study to see the mistakes made by Class X students of Handayani Sungguminasa High School in solving the problems of quadratic equations and squared inequalities.

Based on the background above, the problem in this study was formulated as follows: How big is the percentage of students who make conceptual errors, principle errors, procedural errors, and causes of errors in Class X students of SMA Serayani Sungguminasa in solving quadratic equations and inequalities.

This study aims as follows: To determine the percentage of students who make conceptual errors, principle errors, procedural errors, and causes of errors in Class X students of Handayani Sungguminasa High School in solving quadratic equations and inequality problems.

B. Literature Review

Mistakes Students Make in the Problem Solving Process

According to Slameto (1995: 2) to obtain an objective understanding of learning, especially learning at school, it is necessary to formulate a clear understanding of learning. Various studies show that there are still many mistakes made by students in solving math problems. In solving mathematical problems especially those related to quadratic equations and quadratic inequalities, students need to understand the settlement process, are skilled in selecting and identifying conditions and relevant concepts, seeking generalizations, formulating completion plans and organizing pre-existing skills.

Before going on to the material, it should master the material prerequisites, namely linear equations, addition of tribes, knowledge of imaginary numbers and basic operations of algebra. In solving quadratic equation problems, students often make mistakes because students lack mastery in the supporting material.

In this study, researchers only examined three common mistakes made by students as indicators in conducting research, namely:

Concept Error

The concept in mathematics is an abstract idea that results in someone being able to classify objects or events and determine whether the object or event is an example or not an example of that idea. Related to that, Hudoyo (Fatmawati, 2006: 16) states that learning concepts is learning to understand the properties of concrete objects or events to be grouped into one type.

Erroneous concepts in mathematics will result in weak mastery of the material as a whole especially the mistakes in the basic concepts will make it difficult to master the next higher concept. This is because the order of mathematics subject matter is arranged hierarchically, one concept being the basis for understanding the other concepts. The conceptual error referred to in this paper is the student’s error in writing the model and changes in the form of the attributes of rank, root, and logarithms.

Error Principle

The principle in mathematics which is often also called a principle is an object that expresses the relationship of two objects. The object that is connected is in the form of facts, concepts, and other operations. Principle is a complex mathematical object. The principle can consist of several facts, several concepts that are related by a relationship or operation. In simple terms it can be said that principle is the relationship between various basic objects of mathematics. Principles can be axioms, theorems, traits, and so on.
According to Mappaita (Herman, 2006: 10) that learning principles requires the ability to classify some rules can occur a fairly complex combination. As stated that "the number of two odd numbers is even", this is one example of the principle in arithmetic. The principle error in working on mathematical questions especially on the subject of rank, root, and logarithms is an error in using theorems or properties of rank, root, and logarithms.

Procedure or algorithm error

The algorithm is a series of steps needed to perform a particular task such as solving a problem. In solving the problem of quadratic equations and squared inequalities, algorithms are also things that determine the correct solution to the problem.

The error of the procedure or algorithm referred to in this study is the inability to manipulate steps to answer a problem of equality and inequality of squares and errors in operating numbers (number, difference, divide, times and roots).

As explained earlier that in reality most of the students make mistakes in solving math problems which then have an impact on their learning outcomes. The mistakes made when working on mathematical questions are divided into 3, namely: conceptual errors, principle errors, and algorithmic errors.

With the existence of these conditions, the researcher tried to see the type of errors made by students in solving the quadratic equation and squared inequality problems and calculating the percentage of each of these errors.

C. Methodology

This research is descriptive research which only has one variable aiming to find out the forms of errors made by students who are the subject of research. This study identifies errors made by students in solving quadratic equation problems and quadratic inequalities.

The variables of this study are errors in solving the problems of equations and quadratic inequalities. The error in question consists of three types, namely: (a) conceptual error, (b) principle error, and (c) algorithm error.

The subjects in this study were 22 students of Class X SMA Handayani Sungguminasa, consisting of 11 men and 11 women in the 2016-2017 Academic Year.

The steps taken in compiling the essay test are paying attention to the subject matter of quadratic equations and inequality that have been studied by Class X students of SMA Handayani Sungguminasa.

After paying attention to the subject matter of the quadratic equation and the inequality of squares studied by class X students, the preparation of the steps is as follows: 1). Arrange the grid; 2). Making questions; 3). Assemble the test. 4). Validating tests and, 5). Revise the test.

To obtain data about students 'mistakes in solving quadratic equations and squared inequality problems and also to know students' mastery of the material equations and quadratic inequalities, in this study the authors used two instruments namely achievement tests and interview tests. 1). Learning Outcomes Test; Tests of learning outcomes in this research instrument the author uses 6 items in the form of essays about material quadratic equations and squared inequalities. 2). Interview; After seeing the completion of the essay problem done by students, the authors determine 3 students to be interviewed based on the most mistakes.

Data collection techniques used in this study are in the form of tests with subject matter quadratic equations and squared inequalities. This test is a diagnostic test made by the author by taking into account the scope of the subject matter, namely the material of equations and inequality squares. For the interviews, several respondents were taken who made many mistakes.

From the results of the study identified about the form of mistakes made by students in solving the questions that have been given. The method of examination is adjusted to the indicators contained in each item, then calculates the percentage of each form of error (Herman, 2009: 29).

Criteria for categorizing the error rate used in identifying forms of error are:

0% - 10% : very low category
11% - 20% : categorized as low
21% - 35% : medium category
36% - 45% : high category
46% - 100% : categorized as very high

The percentage formula of the type of error is as follows:
**D. Findings and Discussion**

1. **Findings**
   
   This description will present a descriptive analysis of errors in solving questions consisting of conceptual errors, principle errors, and algorithmic errors. This descriptive analysis includes the percentages of each type of error and error indicators for each item that is done by Class X students of Handayani Sungguminasa High School 2016/2017 Academic Year in solving quadratic equations and squared inequalities.

   The following are presented about data on the number and percentage of conceptual errors, principle errors, and algorithm errors.

   **Concept Error**

   The misconception made by students in solving quadratic equation problems and quadratic inequality can be seen in the following table:

   **Table 1. Percentage of Concept Mistakes**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Number of concept errors</th>
<th>Total concept error</th>
<th>Percentage of misconceptions</th>
<th>Error level category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>44</td>
<td>4.55%</td>
<td>Very low</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>22</td>
<td>59.09%</td>
<td>Very high</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>66</td>
<td>24.24%</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>66</td>
<td>22.73%</td>
<td>Moderate</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>88</td>
<td>62.50%</td>
<td>Very high</td>
</tr>
<tr>
<td>6</td>
<td>40</td>
<td>66</td>
<td>60.61%</td>
<td>Very high</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140</strong></td>
<td><strong>352</strong></td>
<td><strong>39.77%</strong></td>
<td><strong>High</strong></td>
</tr>
</tbody>
</table>

   From the table above, it can be seen that the conceptual error in number 1 of 4.55% is included in the category of low level of error, then at number 2 of 59.09% which is included in the category of very high error rates, then at number 3 amounting to 24.24% which is also included in the category of moderate error rates. Then, at no.4 of 22.73% which is included in the category of moderate error level, then at no.5 of 62.50% which is included in the category of error rate is very high, and at no.6 of 60.61% is meant in the category the level of error is very high. Furthermore, in general the percentage of total concept errors is 39.77%.

   Thus, in general the level of misconception of class X students of SMA Handayani Sungguminasa in solving quadratic equation problems and squared inequality is a high category.

   **Error Principle**

   The principle error made by students in solving quadratic equation problems and quadratic inequality can be seen in the following table:

   **Table 2. Percentage of Error Principles**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Number of errors Principle</th>
<th>Total errors Principle</th>
<th>Percentage of errors Principle</th>
<th>Level category Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>22</td>
<td>4.55%</td>
<td>Very low</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>22</td>
<td>18.18%</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>44</td>
<td>25.00%</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>44</td>
<td>20.45%</td>
<td>Very low</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>22</td>
<td>63.64%</td>
<td>Very high</td>
</tr>
<tr>
<td>6</td>
<td>59</td>
<td>88</td>
<td>67.05%</td>
<td>Very high</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>108</strong></td>
<td><strong>242</strong></td>
<td><strong>44.63%</strong></td>
<td><strong>High</strong></td>
</tr>
</tbody>
</table>

   From the table above it can be seen that the principle error at number 1 of 4.55% which is included in the category of error rate is very low, then at number 2 of 18.18% which is included in the category of low error rate, then at number 3 for 25.00% who are also included in the category of moderate error, then at No. 4 of 20.45% which is included in the category of error rates is very low, then at number 5 of 63.64% which is included in the category of very high
error rates, and at no. 6 of 67.05% referred to in the category of very high error rates. Furthermore, in general the percentage of total principle errors is 44.63%.

Thus, in general the level of error in principle of class X SMA Handayani Sungguminasa in solving quadratic equation problems and squared inequality is a high category.

Algorithm Error
Algorithm errors made by students in solving quadratic equations and quadratic inequalities can be seen in the following table:

Table 3. Percentage of Error Principles

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Number of Algorithm errors</th>
<th>Total Algorithm Error</th>
<th>Percentage of Algorithm errors</th>
<th>Level category error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>88</td>
<td>29.55%</td>
<td>Moderate</td>
</tr>
<tr>
<td>2</td>
<td>178</td>
<td>220</td>
<td>80.91%</td>
<td>Very high</td>
</tr>
<tr>
<td>3</td>
<td>81</td>
<td>154</td>
<td>52.60%</td>
<td>Very high</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>66</td>
<td>22.73%</td>
<td>Moderate</td>
</tr>
<tr>
<td>5</td>
<td>134</td>
<td>176</td>
<td>76.14%</td>
<td>Very high</td>
</tr>
<tr>
<td>6</td>
<td>104</td>
<td>132</td>
<td>78.79%</td>
<td>Very high</td>
</tr>
<tr>
<td>Total</td>
<td>538</td>
<td>836</td>
<td>64.35%</td>
<td>Very high</td>
</tr>
</tbody>
</table>

From the table above, it can be seen that the algorithm error at number 1 is 29.55% which is included in the category of moderate error level, then at number 2 of 80.91% which is included in the category of very high error rates, then at number 3 for 52.60% which is also included in the category of very high level of error, then at number 4 of 22.73% which is included in the category of moderate level of error, then at number 5 of 76.14% which falls into the category of very high error rates, and at number 6 of 78.79% referred to in the category the level of error is very high. Furthermore, in general the percentage of total algorithm errors is 64.35%.

Thus, in general the level of algorithm error of class X SMA Handayani Sungguminasa students in solving quadratic equation problems and squared inequality is a very high category.

Percentage of Error in All Categories
Errors for all categories of students in solving quadratic equations and quadratic inequalities can be seen in the following table:

Table 4. Percentage of Error in All Categories

<table>
<thead>
<tr>
<th>Jenis Kesalahan</th>
<th>Jumlah Kesalahan Siswa</th>
<th>Total Kesalahan</th>
<th>Persentase Kesalahan</th>
<th>Kategori Tingkat Kesalahan</th>
</tr>
</thead>
<tbody>
<tr>
<td>K. Konsep</td>
<td>140</td>
<td>352</td>
<td>39.77%</td>
<td>Tinggi</td>
</tr>
<tr>
<td>K. Prinsip</td>
<td>108</td>
<td>242</td>
<td>44.63%</td>
<td>Tinggi</td>
</tr>
<tr>
<td>K. Algoritma</td>
<td>538</td>
<td>836</td>
<td>64.35%</td>
<td>Sangat Tinggi</td>
</tr>
<tr>
<td>Jumlah</td>
<td>786</td>
<td>1432</td>
<td>54.85%</td>
<td>Sangat Tinggi</td>
</tr>
</tbody>
</table>

Percentage of errors for all categories:

\[
\frac{\text{Number of student errors}}{\text{Total error}} \times 100\% = \frac{786}{1432} \times 100\% = 54.85\%
\]  

From the table above it appears that concept errors amounted to 39.77% which were included in the category of high error rates, then principle errors amounted to 44.63% which were also included in the category of high error rates, and algorithm errors were 64.35% which was a very high error rate. high. Furthermore, in general the percentage of total errors of all categories is 54.85%

Thus, in general the level of error of class X SMA Handayani Sungguminasa in solving quadratic equation problems and squared inequality is a very high category.

Some examples of student mistakes

1. Tentukan akar-akar persamaan kuadrat \( x^2 + 2x - 15 = 0 \) dengan cara melengkapi kuadrat sempurna!
   
   One of the respondent's answers:
   \( x^2 + 2x - 15 = 0 \)
From the answer it appears that students master concepts and algorithms. This is because students are not careful in carrying out the steps to work on the problem.

The real answer is as follows:
\[ (x^2 + 2x - 15) + (-1) - 15 = 0 \]
\[ (x + 3)^2 - 16 = 0 \]
\[ (x + 3)^2 = 16 \]
\[ x + 3 = \pm \sqrt{16} \]
\[ x + 3 = 4 \text{ atau } x + 3 = -4 \]
\[ x = 3 - 1 \text{ atau } x = -3 - 1 \]
\[ x = 2 \text{ atau } x = -4 \]

Jadi, akar-akar dari \( x^2 + 2x - 15 = 0 \) adalah 3 atau -5

2. Tentukan himpunan penyelesaian pertidaksamaan kuadrat \( x^2 - 5x - 6 > 0 \) dengan menggunakan garis bilangan!

One of the respondent’s answers:
\[ x^2 - 5x - 6 > 0 \]
\[ x^2 - 5x - 6 = 0 \]
\[ (x + 1)(x - 6) = 0 \]
\[ x + 1 = 0 \text{ atau } x - 6 = 0 \]
\[ x = 6 \]

From the answer it can be seen that students lack mastery of concepts and principles. So that students make mistakes in solving problems.

The real answer is as follows:
\[ x^2 - 5x - 6 > 0 \]
- Tentukan pembuat nol dari pertidaksamaan kuadrat \( x^2 - 5x - 6 > 0 \)
\[ \Rightarrow x^2 - 5x - 6 > 0 \]
\[ \Rightarrow (x + 1)(x - 6) > 0 \]
\[ \Rightarrow x + 1 > 0 \text{ atau } x - 6 > 0 \]
\[ \Rightarrow x > -1 \text{ atau } x > 6 \]

- Ambil titik uji (-2, 0, 7)
  Untuk \( x = -2 \) maka \((-2)^2 - 5(-2) - 6 = +\)
  Untuk \( x = 0 \) maka \((0)^2 - 5(0) - 6 = -\)
  Untuk \( x = 7 \) maka \((7)^2 - 5(7) - 6 = +\)

Jadi, Himpunan Penyelesaian adalah: \( \{x \mid x < -1 \text{ atau } x > 6\} \)

Interview result
After checking the results of student work and calculating the number of errors made by each student, 3 students were chosen with the highest total errors. In this case 3 students who make the most mistakes are:

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Concept</th>
<th>Principle</th>
<th>Algorithm</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IF</td>
<td>9</td>
<td>7</td>
<td>33</td>
<td>48</td>
</tr>
<tr>
<td>2</td>
<td>MM</td>
<td>9</td>
<td>8</td>
<td>29</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>HS</td>
<td>9</td>
<td>8</td>
<td>37</td>
<td>54</td>
</tr>
</tbody>
</table>
The quotations of interviews with the four students are as follows:

Interviewer of Researcher (P) with IF

P : Apakah Fandi bisa menyelesaikan semua soal yang diteskan?
IF : Tidak bisa kak
P : Menurut Anda soal yang menurut Anda paling sulit untuk diselesaikan?
IF : Soal persamaan kuadrat kak
P : Misalnya, soalnya seperti apa mungkin bisa dijelaskan
IF : Soal nomor 2
P : Coba perhatikan soal tersebut, Anda disuruh menentukan akar-akarnya dengan melengkapkan kuadrat sempurna
P : Langkah pertama yang anda lakukan adalah menambahkan kedua ruas dengan + 15
Kemudian tambahkan kedua ruas dengan ($\frac{1}{2}$ kali koefisien $x$)$^2$
IF :

$$
\begin{align*}
x^2 + 2x - 15 &= 0 \\
x^2 + 2x - 15 + 15 &= 0 + 15 \\
x^2 + 2x &= 15 \\
x^2 + 2x + 1 &= 15 + 1 \\
(x + 1)^2 &= 16 \\
x + 1 &= \pm\sqrt{16} \\
x + 1 &= 4 \text{ atau } x + 1 = -4 \\
x &= 4 - 1 \text{ atau } x = -4 - 1 \\
x &= 3 \text{ atau } x = -5
\end{align*}
$$
P : Kalau soal nomor 3 Anda bisa selesaikan dengan menggunakan rumus abc kemudian menentukan akar-akarnya.
IF : Insya Allah kak bisa

From the interviews with the respondents above, information was obtained that the student had not been able to determine the roots of the quadratic equation by completing the perfect square. It was proven that after being directed only then the respondent was able to answer it.

Interview with Researcher (P) with MM

P : Menurut Mahmud, apakah dari 6 butir soal yang diteskan sulit?
MM : Rata-rata sulit kak
P : Coba perhatikan soal pertidaksamaan kuadrat khususnya nomor 5
P : Kesulitan apa yang Anda alami?
MM : Menentukan pembuat nolnya kak
P : Coba perhatikan baik-baik soal tersebut, untuk menentukan pembuat nolnya bisa dipakai cara memfaktorkan, melengkapkan kuadrat sempurna dan menggunakan rumus abc.
P : Mengapa Anda tidak menggunakan cara yang lain?
MM : Tidak tahu kak
P : Sekarang coba Anda selesaikan soal tersebut
\[ 3x^2 + 4x \geq 7 \]
\[ a = 3, b = 4 \text{ dan } c = -7 \]
\[ x_{1,2} = \frac{-(4) \pm \sqrt{(4)^2 - 4(3)(-7)}}{2,3} \]
\[ = \frac{-4 \pm \sqrt{16 + 84}}{6} \]
\[ = \frac{-4 \pm \sqrt{100}}{6} \]
\[ x_1 = \frac{-4 + \sqrt{100}}{6} = 1 \]
\[ x_2 = \frac{-4 - \sqrt{100}}{6} = -\frac{7}{3} \]
+ Ambil titik uji -3, 0, 2

Jadi Himpunan Penyelesaian adalah: \( \{x \mid x \leq -7/3 \text{ atau } x \geq 1\} \)

From interviews with the respondents above it can be obtained information that the respondent only understands and knows how to factor so that it is difficult to determine the maker of zeros but after being directed only then the respondent is able to determine the maker of zeros by using the abc formula.

Interview with Researcher (P) with HS
P : Dari 6 butir soal yang diteskan, manakah yang paling sulit?
HS : Nomor 6 kak
P : Coba perhatikan soal tersebut, Anda disuruh menentukan himpunan penyelesaiannya dengan menggunakan garis bilangan
HS : Nah sekarang, tentukan titik ujinya dalam garis bilangan kemudian tentukan intervalnya. Heri bisa tidak diselesaikan sampai selesai.
HS : Insya Allah bisa kak.

From the interviews with the respondents above, information was obtained that the student had not been able to determine the set of resolutions of the quadratic inequality questions, this proved that after being directed.

2. Discussion
Based on the results of the descriptive analysis it was found that the level of errors made by class X students of SMA Serayani Sungguminasa in solving quadratic equations and inequality problems was very high, which meant that students’ mastery of the material was still lacking.

For the percentage of each type of error made by students, namely:

Obtained the level of conceptual error made by students classified as high with a percentage of 39.77%, which means mastery of students' concepts of matter about quadratic equations and inequality squares is still lacking. 2) obtained by the principle level of error made by students classified as high with a percentage of 44.63%, which means mastery of the principle of students towards the material about quadratic equations and inequality of squares is less. 3) From the data in Table, the category of algorithm error rate that is done by students is very high with 64.35%, which means that mastery of students' algorithms on the subject matter of the
system is two variables that lack two variables. 4) From the data on the Table, the most common types of errors were made by students were algorithm errors of 54.85% with a very high error rate category.

Solution Alternative
To further minimize the mistakes made by students in the future some solutions are proposed as follows:

Remedial Teaching
In planning and preparing a remedial program, the teacher must be willing to take the time to look at all the factors that might influence student achievement in learning mathematics, including attitudes and interests. In this case the readiness of teachers is needed in monitoring the weaknesses of these students.

There are two things that need to be considered in the implementation of remedial teaching, namely: 1) Individual teaching; 2) Group Teaching. For individual teaching, the teacher must first provide diagnostic tests to students to find out the weaknesses/weaknesses that are individual and fields that receive special treatment. Interviews were then held to find out the weaknesses of these students. After that, remedial teaching can be done, in this case for any errors found, a collective work is prepared for each individual, to determine the ability of students, should always be given a test at the end of each meeting with only ten to fifteen minutes, while for teaching groups are carried out if small groups or large groups have almost the same weaknesses in a particular group.

Remedial teaching is directed at achieving learning outcomes optimally according to the abilities of each student through overall improvements in teaching and learning.

Guidance outside the classroom
Tutoring is a process of providing assistance to students or groups of students whose aim is to direct and increase potential in the learning process in order to obtain optimal learning achievement.

Guidance can be done by giving students the opportunity to consult with regard to the difficulties faced in teaching mathematics in the classroom. Students are given the opportunity to ask things that are considered difficult in mathematical prerequisite materials that have not been understood.

Furthermore, the teaching guidance of students outside the class can not only be done by the teacher but also with other parties or other students. Guidance outside the classroom is expected to support the smoothness of the teaching and learning process in the classroom and minimize student errors in solving problems related to mathematics.

Study Group
In the Dictionary of Sociology M. Jafar Masuha (Mulyono, 2012: 27), expresses the understanding of groups as follows: "groups are a set of two or more people who are intertwined in an interaction"

Based on the above limits, it gives an understanding that group learning is the collective effectiveness of a number of students to study mathematics, certain lessons or trying together to solve certain problems in achieving a goal.

Group learning has social benefits. Group learning can emphasize an interaction in terms of helping, communicating, discussing, dividing tasks, accepting responsibility in developing mutual respect for friends and their jobs. Group learning is also determined by the number of group members as M. Jafar Masuha (Mulyono, 2012: 28) provides a clue that the most effective and ideal groups are groups of two to six people, more than that will lead to unfair competition.

E. Conclusion
The results of this study can be seen that the three types of categories include the difficulty of the concept, difficulty of principle, and algorithm, in the subject of quadratic equations and squared inequality class X of Handayani Sungguminasa High School, 2016/2017 school year, with 22 respondents, conclusions can be drawn as follows: 1). The misconception of class X students of Handayani Sungguminasa High School in solving quadratic equation problems and squared inequality of 39.77% is categorized as high error rate. 2). The mistake of the class X students of Handayani Sungguminasa High School in solving quadratic equation problems and squared inequality of 44.63% is categorized as a high error rate. 3). The algorithm error of class
X SMA Handayani Sungguminasa in solving quadratic equation problems and squared inequality of 64.35% is categorized as a very high error rate. In general, the level of difficulty of students completes the problems of quadratic equations and inequality of squares in class X of Handayani Sungguminasa High School at 54.85% or included in the very high category.

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