The comparative of mathematics learning using guided discovery method and expository method to mathematics learning outcomes

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Abstract. This study aims to determine the difference in mathematics learning achievement between students in the learning using guided discovery method with students in the learning using expository method in students of class XI in Madrasah Mu'allimaat Muhammadiyah Yogyakarta Year 2017/2018. The population in this research is all students of class XI in Madrasah Mu'allimaat Muhammadiyah Yogyakarta academic year 2017/2018. The sample in this research will be taken by cluster random sampling technique and obtained class XI D and XI E as sample. Technique Data analysis using Test prerequisite analysis which includes Test normality and Test homogeneity then done by t-test. The result of the research shows that there are differences of students' mathematics learning outcomes between students using guided discovery method with students using expository method in students of class XI Madrasah Mu’allimaat Muhammadiyah Yogyakarta academic year 2017/2018. This is shown by t-test of two parties obtained the result t_count = 39,7926> t_table = 1.9949 at a significant level of 0.05 and degrees of freedom (dk) = 69. Next do a one-party t test with t_count = 39 , 7926> t_table = 1,6672 at significant level of 0.05 and degrees of freedom (dk) = 69 which means Guided discovery method is more effective than expository method toward mathematics learning achievement of grade XI Madrasah Mu’allimaat Muhammadiyah Yogyakarta Academic Year 2017/2018.

1. Introduction
Education contributes enormously to the development of a nation. With education will be formed human resources (HR) quality. The development of a nation can only be done by human beings prepared for it through education. Formal education is one of the educational paths expected to realize the goal of national education is the development of potential learners in order to be a human being who cautious to God Almighty, noble, creative, independent and responsible.

Mathematics is a compulsory subject taught in formal education. The standard of competition for mathematics subjects is that students have logical, analytical, systematic, critical and creative thinking skills, and have the ability to work together [1]. Therefore, students are expected to be able to comprehend math lessons thoroughly and fundamentally and be able to apply them in everyday life. By learning mathematics is expected to form the character of students who are critically creative and able to cooperate with the surrounding environment. Mathematical comprehension ability is one of the important goals in
learning, giving understanding that the material taught to students is not only as memorization, but more than that with the understanding of students can better understand the concept of the subject matter itself [2].

Learning outcomes are the culmination of learning activities that produce changes in knowledge (cognitive), attitude (affective), and behavior (psychomotor) that are continuous and dynamic and can be measured or observed [3]. Students' mathematics learning outcomes are influenced by internal factors and factors external. Internal factors are factors that come from within students themselves, such as: motivation, emotional intelligence, logical-mathematical intelligence, self-confidence, independence, attitude and others. While external factors are factors that come from outside the student, such as: facilities and facilities, environment, teachers, curriculum, and teaching methods.

But in fact, math lesson is still a subject that is feared and considered difficult by some students so that cause student learning outcomes are not optimal. To change the paradigm of students about mathematics lessons is difficult and frightening, it must be made an effort one of them is to innovate in the learning process. Teachers as important figures in the learning process must be able to present an interesting and innovative learning so as to be able to bring the students on learning fun and more meaningful. Running innovation also has an impact on students' attitudes to mathematics. The teacher has the most important influence on student progress in the learning process. [4] Students' attitudes that need to be developed in mathematics learning are understanding concepts. To achieve concept understanding, problem identification can help create an atmosphere for students to think.

Methods that can be used by teachers in the learning process include expository methods and guided discovery methods. Guided discovery learning model is a student oriented learning model with trial and error techniques, guessing, using intuition, investigating, drawing conclusions, and allowing teachers to conduct guidance and guide in helping students to use the ideas, concepts, and skills they have for find new knowledge [5]. Whereas in the guided discovery method the teacher presents the lesson material not in final form, but the students are given the opportunity to search and find it. This method involves students in answering teacher questions. Students make discoveries, while teachers guide them in the right direction or right. Learning with discovery is an examination-based approach. Students are given a question to answer a problem to solve or observation observations to explain, direct themselves to complete assignments, draw conclusions that match their findings, and "find" conceptual knowledge based on desired facts in the process [6]. Discovery acts are usually progressed by groups. They require learners to have high thought techniques in order to find out new things. Because learners themselves find problems, the learning has a high quality. Each of members of this group can provide “a piece of puzzle” of his understanding on the researching topic [7]. The students are expected to use mathematics and mathematical mindset in daily life, and to study many kinds of sciences which stress to be logical arrangement and student’s character building and also ability to apply mathematics [8]. In the expository method the teacher presents the material in a form that has been prepared neatly, systematically and completely, so that students stay listening and digesting it [9].

From a variety of problems above researchers will try to study the comparison of learning with guided discovery methods and expository methods of mathematics learning achievement.

2. Methods
This research method is a quasi-experimental method with a posttest only control group design research design. In this study there were two classes compared to giving different treatments. The treatment imposed in this study is a guided discovery learning model as a variable X1 and Expository method as X2 with the research subjects of class XI students of Mu'allimaat Madrasah Muhammadiyah Yogyakarta. The test results of both groups were tested statistically to see if there were differences that occurred due to
different treatments, namely guided guiding learning models and expository learning. The research design is as follows:

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\begin{align*}
A_1 & \times X_1 & O \\
A_2 & \times X_2 & O
\end{align*}
\]

Information:
A1 = Classifying subjects randomly in classes  
O = Post test  
X1 = Learning using Guided Discovery  
X2 = Learning using Expository

To get the data of mathematics learning achievement used test method. Data analysis techniques used are the test Requirements Analysis which includes the normality test and homogeneity test. Furthermore, hypothesis testing using t test which includes two-party hypothesis test and one-party hypothesis test.

3. Result and discussion
Will be presented a description of data and data analysis of mathematics learning results and then followed by hypothesis testing

3.1. Description of Test Data Mathematics Learning Results
The test of mathematics learning result is done to know the result at the end of the students score after being given treatment on each experiment class. From the results of the study, obtained the value of the test results of mathematics learning students presented in Table 1 as follows

| Variable            | Experiment Class (Ekspositori Methode) | Experiment Class (guided discovery Methode) |
|---------------------|----------------------------------------|---------------------------------------------|
| Many students       | 38                                     | 33                                          |
| The highest score   | 100                                    | 100                                         |
| The lowest value    | 25                                     | 90                                          |
| Average             | 60.6757                                | 99.3939                                     |
| Standard Deviation  | 22.3035                                | 2.423                                       |
| Variance            | 497.4474                               | 5.871                                       |

From Table 1 above it can be seen that for the experimental class using the expository method obtained the lowest value of 65, the highest value 100, and the average of 60.6757. For the experimental class using guided discovery method, the lowest score is 90, the highest value 100, and the average is 99.3939.

3.2. Data Analysis Test of Mathematics Learning Outcomes

3.2.1. Normality test
To do the normality test used Chi Square formula. Summary of test results of normality test of mathematics learning result can be seen in Table 2
Table 2. Summary of normality test results of learning results

| Learning Process                           | $X^2_{count}$ | $X^2_{table}$ | Significant Level | dk (k-1) | Information |
|-------------------------------------------|---------------|---------------|-------------------|----------|-------------|
| Experiment Class (Ekspositori Methode)     | 2,1889        | 5,9915        | 0,05              | 2        | Normal      |
| Experiment Class (guided discovery Methode)| 1,5122        | 3,8415        | 0,05              | 1        | Normal      |

The sample criterion is normal if $X^2_{hitung} < X^2_{table}$. Based on the calculation of normality test in Table 2 above shows that in the experimental expository class value $X^2_{hitung} = 2,1889$ and $X^2_{table} = 5,9915$ so that $X^2_{hitung} < X^2_{table}$ with significant level of 0.05 and degrees of freedom 2, so that the data value of mathematics learning result in experimental class of expository method is normal distributed data. In the experimental class the discovery of the guided value $X^2_{hitung} = 1,5122$ and $X^2_{table} = 3,8415$, so $X^2_{hitung} < X^2_{table}$ with significant level of 0.05 and degree freedom 1, so that the value data of mathematics learning test result in experimental class of guided discovery method is normally distributed.

3.2.2. Homogeneity Test
To test the homogeneity of samples used Bartlett test. Summary of homogeneity test result test result of mathematics learning can be seen in table 3

Table 3. Summary of homogeneity test

| $X^2_{count}$ | $X^2_{table}$ | Significant Level | dk (k-1) | Information |
|---------------|---------------|-------------------|----------|-------------|
| 58,9842       | 3,8415        | 0,05              | 1        | Homogen     |

The sample criterion is homogeneous if $X^2_{hitung} < X^2_{table}$. Based on Table 3 above shows that the value of $X^2_{hitung} = 0,01752663761$ and $X^2_{table} = 3,8415$ at a significant level of 0.05 and dk = 1 so that $X^2_{hitung} < X^2_{table}$ then the variance data test value the results of mathematics learning in the sample class are the same or homogeneous.

3.3. Testing hypothesis test value results mathematics learning

3.3.1. Double-t Test
Using the two-t test, the results can be seen in Table 4 as follows

Table 4. Summary of test results the two-t test results of learning outcomes

| $X^2_{count}$ | $X^2_{table}$ | Significant Level | dk (k-1) | Information     |
|---------------|---------------|-------------------|----------|-----------------|
| 39,7926       | 1,9949        | 0,05              | 69       | $H_0$ rejected and $H_1$ accepted |
From table 4 above it is known $t_{\text{account}} = 39.7926$ and $t_{\text{table}} = 1.9949$ at significant level of 0.05 and degrees of freedom (dk) = 69 then $t_{\text{account}} = 39.7926 > t_{\text{table}} = 1.9949$ so $H_0$ is rejected and $H_1$ is accepted. It means that there is a difference of students' mathematics learning achievement between students using guided discovery method with students using expository method in grade XI students Madrasah Mu’allimaat Muhammadiyah Yogyakarta Academic Year 2017/2018.

3.3.2. Single-t Test

Using the single-t test, the results can be seen in Table 5 as follows:

| $X^2_{\text{count}}$ | $X^2_{\text{table}}$ | Significant Level | dk (k -1) | Information |
|-----------------------|-----------------------|--------------------|-----------|-------------|
| 39.7926               | 1.6672                | 0.05               | 69        | $H_0$ rejected and $H_1$ accepted |

From table 4 above it is known $t_{\text{account}} = 39.7926$ and $t_{\text{table}} = 1.6672$ at significant level of 0.05 and degrees of freedom (dk) = 69 then $t_{\text{account}} = 39.7926 > t_{\text{table}} = 1.6672$ so $H_0$ is rejected and $H_1$ is accepted. It means that the achievement of learning mathematics of students in learning using guided discovery method better than the achievement of learning mathematics students in learning using expository methods.

After conducting research in Madrasah Mu’allimaat Muhammadiyah Yogyakarta, the result of research to test result data of mathematics study show that data are normal and homogeneous distribution. Then in accordance with the hypothesis that has been proposed, then tested the hypothesis using two-t test and one-party t test. Based on two hypothesis test analysis of mathematics learning result obtained $t_{\text{count}} = 39.7926$ and $t_{\text{table}} = 1.9949$ at significant level 0.05 and degrees of freedom (dk) = 69 then $t_{\text{count}} = 39.7926 > t_{\text{table}} = 1.9949$ this shows that there is a difference in students' mathematics learning achievement between students using guided discovery methods with students using expository methods. With subsequent one side $t_{\text{count}} = 39.7926$ and $t_{\text{table}} = 1.6672$ at significant level 0.05 and degrees of freedom (dk) = 69 then $t_{\text{count}} > t_{\text{table}}$, so $H_0$ rejected and $H_1$ accepted which mean Achievement learning mathematics student in its learning using guided discovery method is better than students' mathematics learning achievement in learning using expository method.

Guided discovery learning is a learning where the teacher plays a role in stating the problem, then guides the student to find the solution of the problem with the commands or worksheets of students and students following the instructions and finding their own solutions. The advantage of guided discovery learning is that students learn how to learn self-esteem, self-motivation and easier to transfer, minimize or avoid memorization and students are responsible for their own learning. So with this allows students to be more creative in solving math problems. Learning by discovery methods according to active knowledge seeking by humans. Try yourself to look for problem solving and the accompanying knowledge, generating knowledge that is truly meaningful to students [10]. However, guided discoveries have shortcomings for certain materials, less time consumed, not all students are able to follow the lesson in this way well, not all suitable topics are presented with this method. To minimize the above weaknesses, teachers can help by forming study groups and assisted with student activity sheets (LKS) that are designed to lead to a goal and choose a topic that is not so broad.

While the expository method is a more practical learning method, where the lesson material is given in a form that has been prepared neatly, systematically, and complete by the teacher so that students stay listening and digesting it in an orderly and orderly manner. This method has the advantage that teachers can master classes more easily and can organize more simple classes. However, this method, does not
make students much involved in the process of discovery of the concept of mathematics, students tend to accept what teachers have prepared. From the description above, gives an illustration that learning using guided discovery method can improve student pattern in understanding math lesson so that it influence to better learning achievement than expository method.

4. Conclusion

The results showed that there is a difference between the mathematics learning achievement of students in learning using guided discovery methods with students in the learning using expository methods in students of class XI Madrasah Mu'allimaat Muhammadiyah Yogyakarta Achievement of learning mathematics between students who in learning using guided discovery method better than student achievement in learning using expository methods in students of class XI in Madrasah Mu'allimaat Muhammadiyah Yogyakarta

References

[1] Depdiknas 2006 Panduan Penyusunan Kurikulum Tingkat Satuan Pendidikan. (Badan Standar Nasional Pendidikan: Jakarta)
[2] A Bani 2011 Meningkatkan Kemampuan Pemahaman dan Penalaran Matematik Siswa Sekolah Menengah Pertama Melalui Pembelajaran Penemuan Terbimbing (SPS UPI : Bandung)
[3] Huri S 2011 J. Formatif 1 29
[4] Abel S and Smith D 1994 Int. J. Sci. Educ. 16 475
[5] Leo, A E 2012 J. Penelitian Pendidikan 13 2
[6] Prince M J and Felder R M 2006 J. of Engineering Education 95 123
[7] Dahar R W 1996 Teori-teori Belajar (Jakarta : Erlangga)
[8] Trung T 2014 Int. J. Learn. Teach. Educ. Res. 7 1
[9] Yuliani K and Saragih S 2015 J. educ. pract. 6 116
[10] Santos L Semana S 2015 Educ. stud. math. 88 65