Discovery Learning with Scientific Approach on Geometry

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Abstract. Geometry as one of the branches of mathematics has an important role in the study of mathematics. This research aims to find out about discovery learning (DL) toward geometry learning achievement. This research was conducted at Junior High School in Karanganyar Regency. Research data are obtained through the test and questionnaire. Furthermore, the data were analyzed by using two-way Anava. The result of this research shows that shows that DL with scientific approach is positive effect towards mathematics learning achievement. DL with scientific approach gives better mathematics learning achievement than direct learning. Students with high self-efficacy category have better mathematics learning achievement than those who have moderate and low self-efficacy category, students with moderate self-efficacy are having the same mathematics learning achievement with those having low self-efficacy category. There is an interaction between discovery learning model with a scientific approach and self-efficacy toward student’s mathematics learning achievement. Introduction. Therefore, DL with scientific approach can improve student learning achievement.

1. Introduction
Mathematics is a science that has an important role in education because mathematics equips students to have an ability to think logically, critically, creatively, systematically and innovatively. However, many students find difficulty to understand mathematics because mathematics is abstract, while in their minds are accustomed to thinking about concrete objects. It affects students’ low achievement. Based on national examination obtained that the absorption capacity of junior high school students in Karanganyar District in mathematics subjects for geometry and measurement materials has the lowest absorption of 42.01% at the district level, 40.26% at the provincial level, and 47.19% at the national level [1]. Geometry is a branch of mathematics concerned with point, straight line, plane figures, space, spatial figures, and the relations between them [2]. The study of geometry contributes to helping students develop the skills of visualization, critical thinking, intuition, problem-solving, deductive reasoning, logical argument and proof [3]. So, geometry is an important branch of mathematics.

The factors of the teacher becomes one of the decisive factor in the success of student learning. Based on interviews with teachers, it can be seen that teachers are still using direct learners when giving lessons in the classroom. Students are accustomed to only memorizing the formula that is usually given by the teacher so that students do not understand that concept or formula. Mayberry (Zuya and Kwalat) said most students learn geometry based on memorizing [4]. As a result, students can not solve mathematical
problems, especially if students face math related to the problems in everyday life. Therefore, teachers must design and implement various models of learning that are appropriate to each subject matter provided. Learning model that can be used as a solution to the problem is Discovery Learning Model (DL). DL is a model for developing an active student learning method by finding out for themselves, self-investigating, the results obtained will be long lasting in their memory, will not be easily forgotten by the students [5]. DL occurs when learners have to discover the knowledge of a target concept in a self-regulated way with only the provided materials [6]. Stages or procedures in DL are stimulation, problem statement, data collection, data processing, verification, and generalization [7]. Joolingen in his research states that discovery learning (DL) is viewed as a promising way of learning for several reasons, the main reason is that students’ active involvement with domains will result in better structured bases of knowledge of the learners in opposition to more ways traditional learning, in which knowledge is said to be simply transferred to the students [8]. The study conducted by Alex and Olubusuyi showed that the discovery learning is very useful for students who have a high ability and also can enhance his/her ability for those in the medium category [9]. Other than, Martin and Oyebayi’s research shows that discovery learning is more effective than conventional learning and it improves the ability of students [10]. However, Alfieri’s research shows that unassisted discovery does not benefit learners [6].

The curriculum is developed at this time was learning based on scientific approach and interactive. Standard Process of Primary and Secondary Education mentions the need for a learning process that is in accordance with the rules of the scientific approach [11]. The six aspects are integrated with five aspects of the scientific approach are observing, asking questions, exploring, associating, and presenting [12]. In the process of a scientific approach, teachers have done a way to enable students in the learning process, so that students can think critically and creatively in solving problems encountered. In’am and Hajar’s research show that discovery learning with scientific approach make the students learning result a very good category [12]. Kunsting’s research shows that positive effects of metacognitive support on learning outcome and learning emotions [13].

Most students regard mathematics as a difficult and tedious subject. This has an impact on the emergence of students' negative beliefs on math lessons. The difficulty of a mathematical problem depends on how students' confidence in dealing with it. One important part of self-belief is self-efficacy. Self-efficacy is the reflection of an individual's belief in his or her capabilities to complete tasks [14]. Self-efficacy is also the expectation (hope) about how far a person is able to perform one behavior in certain situations [15]. Thus, it can be concluded that self-efficacy is a person's belief in his ability to perform a behavior in certain situations and how to overcome obstacles. Self-efficacy can be grown and studied through four main sources of information, a namely experience of success, vicarious experience, verbal persuasion and physiological state. Self efficacy consists of several dimensions, namely Magnitude, Strength and Generality [16]. In this research, the three aspects will be used as a reference in the self-efficacy questionnaire. The purpose of this research finds out whether discovery learning model provides better mathematics learning achievement than the direct learning model, know students who have mathematics learning achievement, better among students with high self-efficacy, students with moderate self-efficacy or students with low self-efficacy, know an interaction between learning model and self-efficacy toward students’ achievement.

2. Experimental Method

This research is a quasi-experimental research. Researchers are unlikely to control all relevant variables. The false experimental goal is to obtain information which is an estimate information that can be obtained with actual experiments in circumstances that are not possible to control and or manipulate all relevant variables [17].

The design of this research using 2x3 factorial with the intention to know the influence of two independent variables to the dependent variable. The independent variable in this research is discovery learning model with the scientific approach for the experimental class and direct learning for the control class, while the other independent variable is the self-efficacy of the students grouped into high, medium, and low self-efficacy. The population of this study is all students of class VIII SMP Negeri 3
Karanganyar in the academic years of 2016/2017, while the sample used is class VIII H which amounted to 32 students as an experimental class and class VIII D which amounted to 32 students as a control class. Mathematics learning achievement data obtained through a test in the form of multiple choice test which contains an indicator of geometry materials, while self-efficacy data are obtained through a questionnaire based on indicator formed from the aspect of self-efficacy.

3. Result and Discussion

Student's Mathematics achievement test is 25 items of multiple choice given to the experimental class students and control class students. Based on the results of the test obtained, the average of students' mathematics learning achievement is 81 for the experimental class and an average of 65.875 for the control class. Prior to the two-way ANOVA test, normality tests were performed on the data. Test of normality of student's mathematics learning achievement data was done using SPSS with significance level 5%. The result of normality test of student's mathematics learning shows that in the experimental class and control class the sig. value. > 0.05 is 0.091> 0.05, and 0.156 > 0.05. Therefore it can be concluded that the sample of achievement tests comes from a normally distributed population. The homogeneity test of student achievement test shows that the value of sig. = 0.387 > 0.05. Therefore it can be concluded that the population has the same or homogeneous variance. In this study data analysis using two-way ANOVA shown in table 1 with the following results

| Source            | Type III Sum of Squares | df | Mean Square | F     | Sig. |
|-------------------|-------------------------|----|-------------|-------|------|
| Corrected Model   | 5045.545                | 5  | 1009.109    | 34.064| 0.000|
| Intercept         | 328585.054              | 1  | 328585.054  | 1.109E4| 0.000|
| Class             | 3255.493                | 1  | 3255.493    | 109.893| 0.000|
| SE                | 1009.348                | 2  | 504.674     | 17.036| 0.000|
| Kelas*SE          | 237.394                 | 2  | 118.697     | 4.007 | 0.023|
| Error             | 1718.205                | 58 | 29.624      |       |      |
| Total             | 351920.000              | 64 |             |       |      |
| Corrected Total   | 6763.750                | 63 |             |       |      |

### Table 2. The Result of Post Hoc Tests Anava

| (I) SE | (J) SE | Mean Difference (1-J) | Std. Error | Sig. | 95% Confidence Interval |
|-------|-------|-----------------------|------------|------|-------------------------|
| High  | moderate | 8.63*                 | 1.705      | 0.000| [4.53, 12.73]           |
| low   |         | 11.13*                | 1.623      | 0.000| [7.23, 15.03]           |
| Moderate | high | -8.63*                | 1.705      | 0.000| [-12.73, -4.53]         |
| low   |         | 2.50                  | 1.687      | 0.307| [-1.56, 6.56]           |
| Low   | high   | -11.13*               | 1.623      | 0.000| [-15.03, -7.23]         |
| moderate |         | -2.50                 | 1.687      | 0.307| [-6.56, 1.56]           |

### Table 3. Homogeneous Subsets Result

| SE      | N  | Subset |
|---------|----|--------|
| Low     | 23 | 68.87  |
| Moderate| 19 | 71.37  |
| High    | 22 | 80.00  |
| Sig.    | 0.301 | 1.000  |
Based on the calculation above it can be seen that the effect of discovery learning model with a scientific approach to mathematics learning achievement has a value of F obtained = 109.893 with sig. = 0.000 < 0.05, so H0 is rejected and Ha is accepted. So it can be concluded that there is a difference between students’ learning achievement of mathematics in experiment class using learning discovery learning model-scientific approach with student's mathematics learning achievement in control class using direct learning. Whereas based on the average of students' mathematics achievement test, group of students with discovery learning model-scientific approach is greater than the student with direct learning model. The effect of self-efficacy on mathematics learning achievement has a value of F obtained of 17.036 and sig. = 0.000 < 0.05, so it can be concluded that there is a difference between categories in self efficacy. Based on Table 2. It can be seen that there is a difference between high self-efficacy against moderate and low category, but there is no difference between moderate and low category self-efficacy, whereas based on Table 3. It shows that high category self efficacy is better than moderate self-efficacy and low, but the self-efficacy of the moderate category is the same as the low self-efficacy category. Based on table 1. In column Class * SE obtained sig. = 0.023 <0.05, so it can be concluded that there is an interaction between discovery learning model-scientific approach and self efficacy toward student's mathematics learning achievement.

The use of learning model aims to overcome the problems in the learning process so that the subject matter can be delivered optimally. Most students learn geometry based on memorizing. Students just memorize a concept, so when faced with problems that use some concept, students have not understood. By Ozereen opinion that the student may hold the visualization and the verbal definition, but prefer the visual prototype when classifying and identifying geometric figures [18]. Therefore, teachers implement discovery learning (DL) to teach material about geometry. The principles learned of DL that is material to be delivered is not in final form, but students are encouraged to identify what it is like to note continued looking for information on its own then organized the already known and understood in a final form. The use of DL can change the passive learning conditions become active and creative. Based on the results of the research indicate that discovery learning model and self-efficacy influence mathematics learning achievement. This is in line with Kamel who states that the discovery learning strategy helps recruit activities where students learn to themselves and apply what they know in a new situation, which in turn led to achieving effective learning [19]. The results of Gunay's research shows that there is a significant difference in favor of the experimental group over the control group regarding the average of academic achievement, the scores of retention of learning, and the perception of discovery learning skills scores, Both on cognitive and affective levels [20]. Zedan and Bitar's research states that the findings pointed to strong positive correlations between the dimensions of class climate: satisfaction and enjoyment, the teacher's support, rules and instructions, competitiveness and between mathematical self-efficacy and achievement in mathematics[21]. Liu and Koirala's research shows that mathematics self-efficacy and mathematics achievement were positively related. Students with high mathematics self-efficacy were associated with high mathematics achievement [22].

One of the benefits that can be gained from DL is the emergence of student scholarship attitudes, such as objective attitude, curiosity to solve problems well, and critical thinking. Students’ curiosity causes students to be more eager to learn and know his knowledge. Student curiosity provides motivation for students to seek answers to the questions or problems that arise and face it. By Jones opinion that presenting geometry in a way that stimulates curiosity and encourages exploration can enhance student’s learning and their attitudes towards mathematics [23]. If the students can find their own concepts in mathematics, then the results obtained will last long in the memory and students' understanding ability will increase so that the students can solve math problems well. Learning with a scientific approach requires students to be active and critical in facing a problem, so that when the learning model combined with a scientific approach will form a belief in students' self-understanding of the capabilities so students
can find appropriate solutions to overcome these shortcomings. Student self-confidence will make students feel confident to express their opinion and not ashamed to ask when something is not understood.

4. Conclusion
Based on the result of the research, the conclusion that can be taken are there is the difference of students' mathematics learning achievement between the group of students with discovery learning model and direct learning, discovery learning model gives better learning achievement of mathematics than direct learning. There is the difference of students’ learning achievement between students having a high, medium and low category, but students with the same self-efficacy with the students with a low category. There is an interaction between discovery learning model and self-efficacy to student's mathematics learning achievement. Based on the discussion of research results indicate that the influence of discovery learning model on learning mathematics can improve student's mathematics learning achievement higher than direct learning.

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