The Implementation of Discovery Learning Model to Improve Students' Mathematical Reasoning Skill

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Abstract

One of the mathematical skills that students should possess is mathematical reasoning skill. However, the reality shows that students' mathematical reasoning skill is still low. One of learning models that can be applied to improve students' mathematical reasoning skill is Discovery Learning model. This study aims to find out the improvement in students' mathematical reasoning skill which are taught with Discovery Learning model. This study uses a quantitative approach with an experimental method of pretest-posttest control group design. The population included in this study was all students at grade VIII of Keumala Private Junior High School in Pidie Regency, and the samples were class VIII-2 which was used as an experimental class and class VIII-3 was used as a control class. The data from the results of this study were analyzed using an ANOVA test. Based on the results of data analysis, it can be concluded that the improvement in students 'mathematical reasoning skill taught with Discovery Learning model is better compared to the improvement in students' mathematical reasoning skill taught conventionally.

Keywords: Discovery Learning model; Students' mathematical reasoning skill.

1. Introduction

Mathematics is one of subjects taught in every education level, starting from primary, secondary, to tertiary level.

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The goals that are intended to be achieved through learning mathematics in 2013 curriculum are: (1) understanding mathematical concepts, explaining the correlation among the concepts and applying the concepts or logarithms flexibly, efficiently, and accurately in problem solving. (2) using reasoning for patterns and properties, performing mathematical manipulation in creating generalization, organizing proofs, or explaining mathematical ideas and statements. (3) solving problems which include the ability in understanding problems, designing mathematical models, finishing models and interpreting the solutions obtained. (4) communicating ideas with symbols, tables, diagrams, or other medias to clarify situations or problems. (5) having the attitudes of respecting the usefulness of mathematics for life, such as having curiosity, attention, and interest in learning mathematics, and tenacity and confidence in problem solving [3].

One of the most important goals in learning mathematics is teaching students reasoning. It is because when the reasoning ability is not developed, mathematics for students would only become a material that follows a set of procedures and examples without knowing its meaning [7]. This consequence shows that there are some characters that can be developed in learning mathematics, which one of them is the mathematical reasoning skill.

The mathematical reasoning skill is the ability to draw a conclusion based on the relevant facts and sources [16] mentions that the reasoning ability is a process of thinking to draw a conclusion based on the available facts through various credible ways [19] states that students' mathematical reasoning skill is one of factors that must be mastered by students after they learn mathematics. The reasoning ability plays an important role in mathematics learning because students are demanded to not only memorize the mathematical formulas but also to use their reasoning to solve mathematical questions. It is in accordance with [11] argument that states that mathematical materials and mathematical reasoning cannot be separated, where mathematical materials can be comprehended through mathematical reasoning and, at the same time, mathematical reasoning can be trained through mathematical materials. In other words, learning mathematics is attached with reasoning activity. This understanding then requires mathematical reasoning as one of skills that are needed by students both in comprehending mathematics and daily life.

The reality shown in literatures reveals that students' mathematical reasoning skill is still low [1] study found that students are more used to work on mathematical questions given by their teachers without knowing the meaning of the questions. When the students were asked to work on different questions, they got confused and had difficulties to finish them. The mathematical learning in Indonesia emphasizes more on the mastery of basic skills, with hardly on the application of mathematics in daily life contexts and mathematical reasoning [12]. So far, the learning process imposes teachers to be more active than students should do, which causes the students to have a surface understanding on mathematical concepts due to the inadequacy of comprehensive learning experiences. This kind of learning makes students cannot optimally comprehend the learning materials, which thus leads to the situation where only a small number of students that can provide reasons for their answers or draw a conclusion from a mathematical problem given.

Considering the importance of mathematical reasoning, it is expected that teachers can implement a learning model that provides opportunities and pushes students to train their reasoning skill. One of the proposed

solutions to improve the lack of students' mathematical reasoning skill is by using a learning model that supports students' activities in understanding the materials and emphasizes students to be more active in learning process. The implementation of effective learning model which is deemed able to mathematical reasoning skill and learning independence is with Discovery Learning model.

Based on the elaboration stated, the problem questions of this study are Is the improvement of students' mathematical reasoning skill taught with Discovery Learning model better than the improvement of students' mathematical reasoning skill taught with conventional learning?

2. Literature review

2.1 Discovery Learning

Discovery Learning model is a learning model that assigns a child in such a way acquires knowledge that he does not yet know without being told, that partial or even the entire knowledge is found by his own. Discovery Learning model emphasizes more on concepts or principles discovery that previously unknown problems presented to students [15]. Discovery Learning model is a learning that bases on discoveries. By learning discoveries, students will find their own concepts so that students will learn to comprehend the available concepts and think analytically in solving problems they face [5].

From the argument conveyed above, it can be concluded that this learning model is a learning that based on discoveries which is carried out by students based on teacher's instructions. The instructions given are generally in the form of guiding questions. This learning model consists of six learning stages, namely (a) the stage of stimulation, (b) the stage of problem identification (c) the stage of data collection (d) the stage of verification and the stage of drawing conclusions [2].

2.2 Mathematical Reasoning Skill

Reasoning is a process or an activity of thinking to draw a conclusion. [13] states that reasoning is a thinking process to draw conclusions from the existing facts through various recognized credible methods. In its process, reasoning can be divided into two types: (1) inductive reasoning that is formally defined as the reasoning process for reaching a decision, principle, or attitude that is general and specific in nature and based on observations of specific things, (2) deductive reasoning that is based on generally accepted principles, laws, or theories about a matter or symptom. Based on this general principle, specific conclusions are drawn, which is a part of the mentioned symptom. Hence, deductive reasoning moves from common things or symptoms to specific symptoms.

From the argument above, it can be concluded that reasoning is a thinking process to draw conclusions from facts that exist through various methods that are recognizably credible. Based on the discussion of mathematical reasoning above, the indicator of mathematical reasoning skills in this study refers to the opinion of the Ministry of National Education 2004, namely: (1) Proposing assumption; (2) Performing mathematical manipulation; (3) Drawing conclusions, organizing proofs, providing reasons or proofs of the solution correctness; (4) Drawing

conclusions from statements; (5) Checking the validity of an argument; (6) Finding patterns or characteristics of mathematical symptoms to make generalizations [4].

3. Method

This research is an experimental study with a quantitative approach. Experimental research is a study that is used to find the effect of a certain treatment [14]. In this study there are two variable types which are independent and the dependent variable. The independent variable is the mathematical learning using Discovery Learning models, while the dependent variable is the mathematical reasoning skill. The research design in this study is in the form of pretest-posttest control group design. This study involves two classes; one taught with Discovery Learning models as the experimental classes and the other taught with conventional learning as the control class. Before getting the treatment, both the control class and the experimental class were given a pretest to find out the students' initial proficiency towards mathematical reasoning skills. After getting the treatment, the posttest was given to see the difference of the improvement in students' mathematical reasoning skills between the experimental class and the control class.

4. Result and Discussion

The data analyzed in this study are the tests of students' mathematical reasoning skills both in the experimental class and the control class and the normalized gain data of the two classes. N-Gain data are the data used to analyze the improvement in students' mathematical reasoning skills in order to examine the increase of the skills that occurs in both classes. Data processing was carried out using the Office Excel 2010 Microsoft program assistance and then delivered to Statistical Package for the Social Science (SPSS) software version 16.0 for further adjustment.

4.1 The Results of the Test of Mathematical Reasoning Skill

One of the mathematical skills that students should possess is mathematical reasoning skill. However, the reality shows that students' mathematical reasoning skill is still low. One of learning models that can be applied to improve students' mathematical reasoning skill is Discovery Learning model. This study aims to find out the improvement in students' mathematical reasoning skill which are taught with Discovery Learning model. This study uses a quantitative approach with an experimental method of pretest-posttest control group design. The population included in this study was all students at grade VIII of Keumala Private Junior High School in Pidie Regency, and the samples were class VIII-2 which was used as an experimental class and class VIII-3 was used as a control class. The data from the results of this study were analyzed using an ANOVA test. Based on the results of data analysis, it can be concluded that the improvement in students 'mathematical reasoning skill taught with Discovery Learning model is better compared to the improvement in students' mathematical reasoning skill taught conventionally.

Mathematical reasoning skill is the ability to draw a conclusion based on the relevant facts and its truth can be justified. Based on the results of data analysis, it was found that the mathematical reasoning skill of the experimental class is better than that of the control class. The experimental class which was taught with

Discovery Learning model showed a significant improvement in mathematical reasoning skill compared to the control class which was taught with conventional learning models. This finding shows that Discovery Learning model provides an influence in improving students' mathematical reasoning skill. This is evidenced by the average N-gain value of students' mathematical reasoning skill obtained by the experimental class that was 0.67, which was higher than the average N-gain value of students' mathematical reasoning skill in the control class that was 0.53.

These results illustrate that the learning using Discovery Learning model can improve mathematical reasoning skills. This finding shows that the design of Discovery Learning model assigns students to be able to find concepts and principles through their own mental processes, where students play a more active role in finding information and gaining their own knowledge through observations or discussions in order to get a more meaningful and long-lasting learning.

The difference in the increase of mathematical reasoning skill between students taught with Discovery Learning model and students taught with conventional learning occurs due to the different characteristics of the two learnings. Discovery Learning model has some characteristics, which are the role of teachers as guides, learners learning to be active as scientists, and the materials presented in the form of information and students performing observations, making guesses, explaining, and drawing conclusions. The implementation of Discovery Learning model in this study has six stages, namely giving stimulation, identifying problems, collecting data, processing data, proving and drawing conclusions.

Based on the elaboration above, in Discovery Learning there are learning stages that provide opportunities to improve students' mathematical reasoning skill and those stages are not found in conventional learning. This is because in conventional learning the teacher dominates the class by explaining the materials in detail, giving examples of questions, giving exercises similar to the sample questions and discussing the exercises so that students can only pay attention, hear, and take notes of what is explained by the teacher. Students are not given the opportunities to express mathematical ideas or ideas in learning. In addition, in conventional learning, there are no discussions in groups, students tend to be passive in learning and there is less interaction between teacher and students and students with other students.

Based on the argument above, it can be concluded that Discovery Learning model can improve students' mathematical reasoning skill while in learning that is taught conventionally, the students' mathematical reasoning skill tends to be less developed. It is in line with the research conducted by [18] which concludes that the learning effectiveness of students taught with Discovery Learning model is better compared to the traditional methods. In another research conducted by [8], it is concluded that the improvement of mathematics learning outcomes by using Discovery Learning model is better than conventional classes. This is what makes students' mathematical reasoning skill taught with discovery learning models increases.

5. Conclusion

Based on the results of this study, it can be concluded that: The improvement in students' mathematical

reasoning skill taught with Discovery Learning model is better than the improvement in students' mathematical reasoning skill taught conventionally.

6. Recommendations

Based on the conclusions obtained, then some suggestions from this study are: (1) he teacher is expected to be able to use the discovery learning model in learning. This needs to be applied because it is proven to be able to improve reasoning skills. Students actively explore their reasoning abilities so that teachers are easier to convey material while developing students' abilities. (2) Further research is needed as a development of this research.

Acknowledgement

References

[1] Ario, M. (2015). Penalaran Matematisdan Mathematical Habish Of Mmid Melalui Pembelajaran Berbasis Masalah dan Penemuan Terbimbing. Edusentris. Jurnal Ilmu Pendidikan dan Pengajaran. Sekolah Pascasarjana Universitas Pendidikan Indonesia, 2(1), 11- 18.

[2] As'ari, A, R.., Tohir, M., Valentino, E., Imron, Z., & Taufik, I. (2017). Buku Guru Matematika. Jakart: Kementrian Pendidikan dan Kebudayaan.

[3] Depertemen Pendidikan Nasional. (2016). Kurikulum 2013. Jakarta:BNSP.

[4] Depdiknas (2004). Peraturan tentang Penilaian Perkembangan Anak Didik SMP No. 506/C/Kep/PP/2004 Tanggal 11 November 2004. Jakarta: Ditjen Dikdasmen Depdiknas.

[5] Hosnan. (2014). Pendekatan Saintifik dan Kontektual dalam Pembelajaran Abad 21. Bogor: Ghalia Indonesia

[6] Kemdikbud. (2013). Modul Pelatihan Kurikulum 2013. Jakarta: Kementian Pendidikan dan Kebudayaan R.I.

[7] Lithner, J. (2017). Principles for designing mathematical tasks that enhance imitative and creative reasoning. Journal on mathematics education, 49(6), 937-949.

[8] Maarif, S. (2016). Improving Junior High School Students' Mathematical Analogical Ability Using Discovery Learning Method, International Journal of Research in Education and Science. 2,(1). 114-124.

[9] Mawaddah, S., & Maryanti, R. (2016). Kemampuan Pemahaman Konsep Matematika Siswa Dalam Pembelajaran Mengunakan Model Penemuan Terbimbing (Discovery learning). Jurnal Pendidikan Matematika, 4(1), 118-125.

[10] Permana, A. F. (2015). Peningkatan Kemampuan Penalaran Logis Matematika Siswa Melalui Pembelajaran Discovery Methods Di Kelas X Sma Negeri 2 Sigli,. Jurnal Peluang, 3(2). 25-29.

[11] Shadiq, F. (2004). Pemecahan Masalah, Penalaran, dan Komunikasi Matematis. Makalah pada Diklat Instruktur/ Pengembangan Matematika SMP Jenjang Dasar. Yogyakarta: PPPG Matematika.

[12] Shadiq, F. (2007). Kemahiran Matematika. Yogyakarta : Depdiknas.

[13] Soemarmo, U., & Hendriana, H. (2017). Penilaian Pembelajaran Matematika. Bandung: Refika Aditama.

[14] Sudjana. (2005). Metode statistik . Bandung:Tarsito.

[15] Sumaryono, Priatna, N., & Anngaena, Y. (2016). Modul Model Pembelajaran Matematika Yongyakarta: PPPPTK Matematika.

[16] Suryadi. (2012). Membangun Budaya Baru dalam Berpikir Matematika. Bandung: Rizqi.

[17] Syahputri, I., & Manullang, M. (2017). Perbedaan Kemampuan Penalaran Matematis Siswa yang Diajar dengan Model Pembelajaran Discovery Learning dan Model Pembelajaran Kooperatif Tipe STAD di Kelas VIII SMP Negeri 6 Medan. Jurnal Inspiratif, 3 (2). 38-45.

[18] Tran, T., Nguyen, N.-G., Bui, M.-D., & Phan, A.H. (2014). Discovery Learning with the Help of the GeoGebra Dynamic Geometry Software. International Journal of Learning, Teaching and Educational Research, 7(1), 44-57.

[19] Wahyudin. (2008). Pembelajaran & Model-model pembelajaran: Pelengkap untuk meningkatkan kompetensi pedagogis para guru dan calon guru profesional. Bandung: Mandiri.

[20] Wawan. (2014)Eksperimen Model Pembelajaran Kooperatif Tipe Student Teams Achievement Divisions (STAD) Berbantuan Winplot dan Team Assisted Individualization (TAI) Pada Materi Aplikasi Turunan Fungsi Ditinjau DariKemampuan Penalaran Mtaematis. Jurnal Elektronik Pembelajaran Matematika, 2(8), 8-791.