

Application of Discovery Learning Model to Improve Students Ability in Solving Math Problems in HOTS Category

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ABSTRACT

The background of this study was obtained by researchers in class VII students of SMPN 4 Sungguminasa when conducting observations at the school. The problem is that the seventh-grade students of SMPN 4 Sungguminasa still have a low ability to solve Higher Order Thinking Skills (HOTS) math problems category. This study aims to determine the effect of the application of the discovery learning model on students' ability to solve the HOTS math problems category. This study used experimental research with a quasi-experimental research design and non-equivalent pretest-posttest control group design type. Populations in this study were all seventh-grade students of SMPN 4 Sungguminasa, Gowa Regency, South Sulawesi. The research sample is class VIIA as the experimental class and class VIIC as the control class with 32 students each. The data analysis technique used descriptive statistical and inferential statistical analysis. Descriptive statistics analyzed the research data to obtain an overview of the research variables. Inferential statistics analyzed the research data to answer the hypothesis. Inferential statistical analysis was carried out using t-test statistics and obtained p-value = 0.000 at the level $\alpha = 0,005$. The result of the analysis show $p = 0,000 < \alpha = 0,005$, which means that H_0 is rejected and H_1 is accepted. This means that the application of the *discovery learning* model can improve the ability of students to solve the HOTS math problems category. Therefore, the researcher recommended applying the *discovery learning* model in learning mathematics, especially to improve the ability of students to solve the HOTS math problems category.

Keywords: *Discovery Learning, Higher Order Thinking Skills.*

1. INTRODUCTION

Education comes from the word educate (teaching) or means to increase (to elicit, to give rise to) and increase (to develop) [1]. In addition, [2] expressed his opinion about education, namely: (a) education is life; (b) education is any learning experience that takes place in all environments and throughout life; (c) education takes place in all environments, whether created explicitly for education or within oneself; (d) education takes place in all forms, patterns, and institutions. Therefore, continuous education during human life is very important to support people in living a more decent life.

Along with time passes, the demands of life are also growing rapidly. So we need education to deal

with it, both in the form of formal and informal education. According to the Minister of Education, the contents of the educational competency standards of SMP/MTs students include students who can think logically, analytically, critically, and creatively and can work together. SMP/MTs students must have high-level thinking skills to solve complex daily problems [3] to be more independent in solving problems they face in the future.

High-level thinking ability (HOTS) combines how critical and creative thinking becomes something meaningful. Dependence on critical and creative thinking skills is the same as dependence on prevailing norms and values. The way of thinking that uses the principle and pays attention to what is contained in it is HOTS. It takes a good way of thinking and analysis, synthesis, and association and

concludes with creative new ideas to be meaningful [4]. Higher Order Thinking Skills is a thinking skill that requires the ability to remember and requires other high skills. Lewis and Smith define Higher Order Thinking Skills as thinking skills that occur when a person receives new information and information that has been stored in his memory, then connects that information and conveys it to achieve the required goals or answers [5]. Higher Order Thinking Skills (HOTS) can be understood as students' proficiency connecting what previous teachers have taught with the new knowledge they receive [6].

Based on interviews and observations conducted with seventh-grade mathematics teachers at SMPN 4 Sungguminasa, it was known that students in grade VII SMPN 4 Sungguminasa still had low abilities in understanding concepts and solving math problems in the Higher Order Thinking Skills (HOTS) category. It was added that students' mathematics learning outcomes were also low. One solution that can be taken is applying a learning model that can accommodate the activities of students' teaching and learning process to improve their abilities.

This is reinforced by the research of [7], which states that during the mathematics learning process, discovery learning can improve the learning process and improve students' mathematics learning outcomes. Furthermore, the research results by [8] found that the learning outcomes of students who used the discovery learning model were significantly higher than the learning outcomes of students who used conventional models.

In addition, discovery learning was also chosen by researchers because through this model, and students can participate actively during the learning process, grow and improve their seeking attitude, involve students directly in the discovery process, improve students' reasoning skills and high level of thinking skills.

Discovery learning is one of the learning models that can improve the ability of students. The discovery learning model can make students actively express their own opinions and find their concepts [9]. The Discovery learning model is a learning model that is arranged in such a way so that students can obtain previously unknown knowledge, not through the teacher's direct information. Still, some or all of the knowledge is found by themselves with the help of teachers [10]. Learning using the discovery learning model can impact the success of students who are increased because this study model emphasizes the

importance of a process in problem-solving and the ability to apply its ideas or concepts [11]. Discovery learning is one of the learning models that demand active students. The discovery learning model emphasizes student-centered learning, making students more engaged in learning and searching for materials to be more meaningful than conventional learning models [12]. The discovery learning model allows teachers to not directly give the materials' conclusions but provide the widest opportunity for students to find concepts and findings from the learning process. It hopes that after the students are able to find their own learning concept, they can face the problem of HOTS category and be able to complete or work according to the concept that they hope have found themselves. The concordance with Tirta Linda's researcher can face learning the models can improve students' ability to solve HOTS problems [13].

This study was discovered to determine the effect of the application of the discovery learning model on the ability of students to solve the HOTS math problems category.

2. RESEARCH METHODS

This research is experimental research with a quasi-experimental research design with a non-equivalent pretest-posttest control group design type. The populations in this study were all seventh-grade students of SMPN 4 Sungguminasa, Gowa Regency, South Sulawesi. The research sample is class VIIA as the experimental class and class VIIC as the control class with 32 students each.

The data analysis technique used is descriptive statistical analysis and inferential statistical analysis. Descriptive statistics analyzed the research data to obtain an overview of the research variables. Inferential statistics analyzed the research data to answer the hypothesis. Inferential statistical analysis using t-test statistics and obtained p-value = 0.000 at the real level $\alpha = 0,005$.

3. RESULTS AND DISCUSSION

Results of this study are presented in the tables below:

Table 1. Descriptive Statistics of Pre-test and Post-test Results of Experimental Class

Statistic	The score of VII.An (Experimental Class)	
	<i>Pre-test</i>	<i>Post-test</i>
Sample	32	32
Minimum	40	65

Maximum	65	95
Average	52,81	80,16
Standard Deviation	7,177	7,980
Variance	51,512	63,684

Table 2. Frequency Distribution and Percentage of Student's Ability to Solve HOTS Math Problems

Interval	Category	Experiment Pre-test		Experiment Post-test	
		Freq	%	Freq	%
40-45	Very Low	7	21,88	6	18,75
46-50	Low	8	25,00	7	21,88
51-55	Average	10	31,25	4	12,50
56-60	High	3	9,38	9	28,13
61-65	Very High	4	12,50	6	18,75
Total		32	100	32	100

Table 3. Descriptive Statistics of Pre-test and Post-test result of Control Class

Statistic	The score of VII.C (Control Class)	
	Pre-test	Post-test
Sample	32	32
Minimum	40	45
Maximum	70	75
Average	56,41	61,09
Standard Deviation	7,539	8,494
Variance	56,830	72,152

Table 4. Frequency Distribution and Percentage of Student's Ability to Solve HOTS Math Problems

Interval	Category	Control Class Pre-test		Control Class Post-test	
		Freq	%	Freq	%
40-46	Very Low	3	9,38	6	18,75
47-52	Low	6	18,75	2	6,25
53-58	Average	9	28,13	11	34,38
59-64	High	7	21,88	4	12,50

65-70	Very High	7	21,88	9	28,13
Total		32	100	32	100

Based on tables 1 and 2, it can be seen that before applying the discovery learning model, the average ability of students in solving HOTS math problems category was 52.81 with the highest percentage of 31.25% or in other words, 10 students in the experimental class had medium category level of ability to solve HOTS math problems. After applying the discovery learning model, the average ability of students in solving HOTS math problems category was 80.16, with the highest percentage of 28.13%. In other words, 9 students had a high level of ability to solve the HOTS math problems category. Thus, it can be said that after applying the discovery learning model, the ability of students to solve HOTS math problems category has increased.

During the learning process, by applying the discovery learning model, students are given time to work and interact in groups so that they are being able to exchange ideas and help each other. Learning like this offers students space to discuss, convey their ideas and thoughts by utilizing their knowledge and learning resources (books, props, and the internet), and discover new insights from discussions with their group friends.

Based on tables 3 and 4 above, it can be seen that before learning without the discovery learning model, the average ability of students to solve HOTS math problems category was 56.41 with the highest percentage of 28.13% or in other words, 9 students at the control class have the medium level of ability to solve HOTS math problems category. After learning without the discovery learning model, the average ability of students in solving HOTS category questions is 61.09 with the highest percentage of 34.38% or in other words, 11 students in the control class have the medium level of ability to solve HOTS math problems category. This result is different from the experimental class, namely the ability to solve math problems in the HOTS category before learning with the discovery learning model, which is at the medium level. After learning with the discovery learning model is in the high-level category.

Based on the results of the data analysis, it can be said that after learning by not applying the discovery learning model, the ability of students to solve the HOTS math problems category did not increase on average compared to before the learning

process. The highest percentage before and after learning without applying the discovery learning model is in the medium category. This is because, during the learning process, only a few students are learning actively. Students who do not understand the material look passive. Even some students talk about other things outside of learning materials with their friends, which results in ineffective learning.

Test normality data using kolmogorov-smirnov test. The homogeneity test used the F test. Normality test results and homogeneity test in control class and experimental class were successively obtained that the data were normal and homogeneous distributed.

The hypothesis test used a t-test (t-test) with a significance level of $\alpha = 0,005$. The analysis results show $p = 0,000 < \alpha = 0,005$, which means that H_0 is rejected and H_1 is accepted. This means that the application of the discovery learning model can improve the ability of students to solve the HOTS math problems category.

4. CONCLUSION AND RECOMMENDATION

Based on the analysis results, the average pre-test score of students in the experimental class was 52.81, and the post-test score of students in the experimental class after applying the discovery learning model was 80.16 with a standard deviation of 7,980. The student's pre-test scores were in the medium category with a percentage of 31.25%. The student's post-test scores were in the high category with a percentage of 28.13%. This means that the application of the discovery learning model can improve the ability of students to solve math problems in HOTS category. Therefore, it is recommended to apply the discovery learning model in learning mathematics significantly to enhance the ability of students to solve math problems in HOTS category.

AUTHORS' CONTRIBUTIONS

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REFERENCES

- [1] Mustofa, B. *Psikologi Pendidikan*. Yogyakarta: Parama Ilmu. 2015.
- [2] Sanjaya, W. *Strategi Pembelajaran*. Jakarta. 2017.
- [3] Hidayat, A. S. Efektivitas Pembelajaran Matematika Menggunakan Metode Kooperatif Tipe *Think Pair Share* (TPS) dengan Pendekatan *Contextual Teaching and Learning* (CTL) terhadap Keaktifan Belajar dan Komunikasi Matematis Siswa SMP, *UIN Sunan Kalijaga Yogyakarta*, 2011. <http://digilib.uin-suka.ac.id/7694/>.
- [4] Aningsih, A. Kemampuan Berpikir Tingkat Tinggi pada Pendidikan Agama Islam Siswa Kelas X SMK Muhammadiyah 1 Purwokerto Ditinjau dari Prestasi Belajar, *Bachelor*, Universitas Muhammadiyah Purwokerto, 2018.
- [5] Nofiana, Mufida, dkk. Pengembangan Instrumen Evaluasi *Two-Tier Multiple Choice Question* untuk mengukur Keterampilan Berpikir Tingkat Tinggi, *Jurnal Inkuiri*, 3 (2), 2014.
- [6] Brookhart, Susan M. *How to Assess Higher Order Thinking Skills In Your Classroom*, Massachusetts: ASCD, 2010.
- [7] Sitinjak, M. F. B., Murni, A., & Hutapea, N. M. Penerapan Discovery Learning untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas VIIIIB SMP Beer Seba Pekanbaru, *Jurnal Online Mahasiswa Fakultas Keguruan dan Ilmu Pendidikan*, 3 (2), 2016. <https://jom.unri.ac.id/index.php/JOMFKIP/article/view/11772>.
- [8] Yerimadesi, Y., Putra, A., & Ririanti, R. Efektivitas Penggunaan Modul Larutan Penyangga Berbasis Discovery Learning terhadap Hasil Belajar Siswa Kelas XI MIA SMAN 7 Padang, *Jurnal Eksakta Pendidikan (JEP)*, 1 (1), 17-23, 2017. <https://doi.org/10.24036/jep/vol1-iss1/29>.
- [9] Mubarokah, Inayatu, Pengaruh Penerapan Model Pembelajaran Discovery Learning terhadap Hasil Belajar Tema 8 Subtema 3 tentang Memelihara Ekosistem Siswa Kelas V Sekolah Dasar Negeri 1 Palapa Kota Bandar Lampung, 2017.

- [10] Rahman, R., & Maarif, S., Pengaruh Penggunaan Metode Discovery terhadap Kemampuan Analogis Matematis Siswa SMK Al-Ikhsan Pamarican Kabupaten Ciamis Jawa Barat, *Jurnal Ilmiah Program Studi Matematika STKIP Siliwangi*, 3(1), 33-58, 2014.
<https://doi.org/10.22.460/infinity.v3i1.p33-58>.
- [11] Balim, A. G., The Effects of Discovery Learning on Students Success and Inquiry Learning Skills, *Journal of Educational Research*, 4(2), 1-20, 2009.
- [12] Tumurun, S. W., Gusrayani, D., & Jayadinata, A. K., Pengaruh Model Pembelajaran Discovery Learning terhadap Keterampilan Berpikir Kreatif Siswa pada Materi Sifat-Sifat Cahaya, *Jurnal Pena Ilmiah*, 1(1), 101-110, 2016. <https://doi.org/10.23819/pi.v1i1.2936>.
- [13] Linda, T., Pengaruh Penerapan Model Pembelajaran Discovery Learning terhadap Kemampuan Siswa Menyelesaikan Soal-Soal Biologi Berkategori HOTS di SMA Negeri 1 Tana Toraja, *Prosiding Seminar Nasional Biologi VI*, 2018.