

IMPROVING STUDENTS' MATHEMATICAL THINKING ABILITIES THROUGH THE APPLICATION OF THE GUIDED DISCOVERY METHOD FOR CLASS VIII UPT SPF SMP NEGERI 39 MAKASSAR

Nurfaida Tasni^{1*}, Rizky Ramadhana², Talib³

¹Mathematics Education, Mathematics Education Study Program, STKIP YPUP Makassar

¹nurfaidatasniypupstkip@gmail.com ²rizkyramadhana53@gmail.com ³dedealieb1521@gmail.com

²Mathematics Education Study Program YPUP Makassar College of Teacher Training and Education
Jl. Andi Tonro No. 17, Pa'baeng-Baeng, Makassar, Indonesia

ABSTRACT

This research aims to determine the improvement of students' mathematical thinking abilities through the application of the guided discovery method for class VIII at UPT SPF SMP Negeri 39 Makassar. This research was conducted at UPT SPF SMP Negeri 39 Makassar using the classroom action research method which was carried out in 2 cycles, where each cycle consisted of 4 meetings and 1 end-of-cycle test meeting. The subjects in this research were class VIII students at UPT SPF SMP Negeri 39 Makassar for the 2022/2023 academic year, consisting of 24 students. The instruments used in this research were observation sheets of teacher and student activities during the learning process, learning outcome tests, and documentation. The research results show that the application of the guided discovery method. It can improve students' mathematical thinking skills and can increase students' learning activities, this can be seen from the percentage of student activity in cycle I of 37.5%, which has increased in cycle II to 70.8%. Meanwhile, the increase in the percentage of ability to think mathematically in cycle I obtained a percentage of ability to question problems of 57.29%, an increase in cycle II to 72.92%, in cycle I the percentage of ability to test was obtained at 65.63%, an increase in cycle II to 65.63%. 73.96%, in cycle I the ability to judge was 66.67%, increasing in cycle II to 81.52%, in cycle I the percentage of ability to make conclusions was 60.42%, increasing in cycle II to 82.29%. So, the mathematical thinking ability of class VIII students at UPT SPF SMP Negeri 39 Makassar in cycle I was 62.42% and increased in cycle II to 72.60%. Based on the research results, it can be concluded that the guided discovery method can be recommended as a method that is able to improve the mathematical thinking abilities of class VIII UPT SPF SMP Negeri 39 Makassar students.

Keywords: Thinking Ability, Method, Guided Discovery, Mathematical Critical Thinking

1. Introduction

Education is an effort carried out by families, communities and government through guidance, teaching and training activities, which take place at school and outside school throughout life to prepare students to be able to play roles in various living environments appropriately in the future. . Apart from that, education can help people develop themselves both cognitively, affectively and psychomotorically so that

they can become intelligent individuals in accordance with one of the national goals of the Indonesian state as stated in the opening mandate of the 1945 Constitution, namely to make the life of the nation intelligent.

According to Hartati and Simanullang, education is an effort to direct students into the learning process so that they can achieve learning goals according to what is expected. Education has a very important role in life because with education humans

can be efficient and independent (Triwiyanto, 2022). One form of formal education that is very effective and able to build independence is mathematics.

Mathematics is a branch of knowledge that has an important role in the development of science and technology, both as a tool in the application of other fields of science and in the development of mathematics itself (Siagian, 2016), therefore mathematics not only teaches about knowledge. about mathematics, but also as a way of thinking in everyday life. Mathematics is the process of providing experience to students through a series of planned activities so that students gain competence regarding the mathematical material being studied (Wulandari, 2021).

Mathematics is also one of the subjects known as an exact science that students must understand as a guide in applying and applying it in modern times. One of the goals of learning mathematics as a science according to Ratnasari (2019) is to have the ability to think logically, systematically, mathematically, objectively, disciplined and honestly in solving problems in the fields of mathematics, science and even in everyday life, which is an illustration of the form of students' reasoning abilities.

Based on the results of observations made by researchers at UPT SPF SMP Negeri 39 Makassar, it was found that the level of students' mathematical thinking abilities was still relatively low. This is shown by several factors and errors made by students in solving mathematics problems. This makes students forget and unable to channel the knowledge and information gained into mathematical concepts, find it difficult to know the formula to be used, are too hasty, don't know the necessary steps, don't write conclusions, and assume that the final answer is nothing more than a value. just get it. This results in the level of students' reasoning abilities being difficult to develop as expected. Reasoning ability is closely related to mathematical thinking ability (Yasinta:2020). Because of the importance of the ability to think

mathematically for students, it makes students able to find the right and correct choices and adjust attitudes based on logic (Kartika, 2022). Indicators of mathematical thinking ability based on the theory put forward by Stacey (2010), namely, 1) specializing, 2) recognizing, 3) guessing, 4) convincing. This is also in line with the opinion of Mason (2011) who states 3 factors that influence the effectiveness of a person's mathematical thinking, namely 1) ability to solve problems, 2) controlling emotions and physiology in the problem solving process, 3) understanding mathematical concepts and their applications.

Based on the results of observations, it was also found that the importance of students' mathematical thinking abilities was carried out, so a literature study was carried out which examined, collected and examined previous research relating to the relationship between a model or learning method that is able to involve student activity and can help teachers in carrying out the learning process. The learning method referred to in this literature discussion is the guided discovery method.

The guided discovery method is suitable for subjects that apply number principles such as mathematics. Mathematics presents many abstract facts and concepts, so mastering it requires creative efforts in thinking, understanding, analyzing, evaluating and applying it in various real world situations. As a form of basic ability, creativity is closely related to learning mathematics. Optimal creativity possessed by students can develop their achievements in solving problems in mathematics.

In line with this, Herman and Hidayat (2018) stated that the guided discovery approach provides achievement and improvement in students' mathematical reasoning abilities.

The aim of this research is to determine the increase in students' mathematical thinking abilities through the application of the guided discovery method for class VIII at UPT SPF SMP Negeri 39 Makassar.

2. Research Methods

This type of research is Classroom Action Research which aims to improve the mathematical thinking abilities of UPT SPF class students at SMP Negeri 39 Makassar using the guided discovery method. In general, the implementation of this action is divided into two cycles, namely cycle I and cycle II, and each cycle includes 4 stages, namely: (1) planning, (2) implementing the action, (3) observation, and (4) reflection.

Data collection techniques in this classroom action research are as follows:

Data on mathematics learning outcomes is obtained by giving a description test at the end of each cycle.

Data about students' learning activities in learning was obtained using observation sheets.

Data about teacher activities in managing learning was obtained using observation sheets.

Data regarding students' mathematical thinking abilities in the form of qualitative data was analyzed using descriptive statistics, namely the method used to collect, process and present data in the form of numbers, tables or graphs, while observational data in the form of qualitative data was analyzed during the research.

Analysis of Observation Data

Data from observations of the implementation of learning through the guided discovery implementation model were analyzed to provide an overview of the implementation of guided discovery learning. Each observed aspect is given a score according to the scoring guidelines on the observation sheet grid that has been created. Calculate the total score that has been obtained after implementing the learning. The percentage of the total score obtained is calculated using the following formula: 37
$$P = (\text{number of scores obtained}) / (\text{maximum number of scores}) \times 100$$

Information :

P = Percentage number

F = Frequency for which the percentage is being sought

N = Number of Cases (number of frequencies/number of individuals)

Table 1. Categorization of Learning Outcomes.

Value	Description
0 – 54	Very Low
55 – 74	Low
75 – 84	Medium
85 – 94	High
95 – 100	Very High

(UPT SPF SMPN 39 MKS)

Furthermore, the Minimum Completion Criteria (KKM) for mathematics lessons set by UPT SPF SMP Negeri 39 Makassar are presented in the following table:

Table 2. Minimum Completeness Criteria Criterion Value

Value	Description
0 – 74	Incomplete
75 – 100	Complete

(UPT SPF SMPN 39 MKS)

RESEARCH RESULT

1. Data Description

This research was carried out in two cycles. Each cycle is carried out in four meetings each. The learning actions carried out in each cycle are adjusted to the learning plan. Implementation of mathematics learning by increasing students' mathematical thinking abilities through the application of the guided discovery method for class VIII UPT SPF SMP Negeri 39 Makassar with a total of 24 students consisting of 8 male students and 16 female students.

2. Implementation of Cycle I Research

The implementation of cycle I was carried out over four learning meetings starting from 8 May 2023 to 27 May 2023. On 08 May 2023, students were given the final test of cycle I. In the implementation of cycle I, the activities carried

out include planning, implementation, observation and reflection.

a) Cycle I Planning Stage

At the planning stage, the researcher prepares the design that will be implemented, namely: preparing a learning implementation plan (RPP) regarding the material of linear equations for two variables using the guided discovery method, compiling and preparing the learning media that will be used, namely, teaching materials containing learning guides and sheets. student activities (LKS).

b) Cycle I implementation stage

At this stage the researcher acting as a teacher carries out actions in accordance with the Learning Implementation Plan (RPP), the implementation stage of cycle I. Implementation of research actions is carried out in four action giving meetings, and one final test meeting of cycle I which is carried out for 2 hours of lessons with the main material for linear equations in two variables. The implementation phase of cycle I of learning activities took place using the observation sheet that the researcher had provided.

c) Cycle I Observation Stage

The observation activity stage was carried out during the process of implementing the action by the researcher who acted as observer in this research. Observation activities are carried out using the student learning activity observation instrument sheet which consists of 10 items on each instrument sheet.

Observation activities were carried out to determine students' behavior and learning activities during the learning process and the impact resulting from the actions given by the teacher to students during the learning process. Apart from that, observation activities are also intended to determine the extent to which the implementation of the actions carried out by the teacher conforms to the action plans that have been previously designed.

Descriptive Results of Student Activity Observations (Cycle I)

Observations (Cycle I)							
No	Observed Components	Meeting				Average	Percentage (%)
		I	II	III	IV		
Positive Activities							

1.	Be present on time when learning takes place	20	20	21	21	21	85
2	Students open the lesson by praying	19	19	21	22	20	84
3	Students who pay attention when the teacher explains the material Lesson	15	14	17	17	16	66
4.	Students who ask questions about material that they haven't yet Understood	16	18	20	18	18	75
5.	Students who answer questions asked by the teacher	17	17	21	20	19	78
6.	Students who can formulate problems	15	15	18	21	17	72
7.	Students who solve Problem	15	12	18	23	17	71
8.	Students who dare to present their results It works	12	12	12	21	14	59
9.	Students who request guidance in working on worksheets	19	18	14	13	16	67
Amount							669
Rata-rata							66,88

The results of the students' mathematical thinking ability test at the end of cycle I regarding the material on linear equations in two variables using the application of guided discovery are as follows:

Results of Students' Mathematical Thinking Ability with the Application of Guided Discovery Cycle I

No	Indicator	Cycle 1	Description
1	Questioning the Problem	57,29%	Low
2	Testing the Truth of the Problem	65,63%	Medium
3	Evaluate	66,67%	Medium
4	Make conclusions from solutions to problems	60,42%	Low
Average percentage		62,50 %	Low

Distribution and Percentage of Student Test Result Scores with Guided Discovery Method Cycle I

No	Value	Description	Frequency	Percentage(%)
1	$0 \leq x < 54$	Very Low	3	12,5 %
2	$55 \leq x < 74$	Low	9	37,5 %
3	$75 \leq x < 84$	Medium	7	29,2 %
4	$85 \leq x < 94$	High	4	16,7 %
5	$95 \leq x < 100$	Very High	1	4,2 %
Amount			24	100

Description of Completeness of Student Test Results with Guided Discovery Method Cycle I

Score interval	Description	Frequency	Percentage(%)
$0 \leq x < 75$	Incomplete	11	45,8
$75 \leq x \leq 100$	Complete	13	54,2
Amount		24	100

d) Reflection Stage

The reflection stage is carried out after passing the action implementation stage and the

observation stage. The reflection activity is intended to find out whether the actions carried out in cycle I have achieved success or not. Apart from that, the results of the reflection activity can be used as a reference for researchers in designing action plans in the next cycle to improve the expected results and not repeat the same mistakes in the previous cycle. Next, the researcher reflected using the data that had been obtained during the learning process.

Based on the observation sheet of student learning activities, deficiencies are still visible. In the learning process in cycle I, students were not active during discussions and were still unable to draw conclusions from the sub-topics discussed in the problem. This can be seen from the percentage of 66.88%. Apart from that, regarding the implementation of learning outcomes, it is known that the results of the first cycle test of students' mathematical thinking abilities are in the low category with a percentage of 62.50%, and have not yet reached the high category, namely more than 70%.

Meanwhile, cycle I learning outcomes are still in the low category with a percentage of 37.5%. This is because students feel confused about the implementation of guided discovery. Based on the reflection results, it can be concluded that the research in cycle I has not reached the very high category and there are still shortcomings and things that need to be improved in the process of implementing the action. Therefore, this research was continued in cycle II by making improvements as described above.

1. Cycle II Planning Stage

Based on the reflection results from cycle I, the delivery of material is carried out slowly using contextual problems that are close to students' daily lives and utilizing learning media/tools that are around the students, and the teacher motivates students to be active in the presentation so that students really understand the material that has been studied by giving points (additional points) for students who present and who respond to the presentation, students who dare to respond to questions or express their opinions and participate actively in discussions. The teacher also motivates students to dare to present the results of student discussions.

2. Cycle II Implementation Stage

At the beginning of the learning process, the teacher conveyed to the students that at this

meeting they had entered cycle II. At this stage the researcher acting as a teacher carries out actions in accordance with the Learning Implementation Plan (RPP), cycle II implementation stage. Implementation of research actions is carried out in four action giving meetings, and one final test meeting for cycle I which is carried out for 2x35 minutes or 2 hours. lesson with the subject of solving linear equation problems with two variables. Learning activities take place using observation sheets that the researcher has provided.

3. Cycle II Observation Stage

Descriptive Results of Student Activity Observations (Cycle II)

Observations (Cycle II)							
No	Observed Components	Meeting				Ave rage	Average Percent age (%)
		I	II	III	IV		
Aktivitas Positif							
1.	Be present on time when learning takes place	22	23	24	23	22	96
2	Students open the lesson by praying	20	21	21	22	20	88
3	Students who pay attention when the teacher explains the material Lesson	18	17	18	20	18	76
4.	Students who ask questions about material that they haven't yet Understood	16	18	20	23	16	80
5.	Students who answer questions asked by the teacher	18	19	21	21	18	82

6.	Students who can formulate problems	19	15	24	21	19	82
7.	Students who solve Problem	18	20	21	20	18	82
8.	Students who dare to present their results It works	12	20	19	21	12	75
9.	Students who request guidance in working on worksheets	23	20	18	19	23	83
Ammount							755

The results of the mathematical thinking ability test at the end of cycle II are as follows:

Results of Students' Mathematical Thinking Ability with the Application of Guided Discovery Cycle II

No	Indicator	Cycle II	Description
1	Questioning the Problem	72,92 %	High
2	Testing the Truth of the Problem	73,96 %	High
3	Evaluate	81,25 %	High
4	Make conclusions from solutions to problems	82,29 %	High
Average percentage		72,60 %	High

Distribution and Percentage of Students' Test Result Scores with Guided Discovery Method Cycle II

No	Value	Description	Frequency	Percentage (%)
1	$0 \leq x < 54$	Very Low	0	0 %
2	$55 \leq x < 74$	Low	0	0 %
3	$75 \leq x < 84$	Medium	17	70,8 %
4	$85 \leq x < 94$	High	5	20,8 %
5	$95 \leq x < 100$	Very High	2	8,3 %
Ammount			24	100

Description of the Completeness of Student Test Results with the Guided Discovery Method

Score interval	Description	Frequency	Percentage (%)
$0 \leq x < 75$	Incomplete	5	20,9
$75 \leq x \leq 100$	Complete	19	79,1
Ammount		24	100

4. Reflection Stage

The reflection activity is intended to find out whether the actions taken in cycle II have met the previously determined research success indicators.

From the reflection results obtained, it shows that there is improvement and improvement in results in cycle II. This can be seen from the increase in student learning activities as well as the increase in student learning outcomes in the final test of cycle II which has achieved the predetermined indicators of success. Based on the results of this reflection, the research in cycle II was said to have been successful because it had met the two indicators of success of the actions that had been determined, namely an increase in student learning activities and an increase in students' mathematical thinking abilities to a high level.

A. Data Analysis Results

The data analysis stage is carried out after all the data has been collected, the data is in the form of observations of student learning activities, tests on student learning outcomes, and field notes regarding events that occurred during the learning process. The data results obtained from data collection using observation techniques are as follows:

1. The results of the observations are used as a guide for researchers in observing student learning activities during the learning process. The observation results obtained in this research were that students' learning activities in cycle I obtained an average percentage of 66.88%, while in cycle II the average percentage was 75.52%. This shows an increase in the learning activities of class VIII UPT SPF SMP Negeri 39 Makassar students in the mathematics learning process using the application of guided discovery.

2. Results of students' mathematical thinking abilities with the application of guided discovery. The results obtained in this research in cycle I obtained an average percentage of 62.42%, while in cycle II the average percentage was 72.60%. This shows an increase in the mathematical thinking ability of class VIII UPT SPF SMP Negeri 39 Makassar students in the mathematics learning process using the application of guided discovery.
3. Learning outcomes by applying guided discovery. The results obtained in this research in cycle I showed that the majority of students were in the low score category with a percentage of 37.5%, while in cycle II it was found that the majority of students were in the medium score category with a percentage of 70.8%. This shows an increase in mathematics learning outcomes for class VIII UPT SPF SMP Negeri 39 Makassar students by using the application of guided discovery.

B. Discussion

This research is classroom action research to improve the mathematical thinking skills of class VIII UPT SPF SMP Negeri 39 Makassar students using the application of guided discovery. The research was conducted by implementing two learning cycles using the application of guided discovery. Each cycle applied to the learning process is able to improve students' mathematical thinking abilities.

Students' mathematical thinking abilities are demonstrated by the results of the end-of-cycle test. The learning carried out in this research is in accordance with the stages of implementing guided discovery. Learning activities using the application of guided discovery have shown quite effective results in implementing the mathematics learning process for class VIII students at UPT SPF SMP Negeri 39 Makassar. This can be seen from the increase in student learning activities and mathematical thinking abilities, namely by using the application of guided discovery, because in the learning process using the application of guided discovery encourages students to actively seek and discover knowledge through direct experience. In guided discovery, the teacher

poses a question or problem to students, and students work together in groups or individually to find answers or solutions.

This is proven based on the results of observations of student learning activities carried out in cycle I which reached 37.5% and increased in cycle II to 70.8%. In line with increasing student learning activities by using the application of the guided discovery method, Likewise with tests on students' mathematical thinking abilities. This is proven based on the results of the final test of cycle I, it was found that students' mathematical thinking ability averaged 62.50% and in Cycle II it increased to 72.60% in the high category. Based on the analysis of the test results from cycle I and cycle II, the mathematical thinking ability of class VIII UPT SPF SMP Negeri 39 Makassar students experienced an increase in each indicator.

Based on the analysis of the research results above, it can be concluded that the results of student learning activities in cycle I reached 37.5% and increased in cycle II to 70.8%. In line with increasing student learning activities, the application of guided discovery also increased the mathematical thinking ability of class VIII students at UPT SPF SMP Negeri 39 Makassar in cycle I. In the first cycle, the percentage of ability to ask questions reached 57.29% in the low category, the ability to test the truth of problems reached 65.63 % in the medium category, the ability to assess reaches 66.67% in the medium category and the ability to make conclusions from problem solutions reaches 60.42% in the low category. So, the mathematical thinking ability of class VIII UPT SPF SMP Negeri 39 Makassar students was obtained on average in the low category with a percentage of 62.50%.

In cycle II, the results of students' mathematical thinking abilities were obtained with the ability to ask questions reaching 72.92% in the high category, the ability to test the truth of problems reaching 73.96% in the high category, the ability to assess reaching 81.25% in the high category and the ability to make conclusions from problem solutions reaching 82.29% high category. Based on the results of the assessment of improving the mathematical thinking ability of class VIII UPT SPF SMP Negeri 39 Makassar students, the average percentage of mathematical thinking ability results was in the high category with a percentage of 72.60%. So that the application of guided discovery can improve the

mathematical thinking abilities of class VIII UPT SPF SMP Negeri 39 Makassar students.

5. Acknowledgments

The author would like to thank God Almighty because of His grace the author was able to complete this scientific work well. The author also thanks the supervisor who has directed and guided the author so that this scientific work can be completed properly.

6. References

- Ahmadi, A. & W. Supriyono. 2008. *Psychology of Learning*. Jakarta: PT. Rineka Cipta.
- Anggraini, 2017. *Guided Discovery Method*. Bandung: Alfabeta
- As'ari, A. d. (2016). *Mathematics Volume I for Middle School Class VIII*. Jakarta: Ministry of Education and Culture: internet.
- Cornelius. (2000). *The Importance of Learning Mathematics*. Jakarta: Balai Pustaka
- Ernayanti, D. S. (2016). Level of Students' Mathematical Thinking Ability after Implementing the Student Team Achievement Divisions (STAD) Learning Model in High School (SMA) Students. *Proceedings of the National Quantum Seminar*, 42, 175–181.
- Farida Kurniawati, Sapti, M., & Yuzianah, D. (2021). Description of Mathematical Thinking Ability Levels Based on Shafer and Foster in Solving Fraction Material Problems. *Journal of Mathematics Education Innovation (JIPM)*, 3(2), 73–82. <https://doi.org/10.37729/jipm.v3i2.1646>
- Hermawan, A. S., & Hidayat, W. (2018). Improving Middle School Students' Mathematical Reasoning Ability Through a Guided Discovery Approach. *JPMI (Journal of Innovative Mathematics Learning)*, 1(1), 7. <https://doi.org/10.22460/jpmi.v1i1.p7-12>

- Mason, J., L. Burton, & K. Stacey. 2010. Thinking Mathematically. Wokingham, UK: Addison Wesley.
- Meltzer, D. . (2002). The Relationship between Mathematics Preparation and Conceptual Learning Grains in Physics: A Possible "Hidden Variable" in Diagnostic Pretest Scores. American Journal of Physics, 70(12), 17.
- Nasruddin, N., Mashuri, S., & Nafiah, U. (2020). Improving Mathematics Learning Outcomes on Triangle Material Through a Guided Discovery Approach for Middle School Students. Journal of Educational Research and Studies: E-Saintika, 4(2), 80.
<https://doi.org/10.36312/e-saintika.v4i2.169>
- Triwiyanto, T. (2022). Curriculum and learning management. Earth of Letters: books.google.com.
- Sari, W., Nasriadi, A., & Salmina, M. (2021). Analysis of Students' Mathematical Thinking Ability Completing Final Semester Examination (UAS) Questions in the 2020 Academic Year at SMAN 1 Teluk Dalam, Simeulue Regency. 2(1).
- Siagian, M. (2016). Mathematical Connection Ability in Mathematics Learning. Journal of Mathematics Education and Science, 2.1.
- Kartika, Y. K. (2022). "Improving Students' Mathematical Thinking Ability Using the Inquiry Learning Model. Scholar's Journal: Journal of Mathematics Education, 2515-2525.
- Trisanti, L. B. (2018). STUDENTS' THINKING PROCESS THROUGH THREE WORLDS OF MATHEMATICS: A CASE STUDY FOR TARA. academia.edu.
- Triwiyanto, T. (2022). Curriculum and learning management. Earth of Letters: books.google.com.
- Wulandari, E. &. (2021). Class V Student Worksheets on Geometry Material Based on Ethnomathematics. Journal of Mathematics Education Innovation, 73-82.
- Wahyu Setiawan. (2015). Improving Students' Mathematical Thinking Ability by Using the Guided Discovery Model. P2M STKIP Siliwangi Scientific Journal P2M STKIP Siliwangi, 2(1).
- Wahyudi. (2015). Improving Mathematics Learning Outcomes Through the Guided Discovery Method in Class VII A Students of Handayani Sungguminasa Middle School [Muhammadiya Makassar].