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Analysis of Students' Thinking Ability in Solving Open-Ended Problems in Mathematics Learning for Grade I of Madrasah Ibtidaiyah

Fuaddilah Ali Sofyan[1], Haryanto[2]
[1,2]Universitas Negeri Yogyakarta

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ABSTRACT

1st-grade elementary school teachers must be able to quickly group children's thinking abilities before delving into deeper material, especially in mathematics. This research aims to assist teachers in grouping students based on their thinking abilities by providing open-ended questions. A qualitative descriptive method was used in this research by describing the analysis results of the Madrasah Ibtidaiyah students' work documents. The analysis revealed three categories of student thinking abilities: low, medium, and high based on the types of approaches used by students. The approaches used by students are influenced by their experience in solving problems with various methods and not just one solution. Students are given the opportunity to express any method they understand in solving math problems and aim to improve students' open and developing thinking abilities.

Corresponding Author:
Fuaddilah Ali Sofyan
Universitas Negeri Yogyakarta
Email: fuaddilahali.2022@student.uny.ac.id

1. INTRODUCTION

The goal of learning mathematics can be achieved if mathematics learning prioritizes the improvement of high-level thinking skills. High-level thinking skills must be instilled from an early age. With high-level thinking skills, students are able to search for new information and connect it with the information they already have. Then, the information is processed to develop their ideas by finding suitable strategies for the problems they face. A positive impact for students is the ability to think creatively. Creative thinking is the ability to develop ideas or concepts to produce something new. Mann stated that this ability is an important aspect in developing mathematical talents. Therefore, open-ended questions provide space for students to explore and develop critical thinking and creative thinking skills in solving a problem. However, currently students have limitations in their creative thinking because teachers usually only give routine problems that only have one solution, and teachers are only fixated on memorization and calculation methods. Teachers should provide space for students to solve problems/questions that have been given so that students will experience more open thinking in solving a problem.

According to Aris Shoimin, Open Ended Problems are formulated problems that have multiple correct answers[1] . These problems are also known as incomplete problems or open problems. In addition, Open Ended problems also encourage students to use various methods or approaches to arrive at the desired answer. In mathematics education, for example, using the Open Ended approach involves providing students with open problems to solve. The learning activities should enable students to answer the problems in many ways and potentially have multiple correct answers, thus inviting intellectual potential and experiences in discovering

something new. In solving problems, the teacher attempts to combine the students' previously acquired knowledge, skills, and mathematical thinking approaches.

The open-ended method itself starts by giving open-ended problems to students. Students are invited to solve problems with various strategies and varied answers. According to Suherman, this method has several advantages including active student participation and frequent expression of their ideas, more opportunities to use comprehensive mathematical knowledge and skills, low mathematical ability students can respond to problems in their own way, intrinsically motivated to provide proof or explanation, and students gain a lot of experience in finding something new in problem-solving [2]. However, open-ended is not easy for teachers to implement, as teachers do not present concepts in a finished form but through problem-solving activities, and then students are directed towards finding their own concepts. Teachers must be able to determine and create problem-solving strategies so that students are interested in problem-solving, even if they do not find the answer quickly. Students who face obstacles need the teacher's role in guiding and indirectly directing them. The teacher must understand the related mathematics and prepare various ways to obtain answers as anticipation to guide and direct students in problem-solving.

Based on the explanation above, it is stated that giving open-ended questions can measure students' thinking abilities. The research was conducted in the first grade because it is the initial class in elementary school, so teachers can know the characteristics of each student in the class. By doing so, this research can provide an example or experience for first-grade teachers to determine students' thinking abilities in the class, and teachers can take appropriate actions accordingly. Moreover, this method supports differentiated learning because the teacher knows the students' thinking abilities first.

2. RESEARCH METHODS

The research used a descriptive qualitative method. The researcher described the results of analyzing the students' answers that have been worked on. The subjects in this study were 151 students from the first semester of grade 1 in the academic year of 2022-2023. The study was conducted on November 24, 2022, and December 3, 2022, at Madrasah Ibtidaiyah Negeri 1 Palembang. The data collection technique used documentation of students' answer sheets. The data analysis was carried out by reducing the students' answers, which were then categorized into three categories, namely low, medium, and high, and the next step was to draw conclusions from the three students' answer sheets. Then, the researcher conducted in-depth interviews related to the problems of students who were classified as low with teachers and students.

The stages of this research consist of several phases. 1) Planning, preparing questions or problems to be given to students, and creating a letter of permission from the school regarding the strategies and answers. 2) Observation, conducting observations or guidance with the school. 3) Implementation, the researcher carries out the research by giving questions or problems for the students to work on, then the researcher collects the papers back. 4) Analysis, the researcher corrects the answers of the students who worked on the questions or problems. 5) Compilation, the researcher compiles the data obtained from the research.

3. RESULT AND DISCUSSION

Before entering the classroom, the author conducted interviews with each of the 1st grade homeroom teachers and obtained information on what subjects have been taught and which ones have not, so that the questions given would not burden the students. Then, the author entered each classroom and provided open-ended question sheets consisting of 5 questions and explained the instructions or ways to answer the questions using open-ended methods, and gave the students a chance to ask questions if they did not understand how to answer. After that, the teacher explained again about the given questions. Based on the research results, all students answered directly and were fixated on the results, as the school already has a system where only one answer is taught by the teacher.

Table 1. The score of the students per class

No	Class	High	Medium	Low
1	1A	32	3	1
2	1B	16	6	5
3	1C	16	7	11
4	1D	19	7	12
	Total	83	23	29

Table 1. Persentase Student's Thinking Ability

No	Persentase	Keterangan
1	61%	Tinggi
2	17%	Sedang
3	22%	Rendah

From the above research, there were 151 students in class 1, but only 135 students participated or completed the test because 15 other students were absent due to illness. The class with the highest scores was class 1A, while the class with the lowest scores was class 1D. However, when observing directly in the location of the students, the class that finished the test the fastest was class 1B. The percentage or number of students who received the lowest scores was higher than those who received average scores, which was due to the lack of understanding of the questions. Students were still confused even though their teachers had explained the questions. Some students asked the same questions repeatedly and even copied answers from other students. To address this issue, students answered the questions with only one answer and did not provide various answers or reasoning. Most of them did not even provide reasoning that could strengthen their answers, such as calculations or relevant concepts. This was due to several other obstacles that influenced their ability to provide comprehensive answers.

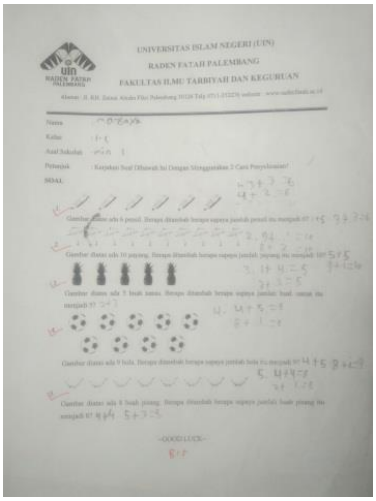

Fig. 1. High Ability

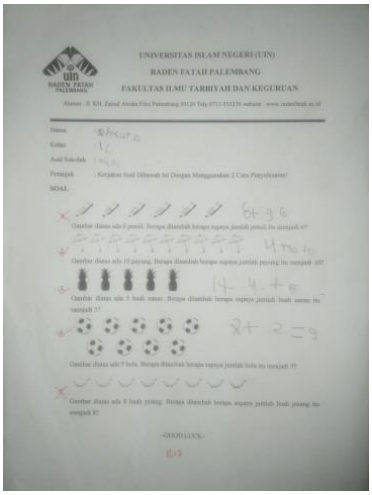

Fig. 2. Medium Ability

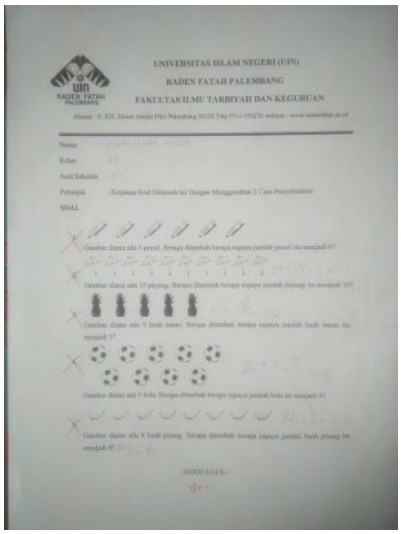

Fig. 3. Low Ability

The students still face many obstacles, these obstacles are: 1) Lack of understanding of open-ended mathematical problems so that students cannot determine the method to be used to solve the problem. 2) Lack of ability of students in performing reasoning where students only use ineffective reasoning such as trial and error in determining measurements. 3) Difficulty of students in determining other methods that can be used in solving problems. This is because students are accustomed to procedural learning by only memorizing and applying formulas precisely without understanding the concept comprehensively. 4) Lack of ability of students in representing and thinking in a realistic way to solve problems so that students can think of the best way to solve open-ended mathematical problems.

Therefore, it is necessary to teach or apply the open-ended problem method since early grades. This learning activity can be used to stimulate the participation of students in the lesson to be presented and to remind students to listen carefully and be open to various answers or opinions. Besides, it can also build social relationships among student individuals, thus creating a sense of self-esteem, tolerance, democracy, critical and systematic thinking, making the classroom environment more lively. Sometimes the time allocated is not enough to present the problem, solve it, discuss approaches and solutions, and summarize what students have learned. Therefore, the teacher must provide enough time for students to explore the problem. Active discussion among students and between students and teachers is an important interaction in open-ended learning. The teacher can divide two periods of time for one open-ended problem. The first period, students work individually or in groups to solve the problem and make a summary of the discovery process they have made. Then the second period is used for classroom discussion about strategies and solutions, as well as conclusions from the teacher. This type of learning experience has been proven to be effective.

Teachers in mathematics education are expected to lift the understanding of mathematical thinking according to individual abilities. Although generally teachers will prepare and implement lessons according to their own experience and considerations. Teachers can teach students through high-level systematic mathematical activities or through basic mathematical activities to serve students with low abilities. Such a unilateral approach can be said to be open to the needs of students or open to mathematical ideas. Thus, the open-ended approach promises an opportunity for students to investigate various strategies and ways they believe are appropriate to elaborate on problems. The goal is none other than to maximize students' mathematical thinking abilities, and at the same time, the creative activities of each student are communicated through the teaching and learning process.

The open-ended problems also help students to think creatively. The importance of creative thinking in education should be acknowledged by authorities and become a crucial issue in the educational agenda. More scientific research on the use and development of creative thinking should be conducted, and relevant resources for research should be allocated. Furthermore, this research indicates that subjects with visual-spatial intelligence can achieve high levels in mathematics, and it is recommended for teachers to design mathematics learning that can stimulate students' creative thinking ability by providing HOTS tasks or open-ended questions.[3]

The ability to think creatively showed a significant improvement between pre-test and post-test when using the discovery learning model in teaching Super Antimagic Total Face Coloring material. Students faced some difficulties in completing the tasks as they were not used to discovery-based learning. Factors influencing students' level of creative thinking skills include accuracy in proving theorems and finding functions. Developing students' creative thinking skills can be achieved by increasing their motivation to develop the concepts taught by the teacher. The discovery learning model can enhance students' creative thinking skills in the subject of combinatorics. [4]

Some ways that have been done in previous studies if students are not creative. This study describes the creative thinking skills of high school students in grade XI in the topic of colloid, using a quantitative descriptive research method. The research sample consisted of 30 students who were tested using validated essay questions, and the results showed that the students' creative thinking skills were in the moderate category. This study recommends that students practice answering questions that require creative thinking to develop their skills and connect theory with everyday life.[5]

Each individual has different levels of creative thinking ability. The research results show that subjects with a visual-dominant learning style have creative thinking abilities in the indicators of fluency and novelty, thus included in level 3 or creative. Meanwhile, subjects with a visual-kinesthetic learning style only have creative thinking ability in the indicator of fluency, thus included in level 1 or almost non-creative. This shows that different learning styles can affect one's creative thinking ability[6]. There is no clear pattern between students' curiosity and their creative thinking abilities. Therefore, the use of self-learning methods such as E-Learning is recommended to support the development of creative thinking skills. [7]

4. CONCLUSIONS

Based on the results of the research on the analysis of Open-Ended Problem questions in Mathematics Learning for Grade 1 students at Madrasah Ibtidaiyah I, it can be concluded that students are divided into three groups of thinking abilities, namely high, moderate, and low. The problem for students with low ability is caused by: 1) A lack of understanding of mathematical problems, so students cannot determine the method to be used to solve the problem. 2) Lack of student ability in reasoning where students only use ineffective reasoning such as trial and error in determining the size. 3) Students have difficulty in determining other methods that can be used to solve the problem. This is because students are accustomed to procedural learning by only memorizing and applying formulas correctly without understanding the concepts thoroughly. 4) Lack of representation skills and real thinking skills in students in solving problems so that students can think of the best way to solve open-ended mathematical problems.

In addition, open-ended questions can make students creative and develop their skills. The researcher realizes that this study still has limitations, which are the analysis of the abilities of students who are classified as high and moderate. The next researcher has the opportunity to conduct a case study to uncover the patterns used by students to achieve high and moderate thinking abilities.

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