DESCRIPTION OF THE MATHEMATICAL LOGICAL THINKING ABILITIES OF STUDENTS WITH SPECIAL NEEDS

Alifia Nur Cholifah[1], Trisna Roy Pradipta[2*]

[1,2]Departement of Mathematics Education, Universitas Muhammadiyah Prof. Dr. Hamka, Jakarta, Indonesia

*Correspondence: troymath@uhamka.ac.id

ABSTRACT
This study aims to describe the mathematical logical thinking abilities of students with special needs. This was a qualitative study that followed a case study design. The research subjects were selected using purposive sampling. The source of data in the study were 12th grade high school students, a total of 5 students with special needs (hearing impaired). This research was conducted in one of the schools in Jakarta. Data collection was done by administering a mathematical logical thinking ability test, conducting interviews, and categorizing students according to their level of mathematical logical thinking ability. The results of this study show that there are 2 students who have level 2 mathematical logical thinking ability. There is 1 student who has mathematical logical thinking ability level 1. There are 2 students with mathematical logical thinking ability level 0. Students with level 2 mathematical-logical thinking ability are able to fulfil all indicators of mathematical-logical thinking ability. Students with level 1 mathematical-logical thinking ability were able to fulfill three indicators of mathematical-logical thinking ability. Students with level 0 mathematical-logical thinking ability were unable to fulfill the indicators of mathematical-logical thinking ability.
Keywords: Mathematical Logical Thinking Ability, Students With Special Needs, Deaf Students

PRELIMINARY

The learning process is the most important activity in continuing education. Through this learning process, educational goals are achieved in the form of a thought process and maturation of the student's character. In classroom learning, there is interaction between teachers and students through subjects. One of the important subjects is mathematics (Zulkarnain & Nurbiati, 2019). The Graduate Competency Standards for Secondary Education in Permendikbudristek Number 5 of 2022 states that students can demonstrate numeracy in reasoning using mathematical concepts, procedures, facts, and tools to solve problems related to themselves, the immediate environment, the surrounding community, and the global community (Naibaho, 2022).

Mathematics is a subject that must be taken by students at all levels of elementary, middle, and high school in order to enable students to improve their thinking skills (Utami, 2021). Mathematics has strong and clear structures and characteristics that enable students to think rationally (Kahar, 2017). In learning mathematics, students are more likely to face problems formulated in mathematical symbols and language with a context that is far from everyday life (Syarifah, 2017). In order to solve mathematical problems, students' mathematical abilities are needed. One of the mathematical abilities that can help students to solve mathematical problems is the ability to think logically mathematically.

The ability to think logically mathematically allows students to understand and digest the mathematical problems they face, both difficult and easy problems. Mathematical thinking is part of the ability to think logically mathematically (Fadillah et al., 2023). This ability to think logically mathematically is basically possessed by all students, but it is at different levels and the learning outcomes of each student are also different (Mukarromah, 2019). This is in line with the findings that when the level of mathematical logical thinking skills of students is high, the learning outcomes of students are also high (Milsan & Wewe, 2018). With a high level of logical thinking ability, students will be able to solve mathematical problems well and achieve good learning outcomes.

Mathematical logical thinking skills of students need to be balanced with the ability to understand concepts, master numbers, and perform arithmetic operations. This ability is the basis for learning mathematics and also the basis for solving mathematical problems (Mukarromah, 2019). A study states that students' mathematical logical thinking ability is not properly implemented, the indicators of mathematical logical thinking ability are not maximally fulfilled, and it is known that students' difficulties when working on problems of mathematical logical thinking ability are due to lack of understanding and mastery of mathematical concepts (Utami, 2021). By knowing students' difficulties in working on mathematical problems, teachers will be able to make appropriate learning plans for students (Rayhan & Juandi, 2023).

Mathematical logical thinking skills play an important role in every act of thinking growth in students (Wahyuni & Pasaribu, 2022). Students need logical thinking skills when learning in class, when discussing in groups, and when solving problems that require the ability to connect something that exists and is rational (Fauzan et al., 2020). With the ability to think logically, students will be able to make correct judgments, think rationally when structuring situations into mathematical models or languages, apply mathematical

calculations, and draw conclusions from mathematical problems correctly and accurately (Siregar et al., 2018). Activities performed with mathematical logical thinking can be related to everyday life problems or mathematical problems. The ability to solve problems logically is an advantage of mathematical logical thinking (Octaria, 2017). Logical thinking ability is the ability to think rationally or reasonably. In mathematics education, it requires the ability to think rationally and connect something that exists into mathematical problems so that it will produce conclusions from mathematical problems correctly. Mathematical reasoning ability is the ability to think rationally using mathematical reasoning.

From the description above, the ability to think logically is very important in helping students solve mathematical problems. Logical thinking skills are needed to solve problems either related to numbers or in everyday life. However, in reality, students' mathematical logical thinking skills have not been well implemented. Difficulties in learning mathematics are also often experienced by children with special needs. One of the difficulties of children with special needs in the learning process is the communication or the words given to them. The language used must be clear and easily understood by students with special needs (Anditiasari, 2020). The groups of children with special needs include hearing impaired, mentally impaired, blind, speech impaired, luna laras, luna daksa, autism, slow learners and indigo (Hadi, 2018).

Children with special needs are children who have special characteristics that are different from children in general and are not always indicated by mental, physical or emotional disabilities. Children with special needs have the same rights to education as children in general. Therefore, the government created inclusive schools so that the education of children with special needs is equal to that of children in general. Inclusive education is an education plan provided for children with special needs and children in general. They are brought together in one class and receive the same rules and curriculum (Rabi et al., 2018). Inclusive education involves changes from the school structure to the school policy with changes through the learning curriculum and learning strategies (Strogilos, 2018). When learning mathematics, students can train their brains to think logically and develop their creativity. Children who can develop their creativity will be well accepted by society (Ulva & Amalia, 2020). As inclusive education continues to grow, teachers are expected to adjust and provide appropriate instruction for students (Cooc, 2019). The government's efforts to equalize the general and special education systems will have limitations in its implementation. Therefore, government systems that

provide special education are expected to implement diverse learning systems that include children with special learning abilities and innovate the learning models used in the classroom.

From the results of research on the analysis of math difficulties in children with special needs slow learners, there are several factors that cause difficulties for children with special needs, both internal and external factors. Difficulties in learning can affect their social skills. Students with special needs who are slow learners should be accompanied while studying so that learning can be maximized and they can keep up with other students. In addition, the choice of learning methods and learning media should be varied to optimize learning (Fatimah et al., 2018). One solution that can be done is to instill basic mathematical concepts, motivation, role-playing methods with concrete objects and interesting learning videos (Anditiasari, 2020). The purpose of this study is to describe the mathematical logical thinking skills of students with special needs.

METHODS

This research uses a type of qualitative research with a case study method. Qualitative research is a research method that produces descriptive data in written or oral form based on the subject under study. The case study method is an in-depth search based on phenomena or collected data, which involves studying a problem that is defined as a limited object of science (Juniarti & Zulkarnaen, 2019). This research focuses on a case, which is the mathematical logical thinking ability of students with special needs to be understood and described in more detail. In the following, a table of indicators of mathematical logical thinking ability is presented.

Table 1. Indicators of the mathematical logical thinking ability

Level of mathematical logical thinking ability	Indicators of the mathematical logical thinking ability
Level 2	1. Students are able to correctly state what is known and what is asked in the problem.
	2. Students will be able to correctly explain the steps in solving the problems in the exercise.
	3. Students will be able to give reasons or arguments for the steps in the solution of the problem.
	4. Students are able to infer the results of the answer

Level of mathematical logical thinking ability	Indicators of the mathematical logical thinking ability
	correctly.
Level 1	1. Students are able to mention what is known, but cannot correctly mention what is asked in the question.
	2. Students will be able to correctly explain the steps in solving the problems in the exercise.
	3. Students will be able to give reasons or arguments for the steps in the solution of the problem.
	4. Students are able to infer the results of the answer correctly.
Level 0	1. Students are able to mention what is known, but cannot correctly mention what is asked in the question.
	2. Students are able to explain the solution steps in the problem, but there are incorrect calculations in the solution steps.
	3. Students are unable to provide reasons or arguments for the steps in solving the problems in the problem.
	4. Students are unable to infer the correct answer.

Source: (Ruhama et al., 2021)

The research subjects were selected using purposive sampling technique. The subjects in this study were 12th grade high school students as many as 5 students with special needs (hearing impaired). This research was conducted in one of the schools in Jakarta in the academic year 2022/2023.

The stages of data collection are tests, interviews, and documentation. The researcher conducted tests, then conducted interviews with the research subjects, and based on the results of the interviews, categorized the students according to their level of mathematical logical thinking ability. The data analysis used in this study is the Miles and Huberman model with data condensation, data presentation and conclusion drawing (Lukitasari, 2019).

RESULT AND DISCUSSION`

The results of this study were obtained from interviews with subjects and tests of mathematical logical thinking ability.

Table 2. Research Subjects

No.	Code	Level of Mathematical Logical Thinking Ability
1.	NDR (S1)	Level 2
2.	SPR (S2)	Level 2
3.	ALF (S3)	Level 1
4.	RDN (S4)	Level 0
5.	DF (S5)	Level 0

At level 2 mathematical logical thinking ability, students are expected to be able to mention what is known and asked from the problem appropriately Based on the results of interview excerpts of students with level 2 abilities, it can be seen that students are able to mention what is known and asked from the problem appropriately as expected by the researcher. The following are the results of the common interview excerpts.

Student S1

P : What do you know about this problem?

S1 : Indah has 150,000, Mom gave Indah 75,000 and Dad gave Indah 100,000.

P : What does the problem ask for?

S1 : A lot of Indah money

Student S2

P : What do you know about this question?

S2 : Indah has 150,000 money, Mom gave 75,000, Dad gave 100,000.

P : What does the question ask?

S2 : The amount of Indah money

Then, students who have level 1 mathematical logical thinking ability, based on the results of the interview excerpts, students can mention the known information and cannot mention what is asked from the problem.

Student S3

P : What do you know about the problem?

S3 : Indah has money 150,000 Mom gave 75,000 Dad gave 100,000.

P : What does the question say?

S3 : I don't know.

From the results of the interview above, it can be seen that the students only know what is known from the problem, but do not know what is asked in the problem. Students

with level 0 mathematical-logical thinking ability are able to mention what is known but cannot mention what is asked correctly.

Student S4

P   : What do you know about this problem?

S4 : Indah has 150,000, Mom gave Indah 75,000 and Dad gave Indah 100,000.

P   : What does the problem ask?

S4 : I don't know.

Student S5

P   : What do you know from question 3?

S5 : Beautiful has 150,000, then Mom gives 75,000 and Dad gives 100,000.

P   : What does the question say?

S5 : I don't know.

Analysis of the students who are at level 0, which means that the students are able to mention what they know, but are not able to mention correctly what is asked.

At level 2 mathematical logical thinking ability, students are able to explain the solution steps in solving the problems in the problem correctly Based on the results of the interview excerpts of students with level 2 ability, it can be seen that students are able to explain the solution steps in solving the problems in the problem correctly. The following are the results of the common interview excerpts.

Student S1

P   : How do you do this problem?

S1 : 150,000 plus 75,000 plus 100,000 so 325,000.

Student S2

P   : How do you do this problem?

S2 : 150,000 plus 75,000 plus 100,000

Then students who have level 1 mathematical logical thinking ability, based on the results of student interview excerpts, it can be seen that students are able to explain the steps in solving the problems in the problem correctly.

Student S3

P   : How do you do this problem?

S3 : 150,000 plus 75,000 plus 100,000 so 325,000

From the results of the interview above, which shows that students are able to explain the steps to solve the problems in the problem correctly. While students who have mathematical logical thinking ability level 0 students are able to explain the steps in

solving the problems in the problem but there are wrong calculations in the solution steps.

Student S4

P : How do you do this problem?

S4 : Summed up, but this problem is still difficult.

Student S5

P : How do you do this problem?

S5 : I summed, but I calculated it wrong.

Analysis of Level 0 students who are able to describe the steps in solving the problem, but have incorrect calculations in the steps of completion.

At level 2 of mathematical logical thinking ability, students are expected to be able to give reasons or arguments for the steps in solving the problems in the problem. Based on the results of the interview excerpts of students with level 2 skills, it can be seen that the students are able to provide reasons or arguments for the steps in solving the problems in the problem as expected by the researcher. The following are the results of the common interview excerpts.

Student S1

P : Why did you use addition?

S1 : Because mom and dad gave Indah money.

S2 Student

P : Why did you use addition?

S2 : Because Indah got money from mom and dad.

Then, students who have level 1 mathematical logical thinking ability, based on the results of student interview excerpts, it can be seen that students are able to give reasons or arguments for the steps in solving the problems in the problem.

Student S3

P : Why do you use addition?

S3 : Because Indah got money

From the results of the interview above, which shows that students are able to provide reasons or arguments for the steps in solving the problems in the problem. While students who have level 0 mathematical logical thinking skills are not able to provide reasons or arguments for the steps in solving the problems in the problem.

Student S4

P : Why did you use addition?

S4 : I don't know, this problem is difficult.

Student S5

P : Why did you use addition?

S5 : I don't know

Analyzing students with Level 0 proficiency who are unable to provide reasons or arguments for the steps in solving the problems in the task.

At level 2 of mathematical logical thinking ability, students are expected to be able to make a conclusion about the results of the answer appropriately. Based on the results of the interview excerpts of the students with level 2 skills, it can be seen that the students are able to make a conclusion about the results of the answer exactly as expected by the researcher. The following are the results of the common interview excerpt.

Student S1

P : What conclusion did you come to?

S1 : The answer I get is 325,000.

Figure 1. S1 student answer

Student S2

P : What is your conclusion?

S2 : So the Indah money is 325,000.
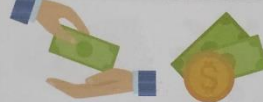
Figure 2. S2 student answer

Then students who have level 1 mathematical logical thinking ability, based on the results of student interview excerpts, it can be seen that students are able to make a conclusion about the results of the answer correctly.

Student S3

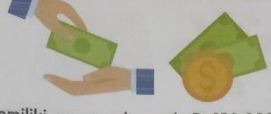P : What is your conclusion?

S3 : So the answer is 325,000.

Figure 3. S3 student answer

From the results of the interview above, which shows that students are able to make a conclusion about the results of the answer appropriately. While students who have level 0 amtematic logical thinking skills are not able to make a conclusion on the results of the answer appropriately.

Student S4
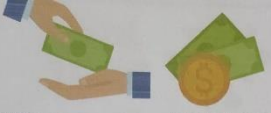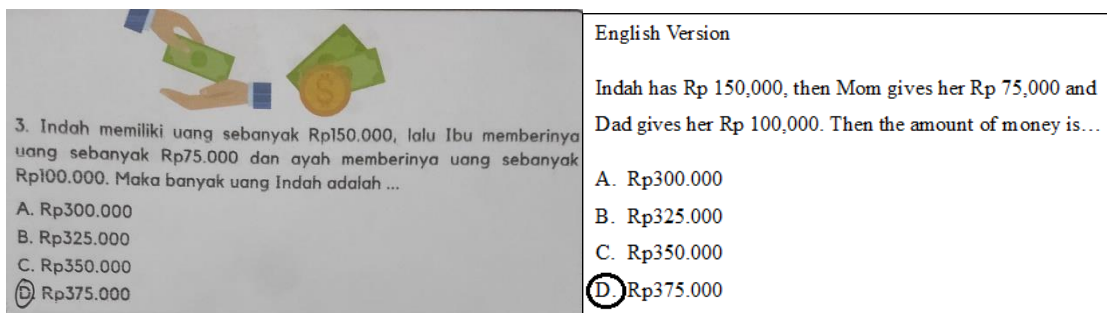
P : What is your conclusion?

S4 : I don't know.

Figure 4. S4 student answer

Student S5

P : What is your conclusion?

S5 : My answer is 375,000

Figure 5. S5 student answer

Analysis of students who have level 0 ability, that is, students who are unable to make an appropriate inference about the results of the answer.

From the results of the interview excerpts conducted with students who have level 2, level 1, and level 0 mathematical-logical thinking abilities, the researcher summarizes the students' mathematical-logical thinking abilities as follows

Table 3. Research Data on Mathematical Logical Thinking Ability

Research Subject	Indicators of the mathematical logical thinking ability	Level of Mathematical Logical Thinking Ability
Student S1	1. Students are able to correctly state what is known and what is asked in the problem. 2. Students will be able to correctly explain the steps in solving the problems in the exercise. 3. Students will be able to give reasons or arguments for the steps in the solution of the problem. 4. Students are able to infer the results of the answer correctly.	Level 2
Student S2	1. Students are able to correctly state what is known and what is asked in the problem. 2. Students will be able to correctly explain the steps in solving the problems in the exercise. 3. Students will be able to give reasons or arguments for the steps in the solution of the problem. 4. Students are able to infer the results of the answer correctly.	Level 2
Student S3	1. Students are able to mention what is known, but cannot correctly mention what is asked in the question.	Level 1

Research Subject	Indicators of the mathematical logical thinking ability	Level of Mathematical Logical Thinking Ability
	2. Students will be able to correctly explain the steps in solving the problems in the exercise.	
	3. Students will be able to give reasons or arguments for the steps in the solution of the problem.	
	4. Students are able to infer the results of the answer correctly.	
Student S4	1. Students are able to mention what is known, but cannot correctly mention what is asked in the question.	Level 0
	2. Students are able to explain the solution steps in the problem, but there are incorrect calculations in the solution steps.	
	3. Students are unable to provide reasons or arguments for the steps in solving the problems in the problem.	
	4. Students are unable to infer the correct answer.	
Student S5	1. Students are able to mention what is known, but cannot correctly mention what is asked in the question.	Level 0
	2. Students are able to explain the solution steps in the problem, but there are incorrect calculations in the solution steps.	
	3. Students are unable to provide reasons or arguments for the steps in solving the problems in the problem.	
	4. Students are unable to infer the correct answer.	

Mathematical logical thinking ability with level 2 subject

Level 2 students are able to correctly name the known and required things in the problem. Students are able to correctly explain the steps in solving the problem. Students will be able to give reasons or arguments for the steps in solving the problem. Students are able to draw a conclusion about the results of the answer correctly. This is in line with the research conducted by (Noviani et al., 2020) students who have high mathematical logical thinking ability can meet all the indicators of mathematical logical thinking ability. According to

(Ruhama et al., 2021) students with level 2 mathematical logical thinking ability are able to mention what is known and asked in the problem, are able to describe the steps of completion, are able to provide arguments regarding the steps of completion, and are able to draw conclusions about the answer results. Therefore, S1 and S2 students have level 2 mathematical logical thinking ability or can be classified as students with high mathematical logigal thinking ability.

Mathematical logical thinking ability with level 1 subject

Level 1 students are able to state what is known, but cannot state correctly what is required in the problem. Students are able to correctly explain the steps in solving the problem. Students are able to give reasons or arguments for the steps in solving the problem. Students are able to draw a conclusion about the results of the answer correctly. This is in line with the research conducted by (Noviani et al., 2020) students who have moderate mathematical logical thinking ability are unable to meet all the indicators of mathematical logical thinking ability. According to (Ruhama et al., 2021) students with level 1 mathematical logical thinking ability are able to mention what is known but are unable to mention what is asked in the problem, are able to describe the steps of completion, are able to provide arguments regarding the steps of completion, and are able to provide conclusions regarding the results of the answer. Therefore, S3 students have level 1 mathematical logical thinking ability or can be classified as students with moderate mathematical logical thinking ability.

Mathematical logical thinking ability with level 0 subject

Level 0 students are able to state what is known, but cannot state correctly what is asked in the problem. Students are able to explain the steps in solving the problems in the problem, but there are incorrect calculations in the steps. Students are unable to give reasons or arguments for the steps in solving the problems in the problem. Students are unable to draw a conclusion about the results of the answer correctly. This is in line with the research conducted by (Noviani et al., 2020) students who have low mathematical logical thinking ability are able to fulfill only 1 indicator of mathematical logical thinking ability. According to (Ruhama et al., 2021) students with level 0 mathematical logical thinking ability are able to mention what is known but are unable to mention what is asked in the problem, are able to describe the steps of completion but there are still errors, are unable to provide arguments regarding the steps of completion and are unable to provide conclusions about the answer results. Therefore, students S4 and S5 have level 0 mathematical-logical

thinking ability or can be classified as students with low mathematical-logical thinking ability.

CONCLUSION

The results of this study show that there are 2 students who have level 2 mathematical logical thinking ability. Students who have level 1 mathematical logical thinking ability are 1 student. Students who have level 0 mathematical logical thinking ability are 2 students. Students with level 2 mathematical-logical thinking ability are able to state what is known and what is required in the problem. Students are able to explain the steps to solve the problem in the problem and are able to give reasons for the steps to solve the problem in the problem. Students are also able to make a conclusion about the results of the answer. Students with Level 1 mathematical-logical thinking skills are able to state what is known, but are unable to state what is required in the problem. Students are able to correctly describe the steps in solving the problem and are able to give reasons for the steps in solving the problem. Students will also be able to draw conclusions about the results of the solution. Students with mathematical-logical thinking ability level 0 are able to state what is known, but are unable to state what is required in the problem. Students are able to explain the steps to solve the problem in the problem, but there are incorrect calculations in the solution steps and they are unable to give reasons for the solution steps in solving the problems in the problem. Students are also unable to draw conclusions about the results of the solution.

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