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THE THINKING PROCESS OF VISUALLY IMPAIRED STUDENTS IN SOLVING GEOMETRY PROBLEMS

Fitriani[1], Elvita Wulandari[2], Sabaruddin[3]
[123]Mathematics Education, Islamic Religion of Langsa State, Indonesia;
fitriani@iainlangsa.ac.id, elvitawulandari2019@gmail.com, sabaruddin@iainlangsa.ac.id

***Corresponding Author**:**
Fitriani,
Program Studi Pendidikan Matematika,
Institut Agama Islam Negeri Langsa,
Jl. Meurandeh, Kota Langsa, Aceh, Indonesia
E-mail: fitriani@iainlangsa.ac.id
Contact Person: 0813-7696-7824

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ABSTRACT

A person carries out the thinking process of remembering knowledge stored in memory to be used in the future in receiving information, processing, and concluding something. In students with intellectual disabilities, the thinking process in solving geometry problems requires more guidance than regular students. The study aims to determine the thinking process of students with intellectual disabilities when solving geometry problems. The research uses a qualitative approach because the data produced is presented in a descriptive form. The research was conducted at S.L.B. (Special School) Kota Langsa. The subjects in the study were class X students with intellectual disabilities at S.L.B. Negeri Kota Langsa, as many as two students. Data collection techniques and research instruments used are tests and interviews. The data analysis in research consists of data reduction, data presentation, and conclusions. The results showed that (1) the thinking process of DZP and MR students in question number one was already at the assimilation stage (2) the thinking process of DZP and MR students in question number two was already at the accommodation stage, and (3) at this stage the thinking process of DZP and MR students in question number three was still at the disequilibrium stage.

Keywords: Thinking Process, Solving Math Problems, Geometry Problems, Students with Intellectual Disabilities

INTRODUCTION

Mathematics learning is deliberately designed to create an environment that allows a person to carry out mathematics learning activities. This process is focused on teachers who teach mathematics by involving the active participation of students in it (Fadilla et al., 2021). Mathematics learning is essential to improve students' abilities (Kim et al., 2024). So, learning mathematics is a crucial process for students to understand mathematics-related materials, such as geometry materials.

Geometry is a material related to the real world. Geometry is an essential branch of mathematics that allows people to understand the world by comparing shapes, objects, and their relationships (Susanto & Mahmudi, 2021). According to van de Walle in Susanto & Mahmudi (2021), Reasons why it is necessary to study geometry include: (a) geometry can provide a fuller appreciation of the world;

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(b) Exploration of Geometry Can Develop Problem-Solving Skills; (c) Geometry plays an essential role in the study of other fields of mathematics; (d) Geometry is used daily by many people; (e) Geometry is fun. Solving geometry problems requires students to think about ways to find alternatives to solve them. Thinking is a mental process that everyone carries out to obtain, choose and manage information in activities (Munahefi et al., 2020).

Meanwhile, the thought process is a series of mental events that arise automatically, naturally or planned, and systematically in space, time, and the media used, resulting in profound changes to the objects that affect it (Budiwaluyo & Muhid, 2021). Teachers need to know students' thinking processes in solving math problems to finally find out what mistakes students are making (Ode & Kasriana, 2023). Each student has a different thinking process for solving mathematical problems, especially for students with disabilities whose thinking process is slow. Students with disabilities require a different thinking process from other regular students to solve geometry problems.

Visually impaired students are students who have shortcomings in their mentality, whereas visually impaired students have intelligence below the average regular student in general. Visually impaired students are students who experience developmental obstacles and mental retardation far below average, so they experience obstacles in various aspects of development (Idhartono, 2020; Zubaidah & Utomo, 2021). According to Brown in Harmanto (2020), The seven characteristics of the disabled include (1) Delay in learning new things, difficulty learning abstract knowledge and strength, low memory is characterized by quickly forgetting what is learned without doing it continuously, (2) Experiencing difficulties in learning something new, (3) Severe mental retardation has a weakness in the ability to speak, (4) physical deficiencies result in impaired motor development, (5) Low independence, (6) Behavior of interaction behaviour that is different from normal children is unusual, and (7) Continuous abnormal behaviour. Even so, students with disabilities have the same role in getting an education. Students with disabilities can also learn geometry despite being slow in learning it. In this study, the researcher examines how the thinking process of visually impaired students in solving geometry problems. The thinking process regarding assimilation, accommodation, and disequilibrium is reviewed.

RESEARCH METHODS

The approach in this study is a descriptive approach with a qualitative type of research. This study uses a qualitative approach because the data produced is presented in an explanatory form. This research was carried out from September to October 2023 at the Langsa City State S.L.B. (Extraordinary School). The subjects in this study are two students with disabilities in class X at S.L.B. Negeri Langsa City. The data collection techniques and research instruments used are tests and interviews. The test given is a written test in the form of an essay with three questions. At the same time, the interview was conducted

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non-structured, which was obtained from the results of the researcher's interview with the student while answering the test questions.

The test questions given to students are according to the learning outcomes contained in the mathematics teaching module phase E class X with geometric elements/area of the square, with the following indicators:

1. Students can identify the square side using a ruler or meter
2. Students can show the square area, which is a large area on a square-shaped object
3. Students can calculate the area of the square using the size that has been obtained with the help of a ruler or meter.

Furthermore, after the research is completed, the researcher conducts data analysis. The data analysis in this study uses model data analysis techniques, as described by Miles et al. (1994), which consists of stages of data reduction, data presentation, and conclusion drawing.

RESULTS AND DISCUSSION

Two high school class X students attended the test at S.L.B.N. Langsa City; both students are included in the special needs students, namely the disabled. The test was carried out after students had received an explanation of the geometric material of the square's flat shape. The test results of each student are as follows:

1. DZP Students

DZP is one of the class X students at S.L.B.N. Langsa City who is classified as a student with disabilities. He has academic abilities that are said to be suitable for learning. During the process of answering the test questions, it is not uncommon for students to be able to answer them immediately, even though they need the teacher's guidance.

Test question number one, after reading the test questions by the researcher, DZP was able to answer it according to the results of the researcher's interview with the following DZP:

P: "Okay, for the first question. Count the sides of the objects below using a ruler! and calculate the results of that measure. Now Mom asks what picture is this?" (while showing the picture on the paper of the test question)
DZP: "Persegi bu."

P: "Now, which side of this picture is it?" (while showing a square image in question number 1).
DZP: "This one, ma'am" (while pointing out the side of the square in question number 1).
Q: "Yes, that's right. Now, use the side pen to thicken it."
DZP: .... (immediately thicken the sides of the square image).

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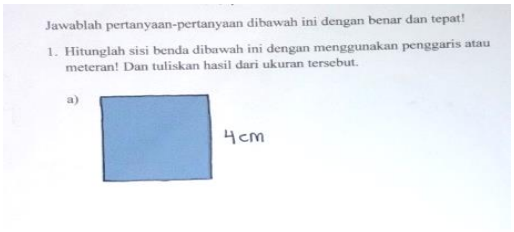

Figure 1. DZP Answer to Question Number 1

Furthermore, DZP can use a ruler to calculate the length of the square side and write down the number obtained at the time of measuring the side. By the results of the researcher's interview with the following DZP:

P: "DZP, can you use the ruler?" (while standing in front of the DZP table)
DZP: "Yes, ma'am" (while using the ruler to calculate the length of the square side).
Q: "How long is the side?"
DZP: "Four, ma'am."
Q: "Okay, that's right, it's written there". (while pointing to the side of the square).
DZP: "Yes, ma'am" (while writing the number on the square's edge).

Question number two is related to determining the area of the area. When answering this question, the DZP can show the area, and he can colour it. The results of the interview conducted are as follows:

P: "The problem is to colour the area of this square area" (while pointing out the square in question number 2)
Q: "Now you ask which square area is drawn?"
DZP: "This one, ma'am" (replies, while showing the inside of the square)
Q: "Now try to colour the inside of the square."
DZP: "Yes, ma'am" (while colouring the inside of the square).

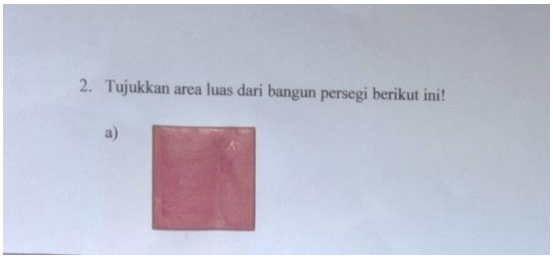

Figure 2. DZP Answer to Question Number 2

Question number three is related to calculating the square area. DZP seemed to forget the formula used to calculate the square area, so the researcher gave the formula again. After being informed again, DZP remembered it but needed guidance in answering the question. So, in question number three, DZP gets guidance in solving problem number 3. The following are the results of the interview with question number 3:

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P: "Now, let's calculate the square area. The side is one, right? So what formula do we use to calculate the area?"
DZP: "....." (just silent and looks confused)
Q: "With this formula (while pointing to the whiteboard where there is already a square area formula). Now you write this formula, that is, the square area is the side multiplied by the side" (while boxing the formula) you write yes this one, below the image.
DZP: "Yes, ma'am..." (while paying attention to the writing that the researcher gave a box and continued to write on the question paper)
Q: "Okay, are you ready?"
DZP: Yes, ma'am.
Q: "Okay, now what do we write next?"
DZP: "...." (just shut up and look at the researcher).
Q: "DZP, now you write the same as here, below" (telling DZP, while pointing it out on the paper about having a DZP)
DZP: "...." (write it down immediately)
P: "Yes"
DZP: "Mom, what else?"
Q: "Now you write again on the same side as that; the side is one, hmm what symbol is it next to that number?" (while showing the symbol)
DZP: "Hmmm…. m bu?"
Q: "I don't know what symbol it is?"
DZP: "Hmm...." (silent, and looked confused while looking at the symbol)
Q: "Okay, it means that we also write the M in the answer; it means one m times one m. You write yes next to the same as the one earlier" (while indicating)
DZP: "...." (write it down immediately)
DZP: "Mom, what else, ma'am?" (after finishing writing)
Q: "Okay, does that mean equal to what? One M times one m, one time one, how much DZP?"
DZP: "Satu bu"
Q: "Okay, that's right, now write it there, one M; there is still a number 2 above the M."
DZP: "...." (immediately wrote it), "The two above are ma'am?" (while showing)
Q: "Yes"

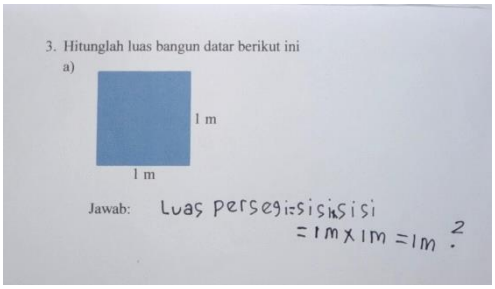

Figure 3. DZP Answer to Question Number 3

2. MR Students

When answering question number one, MR can be said to be able to answer it well, and by the answer, it should be. MR can also answer these questions without any more guidance from the researcher. Based on the results of the following interview:

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P: "Okay, for the first question. Count the sides of the objects below using a ruler! And calculate the results of that measure. Now Mom asks what picture is this?" (while showing the picture on the paper of the test question)
MR: "Square, ma'am".
Q: "Now, which side of this picture?" (while showing a square image in question 1).
MR: "This one, ma'am" (while pointing to the side on the square in question number 1).
Q: "Yes, that's right, now thicken it using the pen on the side."
MR: "All sides are thick, ma'am?"
Q: "Yes, all sides of the picture are bold."

When using a ruler to calculate the length of the square side, MR must be guided more to use the ruler correctly and precisely. MR can find the number he gets from the measurement and write it down. As obtained from the following interview results:

P: "Okay, let's continue; now you are trying to calculate the side length using a ruler. Which ruler are you?"
MR: "It's ma'am." (while holding up to show the ruler)
Q: "MR, this is the side now, right?" (while pointing to the question of having MR)
MR: "Yes, ma'am".
Q: "This is what the ruler here means, so what is the number at the end of this square? Right, from the number 1 to what number is this?" (While teaching MR to use a ruler. And determine the length of the square side, and show the number on the ruler which is the length of the side)
MR: "Four, ma'am".
Q: "Okay, that's right, now you write it there."
MR: "Yes, ma'am" (while writing the number on the square's edge).

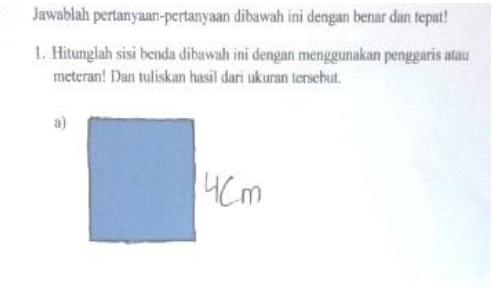

Figure 4. MR's Answer to Question Number 1

Question number two is related to determining the area of the area. When answering this question, MR can show the area of the area and can colour the area of the area. The results of the interview conducted are as follows:

P: "The problem is to show or colour the area of this square area" (while showing the square in question number 2)
Q: "Now, Mom, ask which square area is drawn?"
MR: "This one, ma'am," (replies, while showing the inside of the square)
Q: "Now you colour the inside of the square."
MR: "Yes, ma'am" (while colouring the inside of the square).

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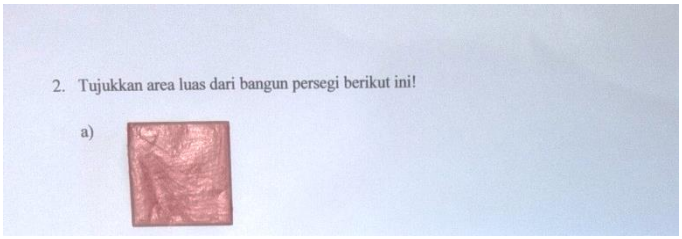

Figure 5. MR's Answer to Question Number 2

Question number three is related to calculating the square area. It seems that MR forgot the formula used to calculate the square area, so the researcher must repeat it. After being told, MR found out again and wrote down the answer. So, in question number three, MR needs guidance in solving the problem according to the flow. The results of the interview obtained are as follows:

P: "Now, let's calculate the square area. The side is one, right? So what formula do we use to calculate the area?"
MR: "....." (just silent and looks confused)
Q: "With this formula (pointing to the whiteboard where there is already a square area formula). Now you write this formula: the square area is the side multiplied by the side (while the formula is boxed). You write yes to this one below the picture."
Student: "Yes, ma'am..." (while paying attention to the writing that I boxed and continued to write on the question paper)
Q: "Okay, are you ready?"
MR: "It's okay, ma'am."
Q: "Okay, now what do we write next?"
MR: "...." (just shut up and look at me)
Q: We write the same as here, below (tell MR, while showing it on the paper about having MR)
MR: Hmmm, isn't this here? (while showing with a pen on the question paper)
Q: Yes
MR: Mom, what else?
Q: Now you write again on the same side as that; just now, the side is one, so there we write one. It is a question of what symbol is next to that number. (while showing about the emblem)
MR: Hmmm.... M letter ma'am?
Q: I don't know what symbol it is.
MR: Hmm.... (silent and looks confused)
P: Okay, it means that we also write the M in the answer; the writing means one m times one m. you write yes next to the same as the one earlier (while indicating)
MR:.... (write it down immediately)
MR: Okay, ma'am, what else, ma'am? (after finishing writing)
Q: Okay, does that mean equal to what? One M times one M, one times one, how much is MR?
MR: Hmmm.... One mom
Q: Okay, that's right, now write there one m, and there is a number 2 above the m
MR:.... (immediately wrote it), are the two above ma'am? (while showing)
Q: Yes, that's right

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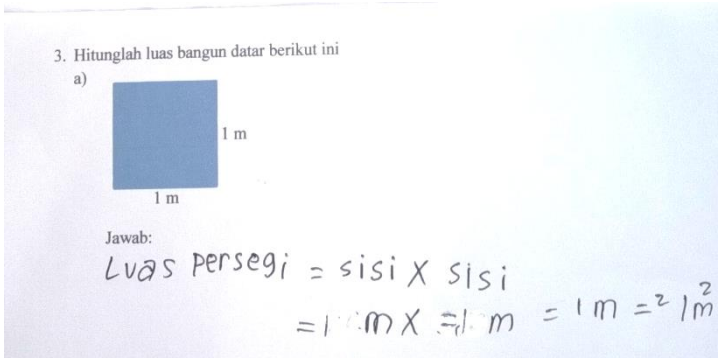

Figure 6. MR's Answer to Question Number 3

Based on the results of the above research, it was obtained that while solving geometry-related problems, students with disabilities need guidance first, such as the teacher rereading the questions, showing pictures and other parts. This is done because they cannot understand the problem. So, to answer the question, students need to be given directions first. In line with what was said by Badawi et al. (2022), when giving assignments to children with disabilities who are still in the process of questions presented by the homeroom teacher, the children with disabilities are assisted by the homeroom teacher by providing directions and provoking children to answer the questions that have been asked.

Question number 1: Students with disabilities can learn about the flat square in the problem and determine the sides of the square. They are also able to thicken the sides of the square. Students understand what is known and ask about the question correctly to have an assimilated thinking process. As the research Permatahati et al. (2015) said, students experience an assimilated thinking process when they can answer questions and make what is known and asked from the problem.

Question number 2: Students with disabilities need a ruler to measure the square side length when calculating the square side length. However, the two students were silent because they could not use the ruler yet. Finally, this process is carried out with the help of teachers (researchers) to guide or teach them how to use the ruler. This happened because students with disabilities had never used a ruler to measure before, as stated by their class teacher. However, in the second problem, teachers do not need much student guidance. They still wondered which area was said to be a square, even though they had been silent for a second. So that in solving this problem, students with disabilities can answer the question correctly. At this stage, students have an accommodative thinking process. As the researcher Agustina (2021) said, students were silent for a moment before answering questions from the researcher, and this is a process of thinking in an accommodating manner.

Finally, when calculating the square area in question number 3, the visually impaired students could not remember the formula for calculating the square area. In addition, they have not been able to solve problem number 3, so guidance is needed on how to work on it until it is completed. This is because students with disabilities easily forget the material that has been taught. This is relevant to

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Indriati (2022), who said that students with disabilities easily forget what they have learned. So, students with disabilities need guidance and direction to properly and correctly solve these problems. So, at this stage, students have *a disequilibrium* thinking process, namely an imbalance in the thinking process. Research Safrida et al. (2023) also says that students experience situations when they cannot understand or solve the problem.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that (1) the thinking process of DZP and MR students in question number one is already at the assimilation stage, (2) the thinking process of DZP and MR students in question number two is already at the accommodation stage, (3) the students with disabilities do not remember the formula used in calculating the square area and have not been able to solve problem number 3, So guidance is needed on how to do it until it is finished. This is because students with disabilities easily forget the material that has been taught, so repetition is needed to teach geometry to them. At this stage, the thinking process of DZP and MR students in question number three is still in disequilibrium.

SUGGESTION

This research was carried out to examine how the thinking process of visually impaired students in solving geometry problems. It is important to note that teachers or educators, especially for students with disabilities, need more guidance in giving lessons. Continually educate and pay attention to students' thinking processes and learning development.

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