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Thinking Processes of Mentally retarded: Students Disabled at Junior High School in Solving Fractions Problems

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ABSTRACT

The purpose of this study was to determine the thinking processes of students with special needs through three stages of thinking, namely the formation of understanding, the formation of opinions, and the conclusion of solving fraction problems. This research is a qualitative descriptive study with the research subject being a male student with mild mental retardation who attends the Special School of Majene Regency. The research instrument consisted of an interview sheet, a written test (containing fractional material (essay form) to find out the thinking process of students with special needs (mental retardation) in solving math problems), and observation sheets. The data analysis method was made in the form of data triangulation, which aims to test the wetness of the data. From the results of the analysis, it was found that the thinking processes involved in solving fractional problems by mentally disabled male students (1) involve the formation of understanding and can form understanding thru their thinking processes; (2) at the opinion formation stage, they need direction to be able to determine what strategies or methods will be used in solving problems; and (3) at the conclusion stage, they have not been able to conclude independently. This results in an incorrect answer. Therefore, it can be said that when students solve story problems, they forget to reinforce the form of conclusions in the form of sentences to answer the questions.

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1. INTRODUCTION

Mathematical problems provide an opportunity to strengthen and broaden their knowledge and to stimulate new learning. Most mathematical materials can be formulated through problems based on experience from the student's life or the context of mathematics (Fachrurazi, 2017; Maulyda, 2020). Education is associated with the process of learning knowledge, skills, and habits of a group of people that are passed down from one generation to the next through teaching, training, or research (Effendi & Usman, 2021; N. Sari, 2013; S. Y. Sari et al., 2021). It has become the right of all citizens to deal with their problems in life. Therefore, it must be regulated in such a way to create quality human resources competent in the development of science and technology. It also becomes a fundamental right for children, including those with special needs or disabilities.

There is a thinking process involved in solving mathematical problems. The thought process is an activity that occurs in the human brain, so it is difficult to observe with the senses. Therefore, thinking processes can be observed through the behavior displayed when solving problems. Government policy in Law 31 paragraph one states that every citizen has the same right to obtain an education, as stated in Law No. 20 of 2003, Article 32 states that "Special education is arranged for students with a level of difficulty in participating in the learning process due to physical, emotional, mental, or social disorders and with the potential for intelligence and special talents." The government has guaranteed children with special needs (ABK) education like normal children. In Indonesia, no accurate and specific data on the number of children with special needs are available. However, the Central Statistics Agency in Indonesia in 2010 announced that the number had reached 1.48 million or 0.7 percent of the total population. Those aged 5-8 years were 21.42 percent or 317,016 children. Only 28,897 or 26.15 percent have received both school and inclusive education services.

Schools for children with special needs are commonly known as Sekolah Luar Biasa/Schools for Disabled Students (SLB), specifically established for children who experience barriers from one or more types of disorders, namely physical and mental or social. There are several types of abnormalities in students with special needs, including deafness (hearing disorder), visual impairment (visual impairment), mental retardation (mental disorder), and physically disabled (physical abnormalities in muscles, bones, and joints). Mentally-retarded students have lower intelligence abilities than normal ones and experience adaptive behavior barriers and developmental delays (Jaya et al., 2018; Nuari & Prahmana, 2019; Rudiyati & Rahmawati, 2019; Supriatna & Ediyanto, 2021).

However, they can be educated in academics (reading, arithmetic, writing), social skills, and work. Regarding cognitive abilities involving perception, memory, idea development, judgment, and reasoning, those with mild mental retardation cannot develop as well as normal students (Notia, 2021). One of the research results proposed by Butler et al, (2001) is that mildly mentally disabled students can be given mathematics lessons, as seen from the cognitive abilities of mildly mentally disabled students can develop when given a math problem with the help of direct instructions. This study indicates that mildly mentally disabled people can express their ideas in the academic field—one of the lessons that can develop students' ideas in mathematics.

Mathematics is one of the concepts that require good understanding, not memorizing but understanding (Revina & Leung, 2018; Shahrill & Putri, 2018). According to Breen & O'Shea (2010), to develop mathematics, students must master mathematics's content and the skills and ability to solve problems. Of course, an optimal thought process is needed to solve problems. The thinking process is a student's cognitive activity that accepts the problem and uses the information understood to solve the given problem. Guarnera et al (2019); Solso et al (2009) states that thinking is a process that produces new mental representations through the transformation of information from a complex interaction of mental attributions that include judgment, abstraction, reasoning, depiction, creativity, intelligence, and problem-solving.

Students' reasoning and thinking abilities with mild mental retardation are seen when they solve mathematical problems. In mathematics, the thinking process can be seen through problem-solving. Marchis (2012) and Febriyanti et al. (2021) revealed that when learning mathematics, students must

complete exercises and problems from which the researchers know their knowledge and mathematical skill development. In this study, the researchers focused on the subjects, namely mentally disabled male students, because several studies showed that male students were superior in problem-solving to women. A study showed that the mathematical abilities of male and female students were different in terms of understanding ability (Sengul & Argat, 2015). Beller & Gafni (2000) and Hergovich et al. (2004) stated that, in general, men are better than women in mathematics.

One of the mathematical problems transformable into everyday life is the concept of fractions, one of the important subject matters to be studied (Misquitta, 2011). However, many students have difficulty understanding this concept (Nasution & Putri, 2018), which involves complex problems (Warsito et al., 2019). Understanding fractions is a basic skill that requires students to know where fractions are on the number line (Mousley & Kelly, 2018). Based on the background revealed above, the researchers wanted to see the thinking processes of mentally-retarded male students in solving problems related to fractions. This study determines students' thinking processes by referring to the following indicators: understanding, opinion, and conclusion drawing/decision stage. This study is expected to provide information related to problem-solving, especially for children with special needs. Furthermore, it can be used as a reference source for the development of learning for children with disabilities to create various sources of information that will be used as references for good learning for children with special needs.

2. METHODS

This research was qualitative research using descriptive and explorative methods to describe the thinking processes of mentally-retarded male students in solving problems related to fractions. Their thinking processes in solving mathematical problems can be seen from written tests that reflect their mental activity. The results of the written works were traced through interviews.

The subject selection process was carried out by determining the target class to be studied and then selecting a male student who had mathematical abilities higher than his friends', could communicate, and was considered capable of providing the data needed by the researchers. The subject's name, Adi (AD), was a pseudonym. Data collection is done by the think-aloud method. Students are asked to solve problems accompanied by verbal expressions of the ideas they think about. Validity of the data by using time triangulation Data is said to be valid if there is consistency in the first and second data collection results.

3. FINDINGS AND DISCUSSION

The problem examined in this study was the thinking process of male students with special needs (mental retardation) in solving fraction problems in junior high schools in three aspects, namely the formation of understanding, the formation of opinion, and concluding, as well as the obstacles faced by students with special needs in solving the mathematical problems. The data related to the description of students' thinking processes with special needs in terms of forming understanding and opinions and concluding problems related to fractions are presented below.

Description of the Thinking Process of Adi

The AD was for a 15-year-old male student in grade VII SLB in Sulawesi Island. From the results of tests, interviews, and observations, the data related to Adi's thinking process are as follows:

Written Test Results

The results of the written test and interview results based on valid data using time triangulation are shown in Figure 1.

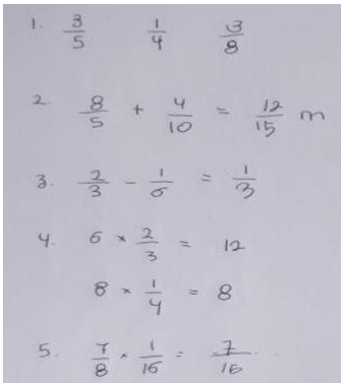

Figure 1. Ad's test results

The test results showed that Ad could solve question number 1 well and answer it correctly. Furthermore, he could work on problem number 2 but incorrectly. He did not equate the denominators first but immediately added the numerators and denominators. It was clear that he did not master the concept of fractions well. For number 3, he returned to work in the same way as for number 2. Although he could recognize addition and subtraction operations well, he could not solve the problem correctly. For question number 4, he could also work on the question well but not give what the question needed. The question asked him to reinforce who gave the most charity: Pak Raul or Pak Omar? For question number 5, he could not understand the question well. He considers that question number 5 was a multiplication problem infraction, while a division problem was presented in a story.

1.2 Results of Interviews

Interviews were used to obtain information related to students' thinking processes and as a follow-up to the written test results.

Table 1. Results of Interview with Ad Concerning Question Number 1

Stage of Forming an Understanding
R: What is known?
S: Figure,
R: What figure?
S: Just pointing to the question
R: What should you do with the figure?
S: It should be done to be like this (pointing to fractions)
Stage of Forming an Opinion
R: How did you complete that problem?
S: By accounting for its shade
R: How can you directly have such a solution?
S: Because I have had the same problem before.
R: How can you be sure that your answer is correct?
S: No problem.
Stage of Drawing a Conclusion/Making a Decision
R: Can you conclude the answers you got?
S: Yes
R: How do you conclude?
S: I do the calculations.
R: Why do you think that those are the correct conclusions?
S: It is just that

Table 1 displays that Ad, at the stage of forming an understanding, could understand what the question meant even though it was difficult for him to express what was known and asked because of his awkwardness towards people new to him. The researchers then needed help from his parents. Furthermore, at the stage of forming an opinion, he tried to solve the problem based on the previously taught material. Finally, he successfully solved the problem. At the stage of concluding, he believed that what he had done was right so that he could conclude for question number 1.

Table 2. Results of the Interview with Ad Concerning Question Number 2

Stage of Forming an Understanding
R: Please tell me what the question wants.
S: Mr. Danu bought a pipe to make
Waterways
R: How long was the pipe Mr. Danu bought?
S: That was the question.
R: Good. So how many pieces of pipe are there in the problem?
S:Two
R: Can you mention it, please?
S : $\frac{8}{5}$ and $\frac{4}{10}$
Stage of Forming an Opinion
R : How did you solve this problem?
S : $\frac{8}{5}$ and $\frac{4}{10}$
R : How did you add both of them?
S : 8+4=12 and 5+10=15
R : What are 12 and 15?
S : 12 is the numerator, 15 is the denominator
Stage of Drawing a Conclusion/Making a Decision
R : What is the conclusion from your answer?
S : $\frac{12}{10}$
R : What does this $\frac{12}{10}$ mean?
S : 12 is the numerator, 15 is the denominator

Table 2 shows that Ad, at the stage of forming an understanding in the first interview, still did not dare communicate with the researcher, and at the time seemed to be starting to open. It was a bit daring to express what he thought in the second interview. He could understand what the question wanted at that stage, but he could not communicate well with the new interlocutor he had just met. At the stage of forming an opinion, he tried to solve the problem, but his answer was wrong because he did not master the concept well. This also impacted him at the stage of drawing a conclusion, where he gave the wrong conclusion for question number 2.

Table 3. Results of the Interview with Ad Concerning Question Number 3

Stage of Forming an Understanding
R : How long would your brother's hair be cut by father?
S : $\frac{1}{6}$ cm
R : What was the initial length of your brother's hair?
S : $\frac{2}{3}$ cm
R : What was the question about?
S : Brother's hair length after cutting
Stage of Forming an Opinion
R : How did you solve this problem?
S : 2–1=1 (numerator) 3–6=3 (denominator)
R : Are you sure this answer is correct?
S : Yes
R : Is there any other way to solve this problem?
S : No
Stage of Drawing a Conclusion/Making a Decision
R : What is the conclusion of your answer?
S : $\frac{1}{3}$
R : What is $\frac{1}{3}$?
S : Brother's hair length now

Table 3 indicated that AD, at the stage of forming an understanding, could understand the problem well and express what was known and asked. Furthermore, AD tried to solve the problem even though he was wrong because of his lack of mastery of concepts when forming an opinion. The conclusion drawing stage is closely related to the previous stage. The AD gave wrong conclusions because he had a conceptual error in the previous stage.

Table 4. Results of the Interview with Ad Concerning Question Number 4

Stage of Forming an Understanding
R : What was known in the question?
S : Raul and Omar bought oranges
R : Why did Raul and Omar buy oranges?
S : For charity purposes
R : Then what was asked?
S : (Shaking his head)
Stage of Forming an Opinion
R : How did you solve this problem?
S : Like this (showing the answer). I immediately multiplied.
R : Are you sure this answer is correct?
S : No
R : Why were you having trouble doing this problem?
S : I didn't understand and had never done anything like this question.
Stage of Drawing a Conclusion/Making a Decision
R : What conclusion did you draw from question number 4?
S : Nothing

Table 4 explains that AD, at the stage of forming an understanding, could not express what was known and asked in the question. He had difficulty understanding the meaning of the question because

he felt unfamiliar with question number 4. At the stage of forming an opinion, he tried to solve the problem again in the wrong way because he could not analyze the question from the beginning. He expressed the answers appearing in his mind without remembering the concept of fractions. At the concluding stage, he could not express any conclusion from the answers he wrote.

Table 5. Results of Interview with Ad Concerning Question Number 5

Stage of Forming an Understanding
R : How much paint was used to paint a tree?
S : $\frac{1}{20}$ liter
R : Then what else?
S : I did not know anymore. I also did not know what this $\frac{7}{8}$ liter of paint is for.
R : Then what was asked?
S : I did not know
Stage of Forming an Opinion
R : How did you solve this problem?
S : Maybe something like this (showing the answer)
R : Are you sure this answer is correct?
S : No
R : Why were you having trouble doing this problem?
S : I didn't know what kind of question this was
Stage of Drawing a Conclusion/Making a Decision
R : What conclusions can you draw from this question?
S : Nothing

Table 5 displays that Ad, at the stage of forming an understanding, could not express what was known and asked in the question. He had difficulty understanding what the question wanted since he was unfamiliar with the form of the question. He even thought that this was a problem related to multiplication. The wrong understanding caused him to experience errors when forming an opinion in his thinking process. So, he could not give his conclusion on question number 5.

Formation of Understanding

When forming his understanding, Ad needs time to understand the problems in the questions. This situation appeared when he read the questions from the given test. He kept repeating the questions and could write down the important elements of the problems. However, when interviewed, he had difficulty expressing what he knew and asked because his ability to communicate was still very lacking. He tended not to be opened to people who were new to him in expressing something in his mind, so the researchers needed help from his parents to dig up data about his thinking process.

Formation of Opinion

The stage of forming an opinion was indicated by how Ad conveyed his opinion regarding the strategy or method used in solving the given fraction problems. He was quite capable of distinguishing the types of operations for addition, subtraction, multiplication, and division. However, he could not use the concepts correctly because mentally retarded students have short-term memories. They often find it difficult to remember the materials taught previously. Furthermore, during the COVID-19 pandemic, face-to-face learning is rarely carried out and is even stopped. Students are only given assignments and are required to work independently without any more detailed explanation from the supporting teachers in their class.

Drawing conclusion/making decision

The last stage, namely conclusion drawing, is very closely related to the previous ones, especially forming an opinion. The AD was unable to form an opinion well. Thus, he could not conclude or provide final answers to some of the questions.

The analysis results showed that the subject could reveal what was known and asked. That is, he could form an understanding through his thinking process. When given problems in the form of questions, students with mild mental retardation can analyze the characteristics of the problems at hand. They can understand what the problems are in the questions. Research conducted by Butler et al. (2001) suggests that students with mild mental retardation can be given mathematics lessons, as shown by the cognitive abilities that can develop when given mathematical problems with the help of direct instructions. Furthermore, in forming opinions, they are quite capable of solving the problems given.

However, they still need direction for specific questions, especially regarding the division operation. The addition and subtraction operations also need to be emphasized to them. To solve the problem of fractional operations in the form of addition and subtraction, they must pay attention to the denominators, which must be equated before solving. The subject made this kind of error when he added and subtracted just like that. The supporting teachers in his class teach how to quickly add and subtract fractions because mentally disabled students have short-term memory; (Gunarsa, 2008) stated that mentally disabled children are in a state of delayed or incomplete development of mind, which affects their cognitive abilities. Low cognitive abilities are closely related to thinking processes such as language, learning, and memory. Students with mild mental retardation have not determined their own strategies or methods used to solve the problems given.

Overall, in developing their thinking processes, they still need help and direction because of their intellectual intelligence. Hakim (2013), who conducted more studies on gross motor skills, revealed that mentally disabled children need guidance and training regularly. This information reveals that the cognitive abilities of those with mental retardation can still be optimized if they are given special intervention. Eldevik et al. (2010) found that specific interventions for low-intelligence students could benefit. These interventions are related to the level of mental age achieved, which is lower than the average student in general. It is more appropriate to learn strategies through concrete objects and fun learning situations.

At the final stage, namely the formation of decisions/concluding, the subject still needed direction in providing conclusions for each given problem related to fractions. Of the five questions given, he did not write any affirmation at the end in the form of any sentence to answer the problems in the questions. However, when interviewed, he could mention it through the direction of the researchers. This finding showed that students with mild mental retardation could not form independent decisions in their thinking processes.

This is in line with Hidayah et al (2014); Saputri et al (2017) in developing problem-solving strategies. The equation for mild mentally disabled students is that students need direction when solving problems, students' complete calculations downward. Students tend to use both hands as counting tools because of their limited abilities and concrete thinking. While the difference is that AD students have difficulty implementing different strategies when solving problems. AD students are also less careful in writing numbers for the information in the questions, so the results obtained are less precise, and errors occur in calculations. In this case, for the category of developing problem-solving strategies, it is proven that mildly mentally disabled students are seen to count, and mentally disabled students cannot detect errors in statements according to academic and mental characteristics.

According to Breen & O'Shea (2010), "To develop mathematically, it is necessary for learners of mathematics not only to master new mathematical content but also to develop a wide range of thinking skills." To develop mathematical abilities, a student needs to master the contents of mathematics, but it is also important to develop their thinking skills. Mathematics learning given to students with mild mental retardation should use concrete or real objects to make it easier for them to abstract mathematical concepts. Mentally disabled students seem to find it easier to remember something concrete. This is in line with a study conducted by Suryani & Mumpuniarti (2018) that stated that such learning limitations/barriers in the teaching/education of mentally disabled children make them need concrete examples, contextual learning experiences, and encouragement of active interaction between them and the environment. The characteristics of students with mental retardation who are weak in

abstract thinking and their limitations in the development of cognitive abilities require a learning approach that can optimize their cognitive abilities through concrete learning. This is in line with what Husniati et al (2020) suggest that in general, the mathematical representation of students with special needs is a challenge in education to achieve learning objectives, as is the case for other students in public schools.

4. CONCLUSION

The results of the research showed that in solving problems related to fractions, at the stage of forming an understanding, mentally retarded students can form an understanding in their thinking processes. When given a problem in the form of questions, students with mild mental retardation can analyze the characteristics of the problem at hand. They can understand what the problems are in the questions. At the stage of forming an opinion, mentally disabled students need direction to determine what strategies or methods to use in solving problems because they have limitations in terms of remembering the materials previously taught, especially in fraction operations. At the stage of concluding, they cannot make conclusions independently. When solving problems in the form of stories, they do not provide any conclusion in the form of any sentence to answer what was asked in the questions.

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