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ANALYSIS OF MATHEMATICAL CREATIVE THINKING ABILITY IN VIEW OF STUDENTS' INTRAPERSONAL INTELLIGENCE BASED ON HOWARD GARDNER'S THEORY OF INTELLIGENCE

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ABSTRACT

This research aims to describe the mathematical creative thinking abilities of students in terms of high, moderate, and low levels of intrapersonal intelligence. The study utilizes a descriptive qualitative method. Data collection techniques include mathematical creative thinking ability tests, intrapersonal intelligence questionnaires, and unstructured interviews. The main instruments used in the study are the mathematical creative thinking ability test and the intrapersonal intelligence questionnaire. Data analysis techniques include data reduction, data presentation, and conclusion drawing. Based on the research findings, it was found that students with high intrapersonal intelligence have high mathematical creative thinking abilities, reflected in fluency, flexibility, originality, and elaboration. They are able to overcome obstacles through deep thinking strategies, interest in challenges, and a positive level of self-confidence. Students with moderate intrapersonal intelligence also demonstrate high creative abilities, including fluency, flexibility, originality, and elaboration. They can express ideas visually and generate innovative solutions. Students with low intrapersonal intelligence show potential in fluency and originality; they can demonstrate originality through efforts that are original in nature, such as combining two different plane figures in one solution. However, they have limitations in flexibility and elaboration. Support is needed to develop flexibility and elaboration in mathematical creative thinking abilities.

Keywords: analysis, mathematical creative thinking abilities, intrapersonal intelligence

INTRODUCTION

Mathematics learning in Indonesia has experienced significant development along with the implementation of Minister of Education and Culture Regulation No. 58 of 2014, which emphasizes the importance of developing creative thinking abilities in students. Creative thinking in the context of mathematics is not only considered an academic achievement, but also as a skill that has positive implications in everyday life. Afrina and Bektiningsih (2018) provide a view that mathematics learning is not only limited to the application of formulas and logic; its essence also includes understanding the concept. This approach is in line with the current direction of development in mathematics education which highlights the importance of teaching creative thinking to achieve deep conceptual understanding (Hadar & Tirosh, 2019). Referring to the opinions of Novegitasari, Dwijanto, and Asih (2020), Dahlan,

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Nurhadi, and Rohimah (2017), and Florentina and Leonard (2017) that the ability to think creatively mathematically is a skill that allows someone to solve mathematical problems using various perceptions and concepts. different.

However, the results of an interview with a class VIII Mathematics teacher at SMP Negeri 9 Tasikmalaya revealed that the mathematical creative thinking abilities of class VIII students still need to be improved significantly. The teacher stated, "In general, the mathematical creative thinking abilities of class VIII students still need to be improved. There are still many students who are not used to thinking creatively and innovatively."

In this context, internal factors such as motivation, self-confidence, and understanding of mathematical concepts play an important role in improving mathematical creative thinking abilities. Anditiasari, Pujuastuti, and Susilo (2021) emphasize that motivation spurs students to think creatively in mathematics, while research by Mimbarwati, Mulyono, and Suminar (2023) shows that self-confidence influences students' ability to face learning challenges. Apart from that, understanding mathematical concepts is also a crucial factor because it allows students to develop creativity in solving mathematical problems. Samuntya, Susiswo, and Muksar (2022), Sari and Untarti (2021) and Munandar in Kadir, Machmud, Usman, and Katili (2022), and Filsaime in Nurlaela, Ismayati, Samani, and Suparji (2019) have the same opinion confirming that students with good mathematical understanding can achieve aspects of creative mathematical thinking such as fluency, flexibility, originality and elaboration.

Interestingly, internal factors related to the ability to think creatively mathematically are very relevant to the concept of intrapersonal intelligence proposed by Howard Gardner. Referring to the opinions of Gardner (1983), Samsinar (2020), and Yaumi and Ibrahim (2013) explains that intrapersonal intelligence is an individual's ability to have a deep understanding of internal aspects such as emotions, motivation, strengths, weaknesses and self-values. Therefore, this research aims to analyze students' mathematical creative thinking abilities in terms of intrapersonal intelligence based on Howard Gardner's theory of intelligence.

Based on the description above, this research aims to analyze creative mathematical thinking abilities in terms of the intrapersonal intelligence of class VIII students at SMP Negeri 9 Tasikmalaya. By limiting the scope of the research to one school and one grade level, the researcher will conduct qualitative research to gain an in-depth understanding of this problem.

RESEARCH METHODS

This research uses a descriptive qualitative approach to obtain an in-depth understanding of the analysis of mathematical creative thinking abilities in terms of the intrapersonal intelligence of class VIII-J students at SMP Negeri 9 Tasikmalaya. This decision was based on the consideration that qualitative research methods, as proposed by Abdussamad (2021), provides space for in-depth and

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comprehensive exploration of the phenomenon under study. "Places, actors and activities" become the focus in data collection, with the researcher as the main instrument directly involved (Sugiyono, 2013). Data was collected through mathematical creative thinking ability tests, intrapersonal intelligence questionnaires, and interviews. Research instruments include validated tests and questionnaires, as well as data analysis techniques involving data reduction, data presentation, and drawing conclusions based on Miles and Huberman's theory in Nasution (2023).

RESULTS AND DISCUSSION

Based on the results of the research and data analysis that has been carried out, the results of the discussion regarding mathematical creative thinking abilities are obtained in terms of high, medium and low intrapersonal intelligence of students. The subjects selected in this research consisted of 3 subjects, representing each category of intrapersonal intelligence. For high intrapersonal intelligence, that is the subject (S-19), then for moderate intrapersonal intelligence, that is the subject (S-16), and finally for low intrapersonal intelligence, that is the subject (S-21). Subjects were obtained based on the results of analysis of mathematical creative thinking ability tests and the results of intrapersonal intelligence questionnaires. The results of the mathematical creative thinking ability test for each selected subject were then analyzed in depth by the researcher and continued with an interview process with the subject to determine the subject's mathematical creative thinking ability verbally and to look for information that may not have been written down on the subject's answer sheet. Next, the researcher described the results of the answers to the mathematical creative thinking ability test in terms of intrapersonal intelligence as follows.

Description of Students' Creative Mathematical Thinking Ability in View from High Intrapersonal Intelligence (S-19)

Analysis of S-19 mathematical creative thinking abilities can be seen based on the results of answers to tests on mathematical creative thinking abilities and interviews for each indicator.

1. Fluency (fluency), the ability to solve mathematical problems quickly and without obstacles.

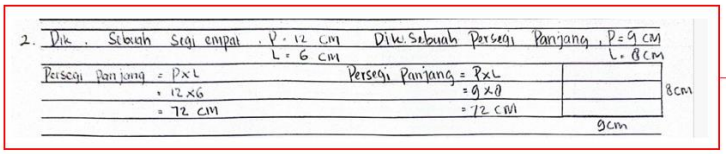

Figure 1. Results of Answers to S-19 Fluency Indicators (Fluency)

The S-19 answer results show good ability to understand the question information. S-19 quickly identifies the relevant shape (rectangle), then carefully calculates its area. S-19 can also easily find alternative shapes with the same area, choosing simple approaches to calculations, such as simple multiplication. This shows the S-19's ability to solve mathematical problems quickly and without obstacles.

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2. Flexibility, the ability to solve mathematical problems by providing a variety of different solutions.

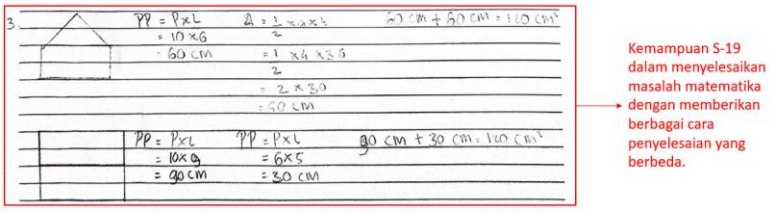

Figure 2. Results of Answers to S-19 Flexibility Indicators

The S-19 answer to this indicator shows good flexibility, because the S-19 can present several different ways of solving a given mathematical problem. However, there are several drawbacks related to the reality of the size of flat shapes that have not been paid enough attention. But overall, the S-19 managed to complete it well, as reflected by its precise and accurate calculations. It can be concluded that S-19 is able to solve mathematical problems by providing various different ways of solving it, as seen in the researcher's interview excerpt with the S-19 subject.

3. Originality, the ability to solve mathematical problems by providing new ideas or ideas based on the results of one's thinking.

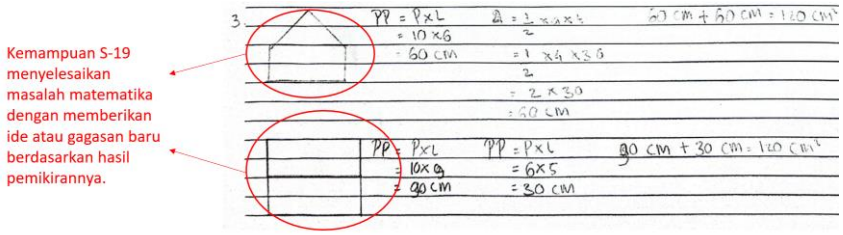

Figure 3. Results of Answers to S-19 Indicators of Authenticity (Originality)

Analysis of S-19's answers shows that he is able to produce original creative ideas. In this example, the S-19 successfully combines two different flat shapes, creating a unique and unusual shape. This reflects the creative abilities and original thinking possessed by S-19 in solving mathematical problems.

4. Elaboration (elaboration), the ability to solve mathematical problems with systematic and detailed answers.

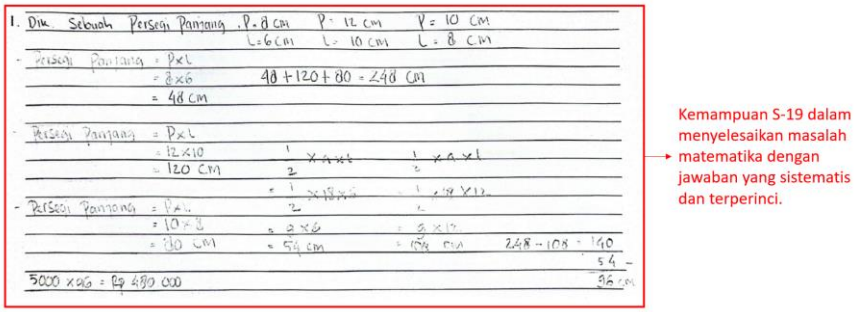

Figure 4. Results of Answers to S-19 Elaboration Indicators (Elaboration)

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Although the S-19 answer results show systematic solving capabilities, they are still lacking in details. Although S-19 provides calculation steps, the explanation is not in depth. In conclusion, the S-19 has the ability to solve mathematical problems systematically, even though there are deficiencies in the details of the answers. This is in accordance with research interviews which show that S-19 is able to explain the answer process systematically with detailed step-by-step descriptions.

Description of Students' Creative Mathematical Thinking Ability in View from Medium Intrapersonal Intelligence (S-16)

Analysis of S-16 mathematical creative thinking abilities can be seen based on the results of answers to tests on mathematical creative thinking abilities and interviews for each indicator.

1. Fluency (fluency), the ability to solve mathematical problems quickly and without obstacles.

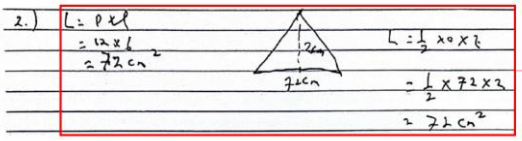

Figure 5. Results of Answers to S-16 Fluency Indicators (Fluency)

Answers from S-16 show the ability to fluency in creative mathematical thinking. He quickly identified the information, calculated the area of a quadrilateral with the right formula, and creatively chose a triangle as an alternative. Interviews show that S-16 is able to effectively plan mathematical solutions with simple and efficient ideas.

2. Flexibility, the ability to solve mathematical problems by providing a variety of different solutions.

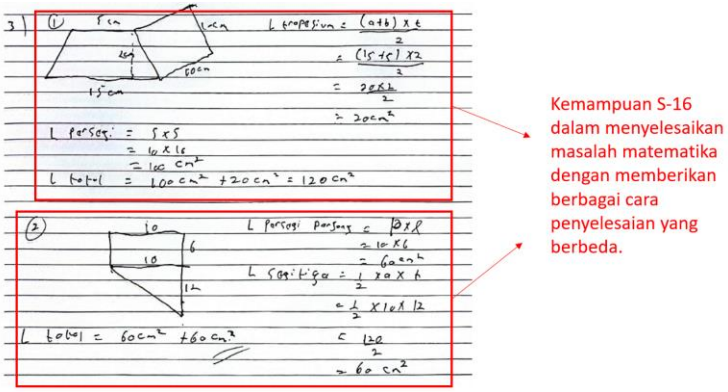

Figure 6. Results of Answers to S-16 Flexibility Indicators

The S-16 answer results show a quick understanding of the complexity of questions that require a combination of flat shapes. They show flexibility by considering various combinations of quadrilaterals and triangles, and adjusting sizes efficiently. The S-16 produces two different shapes, reflecting adaptability and flexibility in thinking of creative mathematical solutions.

3. Originality, the ability to solve mathematical problems by providing new ideas or ideas based on the results of one's thinking.

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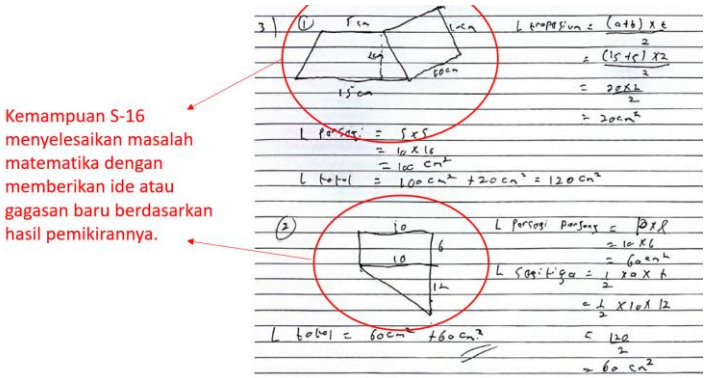

Figure 7. Results of Answers to S-16 Indicators of Authenticity (Originality)

The S-16 answer stands out because it not only produces conventional solutions, but also designs unconventional combinations such as a trapezoid with a square. This approach reflects creativity and the ability to think outside the boundaries of standards, producing solutions that meet requirements.

4. Elaboration (elaboration), the ability to solve mathematical problems with systematic and detailed answers.

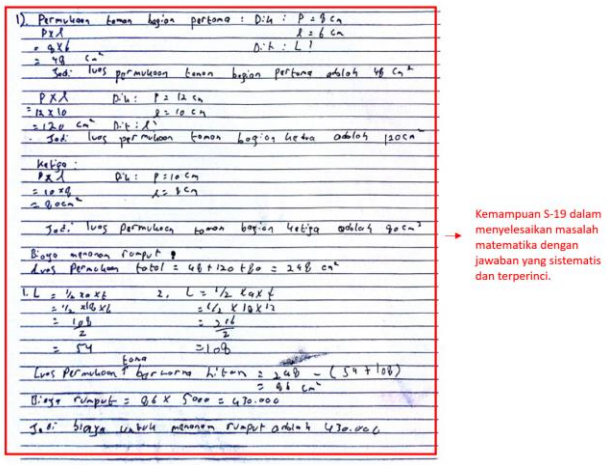

Figure 8. Results of Answers to S-16 Elaboration Indicators (Elaboration)

The S-16 answer results show significant elaboration in mathematical creative thinking abilities. They carefully detailed the size of each part of the garden and applied the concept of garden surface area separately, then adding them up. A thorough understanding of each part of the garden and the use of organized calculation methods demonstrate clarity and caution in thinking.

Description of Students' Creative Mathematical Thinking Ability in View from Low Intrapersonal Intelligence (S-21)

Analysis of S-21 mathematical creative thinking abilities can be seen based on the results of answers to tests on mathematical creative thinking abilities and interviews for each indicator.

1. Fluency (fluency), the ability to solve mathematical problems quickly and without obstacles.

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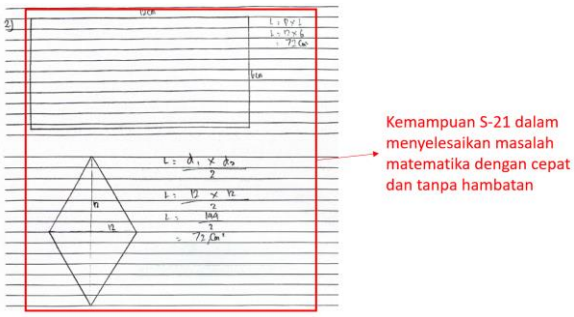

Figure 9. Results of Answers to S-21 Fluency Indicators (Fluency)

The S-21 answer results show good fluency even though it is in the low category. Even so, the S-21 was able to smoothly identify alternative flat shapes and create a flat kite shape of the appropriate size. The ability to present solutions and deliver answers clearly shows that S-21 can pursue fluency well.

2. Flexibility, the ability to solve mathematical problems by providing a variety of different solutions.

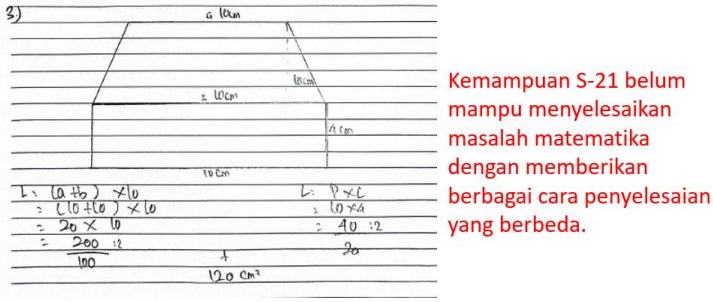

Figure 10. Results of Answers to S-21 Flexibility Indicators

The results of the S-21 work show a lack of flexibility in creative mathematical thinking. Despite providing one answer that meets the criteria, namely a combination of a rectangle and a trapezoid, the inability to present more than one possible shape indicates a lack of flexibility. This shows that participants still need further development in their mathematical creative thinking abilities.

3. Originality, the ability to solve mathematical problems by providing new ideas or ideas based on the results of one's thinking.

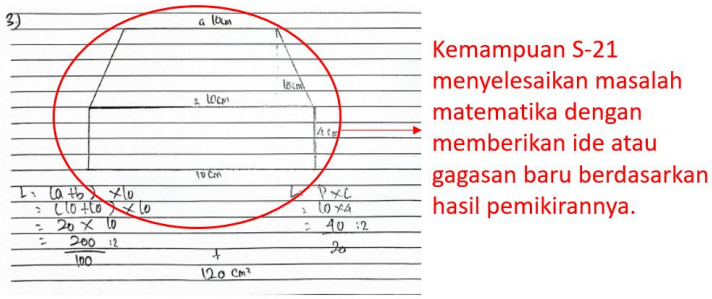

Figure 11. Results of Answers to S-21 Indicators of Originality (Originality)

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The results of S-21's answers to this indicator show efforts to create original solutions in answering these questions. Even though it has limitations in the flexibility of creative thinking, the S-21 succeeds in presenting a combination of flat trapezoidal and rectangular shapes. This choice of combination shows S-21's efforts to think outside the common pattern and create shapes that are not just conventional. Even though he only presents one solution, success in combining two different flat shapes shows the ability to produce an original answer within the framework of his mathematical knowledge and skills. Although further encouragement is needed to expand their creativity, this step is a positive step in developing creative mathematical thinking abilities. So it can be concluded that S-21 is able to solve mathematical problems by providing new ideas or ideas based on the results of his own thoughts. The following is an excerpt from the researcher's interview with the subject S-21.

4. Elaboration (elaboration), the ability to solve mathematical problems with systematic and detailed answers.

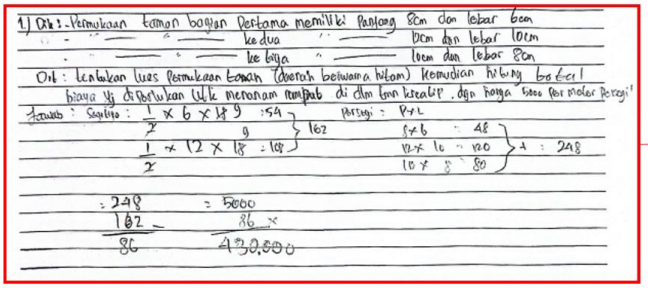

Figure 12. Results of Answers to S-21 Elaboration Indicators (Elaboration)

The answer results from S-21 show the ability to elaborate by providing calculations in a structured manner, even without in-depth explanation. S-21 calculates the area of each part of the garden, the area of empty land, and the area for planting grass with clear steps. Even though it does not include an in-depth explanation, S-21 provides elaboration by covering the entire process of calculating the cost of planting grass.

Table of Analysis Results of Mathematical Creative Thinking Ability in View of Students' Intrapersonal Intelligence

Table 1. Results of analysis of creative mathematical thinking abilities in terms of students' intrapersonal intelligence

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Indicators of Mathematical Creative Thinking Ability	Subject		
	S-19	S-16	S-21
Fluency	Able to solve mathematical problems quickly and without obstacles in accurate mathematical calculations.	Able to solve mathematical problems quickly and without obstacles in accurate mathematical calculations.	Able to solve mathematical problems quickly and without obstacles in accurate mathematical calculations.
Flexibility	Able to solve mathematical problems by providing a variety of different solutions	Able to solve mathematical problems by providing a variety of different solutions	Not yet able to solve mathematical problems by providing various different solutions
Keaslian (Originality)	Able to solve mathematical problems by providing new ideas or thoughts based on the results of his thinking	Able to solve mathematical problems by providing new ideas or thoughts based on the results of his thinking	Able to solve mathematical problems by providing new ideas or thoughts based on the results of his thinking
Elaboration	Able to solve mathematical problems with systematic and detailed answers.	Able to solve mathematical problems with systematic and detailed answers.	Able to solve mathematical problems with systematic and detailed answers.

The results of research on students who have high intrapersonal intelligence (S-19) in mathematical creative thinking abilities show high fluency in solving mathematical problems. This can be seen based on the results of S-19's answer to question number 2, being able to understand the information about the question well, creatively choosing suitable flat shapes, and applying the formula quickly and without obstacles. The S-19's flexibility ability is reflected in its ability to present several alternative solutions to mathematical problems based on the results of the answers to question number 3, even though there are shortcomings related to the reality of the size of flat shapes. The S-19 overall succeeded in completing the task well, which is reflected in its calculations. accurate and precise. Furthermore, S-19's originality has a significant ability to produce creative and original ideas. This can be seen in the results of S-19's answer to question number 3, S-19 succeeded in combining two different flat shapes, creating an unusual and unique shape. This shape reflects the level of creative ability and original

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thinking possessed by the S-19. Then, S-19 also has good elaboration skills, this can be seen from the way he answered question number 1. Writing the arguments for the answer systematically, even though there was a lack of detail in the answer. This is in accordance with the research results Oktaviani & Fitriyani (2022) that the subject is at a high level of mathematical creative thinking ability when he meets all the indicators of mathematical creative thinking ability. In terms of classification of mathematical creative thinking ability, S-19 which can fulfill all indicators of mathematical creative thinking ability is included in the "very creative" classification. This is in accordance with opinion Safitri and Maryati (2021) which states that the classification of being highly creative in mathematical creative thinking ability must meet all indicators of mathematical creative thinking ability, namely fluency, flexibility, originality and elaboration.

The results of research on students who have moderate intrapersonal intelligence (S-16) in the ability to think creatively in mathematics show very good abilities in the aspect of fluency. In answering question number 2, S-16 was able to quickly and without obstacles understand the information about the question, creatively choose appropriate flat shapes, apply area formulas correctly, and express ideas visually. Interview results also confirmed this fluidity, with the S-16 able to quickly identify quadrilateral types and generate creative ideas efficiently. Furthermore, the S-16 shows good capabilities in flexibility. In solving problem number 3, S-16 students showed flexibility in considering various combinations of quadrilaterals and triangles. The resulting image reflects creative thinking and sensitivity to alternative solutions. In addition, students showed flexibility in determining appropriate sizes, adjusting length and width efficiently to achieve the specified area (120 cm^2). The ability to produce two different shapes shows adaptability and flexibility in thinking about mathematical solutions. Overall, these students explored various options with flexibility, created creative solutions and understood the diversity in flat shape concepts. The interview also illustrates the subject's ability to understand the complexity of the problem and consider various options with skill. The S-16's originality ability is also very visible in answering question number 3. By combining two different flat shapes, the S-16 succeeded in creating a unique and unusual shape, showing innovation and creativity. Interviews supported these findings, with S-16 demonstrating the ability to think beyond the boundaries of standard concepts and create original solutions. Finally, S-16 showed significant elaboration ability in answering question number 1. Through systematic and detailed calculations, this subject understood every detail of the creative park carefully, breaking down the problem into organized steps. Interviews confirmed that the S-16 provided structured and elaborative answers, ensuring every aspect of the calculation was understood and carefully accounted for. Thus, S-16 can be categorized as students with "very creative" mathematical creative thinking abilities, fulfilling all indicators of mathematical creative thinking abilities, namely fluency, flexibility, originality and elaboration. . This finding is in line with the results of previous research, the results of research by Oktaviani and Fitriyani (2022) that subjects are at a high

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level of mathematical creative thinking ability when they meet all indicators of mathematical creative thinking ability, fluency, flexibility, originality, and elaboration (elaboration). and confirms that moderate intrapersonal intelligence has the potential to develop significant mathematical creative thinking abilities in students.

From the results of research on students who have low intrapersonal intelligence (S-21) in their mathematical creative thinking abilities, several significant findings can be identified. In the aspect of fluency, even though it is in the low category, the S-21 is able to smoothly identify alternative flat shapes that have the same area as the given quadrilateral. With fairly good fluency, he made a flat kite shape of the appropriate size. The selection and presentation of solutions is done easily, and students are able to convey their answers clearly. Even though the intrapersonal intelligence category is low, this student's fluency ability is impressive, indicating that in this case, he can pursue fluency well. Furthermore, in terms of flexibility, the S-21 still has limitations. Even though he succeeded in providing one answer which was a combination of a rectangle and a trapezoid in question number 3, the lack of ability to provide more than one alternative indicated limitations in creative mathematical thinking. Further support is needed to develop the flexibility of creative mathematical thinking. Meanwhile, in the aspect of authenticity, the S-21 shows an original effort. Even though he was limited to one solution to problem number 3, success in combining two different plane figures shows the ability to produce original answers within the framework of his mathematical knowledge and skills. Finally, in the elaboration aspect, S-21 shows good abilities by providing structured calculations. Even though this answer does not include an in-depth explanation, S-21 has succeeded in arranging the calculations in a clear sequence of stages. Overall, S-21 has the potential to be developed further, especially in the aspect of flexibility, to improve mathematical creative thinking abilities as a whole. These findings provide insight into development areas that need further attention, so that students can reach their full potential in mathematical creative thinking abilities. This finding is in line with the research results of Oktaviani & Fitriyani (2022) where students with low intrapersonal intelligence met 3 indicators of mathematical creative thinking ability, namely fluency, originality and elaboration. In terms of classification of mathematical creative thinking abilities, S-21 which can meet the 3 indicators of mathematical creative thinking abilities of fluency, originality and elaboration are included in the "creative" classification. This is in accordance with the opinion of Safitri and Maryati (2021) who state that creative classification in mathematical creative thinking ability must meet 3 indicators of mathematical creative thinking ability, namely fluency, originality and elaboration.

The results of interviews with S-19, S-16, and S-21 students revealed differences in mathematical creative thinking abilities depending on their level of intrapersonal intelligence, this is in line with the characteristics of intrapersonal intelligence described by Kelly (2015). S-19, with high intrapersonal intelligence, demonstrated significant mathematical creative thinking abilities with deep thinking

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strategies and problem visualization. S-16, who has moderate intrapersonal intelligence, also shows progress in solving mathematical problems with good confidence. However, S-21, with low intrapersonal intelligence, faced difficulties in applying mathematical concepts, even though he succeeded in meeting most of the indicators of mathematical creative thinking ability. Additional support is needed for S-21 to overcome these obstacles and improve its skills in the future.

CONCLUSION

Based on the results of research on mathematical creative thinking abilities in students with various levels of intrapersonal intelligence, the conclusions are as follows: Students with high intrapersonal intelligence demonstrate excellent mathematical creative thinking abilities, showing fluency, flexibility, originality and elaboration in answering mathematical questions . They tend to have deep thinking strategies, an interest in challenges, and a positive level of self-confidence. Students with moderate intrapersonal intelligence also demonstrate good mathematical creative thinking abilities, with fluency, flexibility, originality and elaboration in answering mathematical questions. They are able to overcome difficulties with good self-confidence and see mathematical challenges as opportunities to increase creativity. Meanwhile, students with low intrapersonal intelligence, even though they have limitations, still show potential in mathematical creative thinking abilities. However, they need further support to develop the flexibility of creative mathematical thinking. Their self-confidence in mathematical abilities tends to be low. Overall, students with high or moderate intrapersonal intelligence have good mathematical creative thinking abilities, while students with low intrapersonal intelligence have potential that can be developed further with the right support.

SUGGESTION

Suggestions for improving students' mathematical creative thinking abilities include the importance of teachers paying attention to and accommodating the needs of students with diverse intrapersonal intelligence, by implementing a learning approach that encourages freedom of thinking and visualization of mathematical concepts; students need to be active in developing their abilities by utilizing existing resources, such as extracurricular activities and support from teachers and classmates; and the need for further research to understand the influence of the social environment and family support as well as developing learning methods that suit the characteristics of intrapersonal intelligence, with the hope of producing a holistic approach that suits the needs and potential of each individual.

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