25 (1), 2024, 313-328
Jurnal Pendidikan MIPA
e-ISSN: 2685-5488 | p-ISSN: 1411-2531
http://jurnal.fkip.unila.ac.id/index.php/jpmipa/

Creative Thinking Process of Kinesthetic Male Students in Solving Mathematics Problems in Elementary School

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Abstract: Various concepts have been introduced in every lesson to improve students' mathematical analytical ability. This paper introduces a new concept to improve students' creative thinking ability based on kinesthetic learning style in solving math problems. The uniqueness of Kinesthetic male students' creative thinking process in elementary school can be seen when a person can solve problems correctly, use accurate and different approach strategies, create the correct solution process, and produce unique and new products. The primary purpose of this research is to describe the uniqueness of Kinesthetic male students' creative thinking process in solving mathematics problems in elementary school. The method used in this study is qualitative. The subjects in this study were fifth-grade students of SD Negeri 7 Dobo, Aru Islands Regency. The instrument used in this study was a student creativity test on geometry. This research resulted in a valuable lesson that Male Subjects with Kinesthetic Learning Styles have different uniqueness in solving mathematics. The discovery of correct ideas can prove this by presenting more than one different and correct approach and solution strategy and the discovery of a correct and unique (unusual) answer completed by kinesthetic male students at their stage of development or level of knowledge.

Keywords: uniqueness of creative thinking process, mathematical problem solving, male subject, kinesthetic learning style.

▪ INTRODUCTION

Innovative methods can change the paradigm of mathematics teaching and inspire teachers to come up with new ideas (Cevikbas & Kaiser, 2020). One of the fundamental components of the UN's 2030 sustainable development agenda is the quality of education. It aims to ensure quality education that is inclusive and equitable for all people (Haleem et al., 2022). Teachers can use problem-solving activities as a strategy to increase students' interest in mathematics. One factor that may influence students' interest in mathematics is their perception of the level of creativity, flexibility, and freedom of expression offered through engagement in mathematical tasks. Creativity is the use of divergent thinking to create new ideas or realistic scenarios of their own. There is a common misconception that one cannot be flexible and creative in mathematics (Bevan & Capraro, 2021; Fenanlampir et al., 2024). Among the studies on this issue, Chirinda & Barmby (2018) conducted qualitative research involving 31 secondary schools in South Africa. Their study revealed that students have difficulty understanding the mathematics teaching provided by teachers, which has an impact on students' mathematical problem-solving. This is because teachers still choose traditional teaching methods. Furthermore, the teachers believed that solving math problems was showing students examples and giving them practical exercises to work on. Teachers believe that problem-solving is essential to improve students' abilities and mathematical knowledge and enable knowledge transfer to solve new and unusual problems (Mršnik et al., 2023). Students with good conceptual math, will be able to solve math problems well (Yayuk & Husamah,

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*Email: ishabusuha@gmail.com
DOI: http://dx.doi.org/10.23960/jpmipa/v25i1.pp313-328
Received: 14 July 2024
Accepted: 13 August 2024
Published: 23 August 2024

2020). The results of a study in Sweden also show that teachers give diagnostic tests to check students' mathematical abilities. The results show that the teacher's diagnostic framework is mainly due to the student's cognitive abilities. In contrast, the prognostic framework is mainly related to the organization of learning, such that students should collaborate in group work in class. These results contribute to an overview for Swedish mathematics teachers of students' difficulties in learning mathematics (Kaufmann & Ryve, 2023).

Mathematics is generally perceived as complex, and many students believe that people are good at it because of their talent (Rattan et al., 2012). With such perceptions, many students stop learning math and they wish math were no longer compulsory for them. Students who like math and have high ability must say that math is exciting learning; on the other hand, students with low ability say math is tiresome work and it is difficult to solve math problems (Rizky Novriani & Surya, 2017). Learning math may seem acceptable to students who view math as necessary, but some students consider that learning math is not essential (Laurens et al., 2018). However, it is important to know that math is the gateway to many fields of science and technology. Neglecting to learn math is like limiting students' opportunities to learn various important subjects, thus limiting their future employment opportunities and depriving society of its quantitatively literate potential. This situation needs to change, especially as we prepare students for the increasing challenges of globalization that require good literacy (Li & Schoenfeld, 2019). The main goal of teaching mathematics is for students to solve problems in everyday life. Unfortunately, according to the results of studies in the form of national examinations, most students lack mathematical problem-solving skills. This is proven to be one of the reasons that overall math learning achievement is relatively low. It also reflects that students have difficulty understanding mathematical problems, which affects the problem-solving process. Therefore, teachers can establish an appropriate plan according to students' learning needs. Study results of Phonapichat et al. (2014) showed that there are several difficulties in students' mathematical problem-solving, namely; 1) Students have difficulty understanding the keywords that appear in the problem, so they cannot interpret mathematical sentences; 2) Students are unable to think about what to assume and what information from the problem is needed to solve it; 3) Whenever students do not understand the problem, they tend to guess the answer without any thought process; 4) Students are impatient and do not like reading math problems, and 5) Students do not like reading long problems. Therefore, the results found in this study will lead to the creation and development of a math problem-solving diagnostic test for teachers in order to improve students' mathematical problem-solving abilities.

From this perspective, empowering mathematics learning for mathematically strong students is quantitatively literate students. They can interpret the vast amounts of quantitative data they encounter every day and make balanced judgments based on those interpretations. They use mathematics in practical ways, from simple applications such as proportional reasoning or scale models to impactful statistical analysis and computer modeling. Students are as flexible thinkers with a broad range of thinking and perspectives to deal with new problems and situations. Students who are able to think analytically can be able to argue with others (Schoenfeld, 2016). Today, creativity is considered one of the most valuable attributes of a person (Jeffrey & Craft, 2001), and this leads to its universalization in modern world education (Kousoulas, 2010). Creativity is a multidimensional and complex phenomenon. The novelty of a child's creative ideas is not determined by his or her society but rather by prior knowledge. Meanwhile, a child's high creativity may not necessarily be sustained throughout childhood but may decline by the age of six. In other words, children who are very creative at an early age do not necessarily show their creative form later in life (Volchegorskaya et al., 2020).

Talent development requires creative application in the exploration of mathematical problems. Traditional teaching methods involving demonstration and practice using closed problems with predetermined answers do not adequately prepare students to be mathematically savvy. 21st century students, leave school with adequate computational skills but lack the ability to apply those skills in meaningful ways. If math is taught without providing creativity, the potential of students cannot be developed properly. Therefore, exceptionally gifted students are given the opportunity to appreciate the beauty of mathematics so that gifted students are given the opportunity to develop their talents fully (Mann, 2006). Knowledge is necessary for creative ideas to emerge, so the learning process has a significant influence on student creativity. This, in turn, suggests that learning styles are important in students' creative development (Sitar et al., 2016). Children's low achievement in mathematics is a consistent problem in many countries (Dowker, 2009). Cragg & Gilmore (2014) found that 21% of 11-year-olds completed primary school without achieving what was expected in math learning. Clayton & Gilmore (2015) also found that approximately 6-14% of school-aged children suffer from the persistent disease of math learning difficulties despite adequate achievement in other domains. These findings highlight the importance of analyzing variables related to the development of students' mathematical skills (Cueli et al., 2020). The study results show that students who live in mountainous areas and must go to school every day in coastal areas can learn math well. This is because teachers apply the proper methods and strategies during the learning process (Batlolona et al., 2019).

Capabilities in creative thinking processes and mathematical innovation are skills that every student must have. The ability to think and solve mathematics creatively fulfills the meaning of an individual's ability to think by creating new and different ideas to find new works, ideas that do not usually occur, original with precise and unique solutions. This uniqueness is a soft skill that is needed in the future (Catarino et al., 2019). Higher-order thinking skills categorize the capabilities in creative thinking, including mathematical creative thinking skills, which are considered necessary in the further education process (Kahveci & Akgul, 2019). Those are efforts to solve problems and raise ideas for thinking. Thinking is an ability that plays a vital role in determining the quality of human life (Wartono et al., 2018). In the brain, there is an area called the speech zone, which is found in the analytic mind, and its existence is to encourage the brain to respond to thoughts to create speech to whatever a person thinks about (Binder et al., 1997).

When teachers construct students in the creative thinking process in problem-solving, teachers need to understand students' learning styles. Teachers cannot force students to follow their learning style. In the teaching and learning process, the teacher must be flexible, meaning that the teacher must follow the learning style desired by the students (Leasa et al., 2017). The results of research conducted in 30 elementary schools in Ambon City showed that 88.7% of students used a learning style (unimodal), and 11.3% of students combined more than one learning style (multimodal). For unimodal learning styles, kinesthetic was most prevalent among male and female students, with a percentage of 58.6%, while visual was least prevalent, with a percentage of 6%. The study also revealed that multimodal learning styles were found in all bimodal, trimodal, and quadmodal combinations. The more the combination of learning styles, the less the frequency of determining students' learning styles (Leasa et al., 2018). Each student tends with their learning style. Students' ability to capture subject matter depends on their learning style. Many students decrease their learning achievement at school because they are forced to learn not according to their learning style (Leasa et al., 2020). Students will quickly master the subject matter by using their own (Graf et al., 2007). Learners with independent learning styles are those who rely on their learning abilities and like to think for themselves. These people have personal methods and strategies for learning. They have ideas about the subjects they study and try to learn more with their individual efforts (Wilson-Wünsch et al., 2016). Learners with a dependent learning style aim to learn only the necessary information and prefer environments that do not require them to take responsibility. Learners with a participatory learning style are primarily those who sit at the front of the class and engage in learning course activities. These people are eager to learn and like teachers who can analyze information that is useful to them (McGovern et al., 2017).

Learners with an avoidant learning style are students who are closed off to classroom activities and reluctant to learn about course content. Learners with collaborative learning styles learn by collaborating and sharing their views and skills with others. They like courses and projects that are done in groups. Learners with competitive learning styles learn how well others perform and want to get better (Öznacar et al., 2018). Previous research has found that there is a positive relationship between students' attitudes, learning independence, and learning styles (Ching-Chun Shih, 2001). Furthermore, several factors affect the way a person thinks and learns, namely physical, emotional, sociological, and environmental factors (Abedini et al., 2024). Some people like to learn in groups; others feel that working alone is the most effective. Others can learn with an authoritarian figure, such as a parent or teacher; others can learn with music in the background, and others need a quiet room. Some people need an organized and tidy work environment, but others prefer to lay everything out for all to see (Van Dinther et al., 2011). Thus, there is a relationship between learning style and a person's thought process in solving mathematics problems. Therefore, the purpose of this study was to describe the uniqueness of the creative thinking process of male Kinesthetic students in solving math problems in elementary school.

▪ METHOD

This research intends to obtain a description of the student's creative thinking process in solving problems that arise from the research subjects. An open-ended problem-solving test was given to obtain a description of students' creative thinking process in solving problems. Test results from students will be analyzed in depth based on indicators of students' creative thinking processes. Therefore, this type of research is qualitative exploratory research with the primary data in the form of writing (written test results) and words from the task-based interview, as well as observation data.

The subjects in this study were fifth-grade students of SD Negeri 7 Dobo, Aru Islands Regency. The fifth-grade students were chosen for the following reasons: (1) students have "sufficient" capabilities in the knowledge and experience of basic mathematics materials such as natural numbers, integers, whole numbers, rational numbers, and geometry, mainly flat and spatial figures. (2). The materials are elementary school mathematics materials that can be formed into problem-solving materials in everyday life that can stimulate students to generate and stimulate higher-level thinking, which will become the foundation for the next level. (3). A standardized learning style test will show students' tendencies towards their learning styles, namely Visual, Auditory, and Kinesthetic learning styles. (4). When viewed from the learning style, students at the elementary school level will tend to show their genuine attitude in the teaching and learning process so that the characteristics of students who have visual, auditory and kinesthetic learning styles can be seen. this writing is devoted to male subjects with a kinesthetic learning style.

The instruments used in this study consist of two types, namely the researcher himself as the main instrument and the auxiliary instrument. The auxiliary instrument is made by providing one open question that meets 3 indicators of the creative thinking process, namely the Generating ideas indicator, Planning Problem Solving and Producting problem solving and can also meet the creativity indicators, namely fluency, flexibility and novelty.

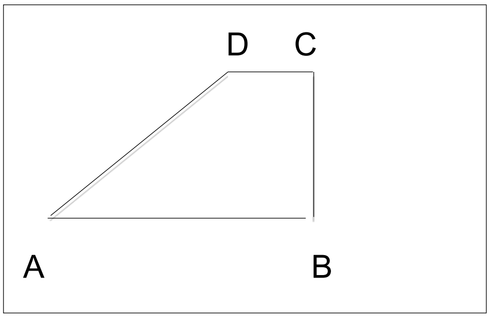
The data that has been obtained is then analyzed, starting with transcribing data, observation results, and interview results. Data transcripts were carried out based on the results of handy cam recordings and the results of the subject's work. Furthermore, data coding was carried out to facilitate categorization and keep the data within the research objectives. After the data transcript was complete, the next step was to conduct a data reliability test to obtain reliable data (consistent) and analyze the data. Data analysis in this study includes data categorization, data reduction, data interpretation, and conclusion drawing.

The uniqueness of students' creative thinking process in solving mathematics problems in this study can be seen through problems that spur three creative behaviors, namely fluency, flexibility, and novelty. It can be explained that (1). Mathematical problem solving meets the fluency indicator if students solve mathematical problems that allow more than one correct answer (2). Mathematical problem solving that meets the Fluency indicator if students in solving mathematical problems can use various approaches (more than one), correctly (3). Mathematics problem solving meets the novelty indicator if students can solve math problems correctly and there is one answer that is different, correct, and unusual done or solved by students at their stage of development or level of knowledge.

Problem

To answer the indicators in the creative thinking process, the teacher gave the following math problem-solving problem: "Jamal's garden is in the shape of a right-angled trapezoid, as shown in Figure 1! The length of AD = 60 m, AB = 45 m and BC = 20 m. Will Mr. Jamal divide his trapezoidal garden so that his two children get equal shares? (make a sketch). Find some other ways to divide Mr. Jamal's garden!

The collected data is then analyzed through transcription of data obtained from observations and interviews. Validation was done by comparing test and interview data. Furthermore, the author conducted data analysis by categorizing data, reducing data, interpreting data, and drawing conclusions



Figur 1. Trapezoidal land division system

▪ RESULT AND DISSCUSSION

The data collected are the results of written tests and in-depth interviews. Based on the data analysis, it can be explained that male subjects with kinesthetic learning styles in the process of solving math problems can be explained as follows:

Generating Ideas

Generating Ideas is to come up with ideas that are directly related to mathematical problems. These ideas arise from past knowledge as well as issues faced today. In this study, the subject correctly read the problem in his heart three times while observing Figure 1 in the problem, accompanied by hand movements by pointing to the problem he read so that he could bring up ideas by mentioning the known and questionable information in the math problem, and was able to correctly show the length of AD = 60 m, AB = 45 m, and BC = 20 m. Then, the subject could also bring up ideas by showing through his index finger movements as if drawing something, which was in his mind, and his mouth was mumbling while holding his chin as if he was thinking about a problem and the steps to solve it. The following interview results can strengthen this:

T : Well, you do this problem, of course, starting by reading it! (P gives the problem along with the paper to answer.)

S2 : S reads the problem silently while glancing at the picture of the problem, accompanied by hand movements, by pointing to the problem that is read until it is finished.

Teacher : Can you explain what the problem means?

S2 : (S reads the problem again and then explains the meaning of the problem to P). The shape of Mr. Jamal's land is like this picture. (S points to the picture in the problem). The length of PS = 60 meters, PQ = 45 meters, and QR = 20 meters. The land will be inherited by Mr. Jamal's two children, each of whom will get the same area.

Planning Problem Solving

Planing Problem Solving means choosing a specific plan to solve the problem. The results of the subject's work can be explained as: First planning, the subject will draw a right trapezoid, then will divide the right trapezoid into two equal areas. Next, calculate the area of each child's part using the formula, then show that the area of the first child's part is equal to the area of the second child's part. The following are excerpts of interviews between researchers and research subjects:

T : How do you plan to complete the distribution of Mr. Jamal's garden land to his two children?

S10 : Yes, we draw a right trapezoid, then we divide the right trapezoid into two equal parts, then calculate the area of each child's part using the formula, then show that the area of the first child's part is equal to the area of the second child's part.

Producing problem-solving

Producing problem solving means getting a problem solution that meets the aspects fluency, flexibility, and novelty. This study shows that: The subject solved the math problem based on the plan that had been prepared previously, step by step, according to the following interview excerpt:

Researcher : Based on your plan, how do you solve the problem of dividing Mr. Jamal's land to his two children?

Subject : (S sketches by moving his index finger, occasionally thinking, and his mouth mumbles while holding his chin, then makes a drawing like Figure 2 below.

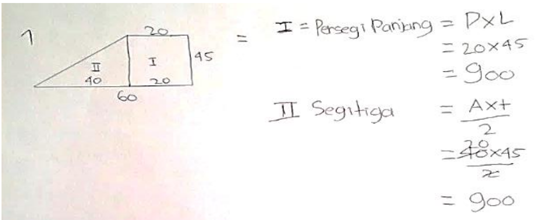


Figure 2. Completion with the first way

Furthermore, the Subject completed the second way as shown in Figure 3.

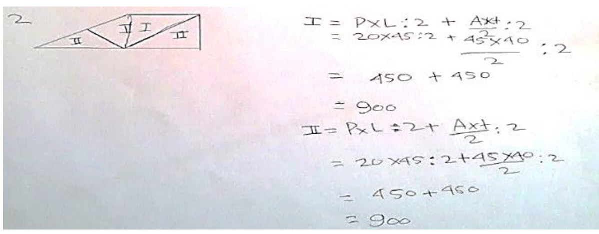


Figure 3. Problem-solving with the second way

The following are excerpts of interviews between teachers and students:

Researcher : Based on Figure 3 above, try to explain to me, the acquisition of the value of Part I = 900 and the value of part II = 900 too!

Subject : Well sir, it was a rectangle with length (p = 20 meters) and width (l = 45 meters) then a right triangle with base (a = 40 meters and height (t = 45), each divided by two, so obtained:

I is the part of Child I, with each part being a right triangle, namely: I = $\left(\frac{p\ x\ l}{2}\right)+\left(\frac{a\ x\ t}{2}\right)=\left(\frac{20\ x\ 45}{2}\right)+\left(\frac{40\ x\ 45}{2}\right)$ = 450 square meters + 450 square meters = 900 square meters.
II is the part of Child II = $\left(\frac{p\ x\ l}{2}\right)+\left(\frac{a\ x\ t}{2}\right)=\left(\frac{20\ x\ 45}{2}\right)+\left(\frac{40\ x\ 45}{2}\right)$
= 450 square meters + 450 square meters
= 900 square meters.
So, the area of child I is equal to the area of child II.

Researcher : Is there any other way to solve the problem of Mr. Jamal's Land Division to his two children?

Subject : yes sir, like the following solution:

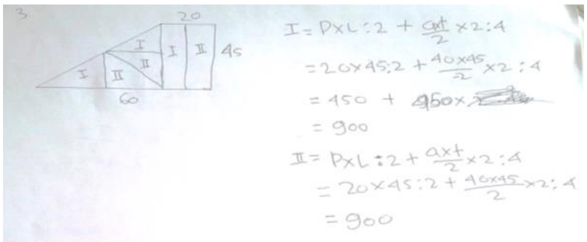


Figure 4. Completion with the third way

Researcher : Explain the settlement of Mr. Jamal's Land Division, which has been made in Figure 3 above!

Subject : Actually, the solution is the same as the solution in Figure 2 above. I think that:
1. The rectangle with length (p = 20 meters) and width (l = 45 meters) is divided in half so that the rectangle is divided into the first child and the second child (the shape of the drawing is divided in the middle like that drawing) (S pointed to the drawing he had made).
The right triangle with base (a = 40 meters) and height (t = 45 meters) is
2. divided by four so that each child gets two equal parts of the right triangle. Therefore, the child's share:

Child I = $\left(\frac{p\ x\ l}{2}\right)+\frac{\left(\frac{a\ x\ t}{2}\right)x2}{4}=\left(\frac{20\ x\ 45}{2}\right)+\frac{\left(\frac{40\ x\ 45}{2}\right)x2}{4}$

= 450 square meters + 450 m^2 = 900 m^2

Child II = $\left(\frac{p\ x\ l}{2}\right)+\frac{\left(\frac{a\ x\ t}{2}\right)x2}{4}=\left(\frac{20\ x\ 45}{2}\right)+\frac{\left(\frac{40\ x\ 45}{2}\right)x2}{4}$

= 450 m^2 + 450 m^2 = 900 m^2 .
So, the first child's share is equal to the second child's share.

Based on the description above, it can be concluded that the creative thinking products of elementary school students for male subjects with Kinesthetic Learning Styles, are as follows:

Fluency aspect

The subject solved the math problem based on the first plan, the second plan, and so on until the eighth plan. Based on these plans, the subject produced six correct answers. This can be clearly seen through the solution in Figure 2, where the subject solves the problem that begins by drawing a right Trapezoid, then divides the Right Trapezoid into two equal parts, namely one rectangular part with a length of 20 m and a width of 45 m, so that the area of the rectangle is L = p x l = 20 m x 45 m = 900 m2. then one other part of the area is in the form of a right triangle with a base of 40 m and a height of 45 m so that the area is L = 1/2 (a x t) = 1/2 (40 m x 45 m) = 900 m2. The rectangular part area is the first child part, and the right triangle part area is the second child part, so that the area of the first child part is the area of the second child part. Thus, male subjects with kinesthetic learning styles produce products that really fulfill the fluency aspect of solving problems.

Flexibility aspect

A subject is said to fulfill the aspect of flexibility, if the subject can solve problems with various methods and strategies correctly. This can be seen when solving math problems, the subject used four (4) different approaches in real terms: the subject divided the right trapezoid into two equal parts, divided it again into four equal parts, divided it again into six equal parts, and then divided it again into eight parts. All of these were done with the correct and valid approach according to the purpose of the mathematical problem, as seen in Figures 2, 3 and 4 above. Thus, male subjects with kinesthetic learning styles fulfill the flexibility aspect.

Novelty aspect

A subject is said to meet the aspect of novelty, if the subject is able to complete various solutions correctly and there is one correct and completely different and unique solution. This is evident at the time of the subject solves mathematical problems, always starting with drawing a right-angled trapezoid, then dividing the right-angled trapezoid into two parts, then four parts, until dividing the right-angled trapezoid into six parts. All of these can be solved correctly and validly. Also, some of his friends solve the same thing as the subject at his level of knowledge, but what is exciting and unique is that the subject was able to solve mathematical problems by dividing the right-angled trapezoid into eight (6) parts, namely 5 parts in the form of a triangle, one part in the form of a long square. This can be seen from the subject's work in solving the Land division problem. Here are the results of his work:

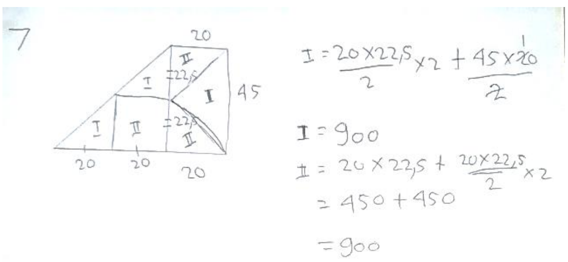


Figure 5. Dividing the right-angled trapezoid into six parts

Thus, male subjects with Kinesthetic learning styles in solving mathematical problems are genuinely unique and new at the subject's level of knowledge and can be said to have fulfilled the novelty aspect. Furthermore, the creative thinking process of male elementary school students with Kinesthetic learning style can be concluded as follows:

Table 1. Conclusion of the creative thinking process of male elementary school students in solving math problems based on Kinesthetic Learning Style

<table>
<tr><th>Process</th><th colspan="3">Explanation of students' thinking process in solving problems</th></tr>
<tr><td>Generating Ideas</td><td colspan="3">The subject correctly read the problem silently, observed Figure 1, and showed the problem read by mentioning the known and questionable information. Then, the subject can also bring up ideas by showing through the movement of his index finger as if drawing something, which is in his mind, and his mouth is mumbling while holding his chin as if he is thinking about a problem and the steps to solve it.</td></tr>
<tr><td>Planning Problem Solving</td><td colspan="3">Subjects can make plans by starting from simple things to complex things.</td></tr>
<tr><td rowspan="2">Producing Problem Solving</td><td>Fluency</td><td>Flexibility</td><td>Novelty</td></tr>
<tr><td>The subject solved the problem by making six solutions correctly, thus fulfilling the fluency aspect.</td><td>The subject made different strategies and solutions correctly, giving rise to flexibility in the solution tactics.</td><td>The subject can solve mathematical problems that are unique and new to him, fulfilling the aspect of novelty.</td></tr>
</table>

The subject solves math problems based on the first plan, the second plan, and so on until the sixth plan. Based on these plans, then the subject solved the problem by producing six correct answers. Thus, male subjects with kinesthetic learning styles in solving problems produce products that really fulfill the fluency aspect. This is in line with the opinion of Batlolona (2023) that fluency in problem-solving refers to the diversity of problem answers that students make correctly. Habib et al. (2024) stated that creative thinking is the ability to think divergently, which includes fluency, namely thinking with many ideas. In addition, fluency refers to the number of problems posed or questions generated by the teacher.

Creative thinking is a mental activity that develops or discovers new, aesthetic, constructive ideas related to the purpose of the concept. It also emphasizes intuitive and rational thinking outcomes. Creative thinking is a process that develops unusual ideas and produces new thoughts that have a broad scope. In this case, creative thinking can produce quality thinking. The creative process certainly cannot be carried out without the knowledge gained by developing thinking correctly. Creative thinking can be annulled as the ability to create something different and new or as the ability to see new relationships between elements that have not existed before. An individual will carry out the thinking process when solving problems until a solution is found; this is because, with a problem, the brain will practice processing new information with new ideas (Karunarathne &

Calma, 2024). Creative thinking is the result of practice. Creative thinking must be trained seriously to produce new products. One can become creative by training oneself to think.

In the field of education, research has consistently emphasized mathematical creative thinking as an essential component of 21st-century skills. In the ever-evolving educational landscape, mathematical creative thinking (MCT) has transcended traditional boundaries, emerging as an essential skill that can be applied across a range of disciplines, such as mathematics, music, engineering, and science. In this regard, the cultivation of MCT becomes a collaborative endeavor and an essential part of the complete process of advanced mathematical thinking (Schoevers et al., 2020). MCTs not only prepare students to deal with the intricacies of mathematics but also face real-world challenges that include the fields of science, technology, and engineering. Beyond academics, MCT equips individuals with the tools to face challenges with confidence and formulate innovative solutions that go beyond conventional boundaries. As such, students who are confident in their creative abilities tend to perform better academically. Students who consider themselves creative are more likely to think creatively in the context of mathematics (Suherman, 2024).

Furthermore, the subject used four (4) different approaches, namely, the subject divided the right trapezoid into two equal parts, then divided the right trapezoid again into four equal parts. The subject divided the right trapezoid again into six equal parts, all of which were done with the correct and valid approach according to the purpose of the mathematical problem. Thus, the male subject's kinesthetic learning style fulfills the flexibility aspect. This is in line with the opinion of Star & Rittle-Johnson, (2008) that flexibility in problem solving refers to the ability of students to solve problems in a variety of different ways. Furthermore, Star et al. (2022) stated that creative thinking is the ability to think divergently, which includes flexibility, namely thinking in many different categories or approaches. Although increasingly recognized as a construct of importance, where many aspects affect it, mathematical flexibility is not well understood. Most lacking in the literature on flexibility are studies exploring similarities and differences in students' repertoires of strategies for solving algebraic problems in different countries with different educational systems and curricula.

Then, the subject solves mathematical problems, always starting with drawing a right trapezoid, then dividing the right trapezoid into two parts, then four parts, until dividing the right trapezoid into six parts. All of these can be solved correctly and validly. Some of his friends also solve the same thing as the subject at his level of knowledge, but what is exciting and unique is that the subject is able to solve mathematical problems by dividing the right trapezoid into six parts, namely 5 parts in the form of a triangle, one part in the form of a rectangle. Kalyuga et al. (2010) stated that creative thinking is the ability to reveal new relationships, see things from a new perspective, and form new combinations of two or more concepts that have been previously mastered.

The evaluation of learning styles showed Accommodator to be a minority among architecture students, which is in line with the study and in contrast to the findings of Kolb (1981), who reported Accommodator as the preferred style of architecture professionals (Demirbaş & Demirkan, 2003). The low number of active learners indicates students' lack of exposure to experiential and hands-on learning. It is reported that Accommodators performed the highest in the second year. The differences in teacher scores and creativity tests suggest that, although some things show that students are creative by nature, they are not able to convey this in their design tasks. The findings also imply that design briefs and presentation criteria may be detrimental to specific learning styles. Since learning styles have a definite impact on creativity, the unique differences among both students, as well as the use of Experiential Learning Theory, which is essentially a framework for understanding learning capacities, can contribute to the development of unique skills and abilities in various design settings (Taneja et al., 2023)

In an Indian study of 121 undergraduate medical students, 53.8% were unimodal learners, and 46.2% were multimodal learners. Among the unimodal learners, the most dominant were visual learners (24.1%). There was no significant effect of gender on learning style preference among medical students. The deep approach was the dominant learning approach among medical students. The mean score for strategic approach was significantly higher in females than male medical students. Conclusion: Successful learning will only be realized if teaching and assessment methods are aligned with students' learning preferences. Students who are aware of their learning styles and approaches may be motivated to apply techniques that best suit their learning styles, and this may result in greater educational satisfaction (Soundariya et al., 2017).

▪ CONCLUSION

Based on the findings of this study, it can be concluded that male students with kinesthetic learning styles in solving math problems have met the indicators of the creative process, namely: a) The subject read the problem silently, observed Figure 1, and showed the problem he read by mentioning the known and questionable information. The subject can also come up with ideas by showing through the movement of his index finger accompanied by his mouth mumbling while holding his chin as if he is thinking about a problem and the steps to solve it; b) planning problem-solving by starting from simple things to complex things; c) The subject can also produce unique and new products by fulfilling the three indicators of creativity, namely Fluency, flexibility, and Originality.

▪ REFERENCES

Abedini, A., Abedin, B., & Zowghi, D. (2024). A framework of environmental, personal, and behavioral factors of adult learning in online communities of practice. Information Systems Frontiers, 26(3), 1201–1218. https://doi.org/10.1007/s10796-023-10417-2

Batlolona. (2023). Mental models and creative thinking skills in students’ physics learning. Creativity Studies, 16(2), 433–447.

Batlolona, J., Laurens, T., Leasa, M., Batlolona, M., Kempa, R., & Enriquez, J. J. (2019). Comparison of problem based learning and realistic mathematics education to improve students academic performance. Jurnal Pendidikan Progresif, 9(2), 185–197. https://doi.org/10.23960/jpp.v9.i2.201921

Bevan, D., & Capraro, M. M. (2021). Posing creative problems: a study of elementary students’ mathematics understanding. International Electronic Journal of Mathematics Education, 16(3), 1–10. https://doi.org/10.29333/iejme/11109

Binder, J. R., Frost, J. A., Hammeke, T. A., Cox, R. W., Rao, S. M., & Prieto, T. (1997). Human brain language areas identified by functional magnetic resonance imaging. Journal of Neuroscience, 17(1), 353–362. https://doi.org/10.1523/jneurosci.17-01-00353.1997

Catarino, P., Nascimento, M. M., Morais, E., Campos, H., & Vasco, P. (2019). Breaking the habit: engineering students' understanding of mathematical creativity. European Journal of Engineering Education, 44(4), 449–460. https://doi.org/10.1080/03043797.2017.1367760

Cevikbas, M., & Kaiser, G. (2020). Flipped classroom as a reform-oriented approach to teaching mathematics. ZDM - Mathematics Education, 52(7), 1291–1305. https://doi.org/10.1007/s11858-020-01191-5

Ching-Chun Shih. (2001). Web-based learning: relationships among student motivation, attitude, learning styles, and achievement. Journal of the American Chemical Society, 123(10), 2176–2181.

Chirinda, B., & Barmby, P. (2018). South African grade 9 mathematics teachers' views on the teaching of problem solving. African Journal of Research in Mathematics, Science and Technology Education, 22(1), 114–124. https://doi.org/10.1080/18117295.2018.1438231

Clayton, S., & Gilmore, C. (2015). Inhibition in dot comparison tasks. ZDM - Mathematics Education, 47(5), 759–770. https://doi.org/10.1007/s11858-014-0655-2

Cragg, L., & Gilmore, C. (2014). Skills underlying mathematics: The role of executive function in the development of mathematics proficiency. Trends in Neuroscience and Education, 3(2), 63–68. https://doi.org/10.1016/j.tine.2013.12.001

Cueli, M., Areces, D., García, T., Alves, R. A., & González-Castro, P. (2020). Attention, inhibitory control and early mathematical skills in preschool students. Psicothema, 32(2), 237–244. https://doi.org/10.7334/psicothema2019.225

Demirbaş, O. O., & Demirkan, H. (2003). Focus on architectural design process through learning styles. Design Studies, 24(5), 437–456. https://doi.org/10.1016/S0142-694X(03)00013-9

Dowker, A. (2009). Use of derived fact strategies by children with mathematical difficulties. Cognitive Development, 24(4), 401–410. https://doi.org/10.1016/j.cogdev.2009.09.005

Fenanlampir, A., Batlolona, J. R., Divinubun, S., & Leasa, M. (2024). Emotional skills with homogeneity psycho cognition strategy: a study of physical education in elementary schools. Retos, 54, 850–856. https://doi.org/10.47197/retos.v54.104283

Graf, S., Viola, S. R., Leo, T., & Kinshuk. (2007). In-depth analysis of the Felder-Silverman learning style dimensions. Journal of Research on Technology in Education, 40(1), 79–93. https://doi.org/10.1080/15391523.2007.10782498

Habib, S., Vogel, T., Anli, X., & Thorne, E. (2024). How does generative artificial intelligence impact student creativity? Journal of Creativity, 34(1), 100072. https://doi.org/10.1016/j.yjoc.2023.100072

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. Sustainable Operations and Computers, 3, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Kahveci, N. G., & Akgul, S. (2019). The relationship between mathematical creativity and intelligence : a study on gifted and general education students. Gifted and Talented International, 00(00), 1–12. https://doi.org/10.1080/15332276.2019.1693311

Kalyuga, S., Renkl, A., & Paas, F. (2010). Facilitating flexible problem solving: A cognitive load perspective. Educational Psychology Review, 22(2), 175–186. https://doi.org/10.1007/s10648-010-9132-9

Karunarathne, W., & Calma, A. (2024). Assessing creative thinking skills in higher education: deficits and improvements. Studies in Higher Education, 49(1), 157–177. https://doi.org/10.1080/03075079.2023.2225532

Kaufmann, O. T., & Ryve, A. (2023). Teachers' framing of students' difficulties in mathematics learning in collegial discussions. Scandinavian Journal of Educational Research, 67(7), 1069–1085. https://doi.org/10.1080/00313831.2022.2115134

Laurens, T., Batlolona, F. A., Batlolona, J. R., & Leasa, M. (2018). How does realistic mathematics education (RME) improve students' mathematics cognitive achievement? Eurasia Journal of Mathematics, Science and Technology Education, 14(2), 569–578. https://doi.org/10.12973/ejmste/76959

Leasa, M., Batlolona, J. R., Enriquez, J. J., & Kurnaz, M. A. (2018). Determination of elementary students' learning styles reviewed from gender aspects. Journal of Education and Learning (EduLearn), 12(3), 478–486. https://doi.org/10.11591/edulearn.v12i3.8978

Leasa, M., Corebima, A. D., & Batlolona, J. R. (2020). The effect of learning styles on the critical thinking skills in natural science learning of elementary school students. Elementary Education Online, 19(4), 2086–2097. https://doi.org/10.17051/ilkonline.2020.763449

Leasa, M., Corebima, A. D., Ibrohim, & Suwono, H. (2017). Emotional intelligence among auditory, reading, and kinesthetic learning styles of elementary school students in Ambon-Indonesia. International Electronic Journal of Elementary Education, 10(1), 83–91. https://doi.org/10.26822/iejee.2017131889

Li, Y., & Schoenfeld, A. H. (2019). Problematizing teaching and learning mathematics as "given" in STEM education. International Journal of STEM Education, 6(1), 1–13. https://doi.org/10.1186/s40594-019-0197-9

Mann, E. L. (2006). Creativity: The essence of mathematics. Journal for the Education of the Gifted, 30(2), 236–260. https://doi.org/10.4219/jeg-2006-264

McGovern, E. F., Luna-Nevarez, C., & Baruca, A. (2017). Utilizing mobile devices to enrich the learning style of students. Journal of Education for Business, 92(2), 89–95. https://doi.org/10.1080/08832323.2017.1281213

Mršnik, S., Cotič, M., Felda, D., & Doz, D. (2023). Teachers' attitudes towards mathematics problem-solving. International Journal of Instruction, 16(2), 823–836. https://doi.org/10.29333/iji.2023.16243a

Öznacar, B., Şensoy, Ş., & Satilmiş, A. (2018). Learning styles and emotional intelligence levels of university teacher candidates. Eurasia Journal of Mathematics, Science and Technology Education, 14(5), 1837–1842. https://doi.org/10.29333/ejmste/85419

Phonapichat, P., Wongwanich, S., & Sujiva, S. (2014). An analysis of elementary school students' difficulties in mathematical problem solving. Procedia - Social and Behavioral Sciences, 116(2012), 3169–3174. https://doi.org/10.1016/j.sbspro.2014.01.728

Rattan, A., Good, C., & Dweck, C. S. (2012). "It's ok - Not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students. Journal of Experimental Social Psychology, 48(3), 731–737. https://doi.org/10.1016/j.jesp.2011.12.012

Rizky Novriani, M., & Surya, E. (2017). Analysis of student difficulties in mathematics problem solving ability at MTs Swasta IRA Medan. International Journal of Sciences: Basic and Applied Research (IJSBAR) International Journal of Sciences: Basic and Applied Research, 33(3), 63–75.

Schoenfeld, A. H. (2016). Learning to think mathematically: problem solving, metacognition, and sense making in mathematics (Reprint). Journal of Education, 196(2), 1–38. https://doi.org/10.1177/002205741619600202

Schoevers, E. M., Kroesbergen, E. H., & Kattou, M. (2020). Mathematical creativity: a combination of domain-general creative and domain-specific mathematical skills. Journal of Creative Behavior, 54(2), 242–252. https://doi.org/10.1002/jocb.361

Sitar, A. S., Černe, M., Aleksić, D., & Mihelič, K. K. (2016). Individual Learning Styles and Creativity. Creativity Research Journal, 28(3), 334–341. https://doi.org/10.1080/10400419.2016.1195651

Soundariya, K., Deepika, V., & Kalaiselvan, G. (2017). A study on the learning styles and learning approaches among medical students. National Journal of Physiology, Pharmacy and Pharmacology, 7(10), 1020–1025. https://doi.org/10.5455/njppp.2017.7.0413011052017

Star, J. R., & Rittle-Johnson, B. (2008). Flexibility in problem solving: The case of equation solving. Learning and Instruction, 18(6), 565–579. https://doi.org/10.1016/j.learninstruc.2007.09.018

Star, J. R., Tuomela, D., Prieto, N. J., Hästö, P., Palkki, R., Abánades, M., Pejlare, J., Jiang, R. H., Li, L., & Liu, R. De. (2022). Exploring students’ procedural flexibility in three countries. International Journal of STEM Education, 9(1), 1–18. https://doi.org/10.1186/s40594-021-00322-y

Suherman, S. (2024). Role of creative self-efficacy and perceived creativity as predictors of mathematical creative thinking: Mediating role of computational thinking. Thinking Skills and Creativity, 53, 1–14. https://doi.org/10.1016/j.tsc.2024.101591

Taneja, R., Taneja, P., & Goel, M. (2023). Impact of learning styles on student’s creativity: insights from India. ISVS E-Journal, 10(10), 143–153. https://doi.org/10.61275/ISVSej-2023-10-10-10

Van Dinther, M., Dochy, F., & Segers, M. (2011). Factors affecting students’ self-efficacy in higher education. Educational Research Review, 6(2), 95–108. https://doi.org/10.1016/j.edurev.2010.10.003

Volchegorskaya, Y., Zhukova, M. V, Frolova, E. V, & Shishkina, K. I. (2020). The relationship between creativity and subjective well-being of children. Educación • Education • Educação •, 41(23), 74–80.

Wartono, W., Diantoro, M., & Bartlolona, J. R. (2018). Influence of problem based learning learning model on student creative thinking on elasticity topics a material. Jurnal Pendidikan Fisika Indonesia, 14(1), 32–39. https://doi.org/10.15294/jpfi.v14i1.10654

Wilson-Wünsch, B., Beausaert, S., Tempelaar, D., & Gijselaers, W. (2016). Expertise development of hospitality students: do personality, emotional intelligence, and learning style matter?. Journal of Hospitality and Tourism Education, 28(3), 155–167. https://doi.org/10.1080/10963758.2016.1190595

Yayuk, E., & Husamah, H. (2020). The difficulties of prospective elementary school teachers in item problem solving for mathematics: Polya's steps. Journal for the Education of Gifted Young Scientists, 8(1), 361–378. https://doi.org/10.17478/jegys.665833