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EXPLORING THE IMPACT OF COGNITIVE ASPECT ON CREATIVE REASONING IN SOLVING MATHEMATICAL PROBLEM

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Abstract

The low development of creative reasoning among prospective mathematics teachers is caused by the dominance of imitative reasoning and the limitations of working memory capacity in the problem-solving process. Therefore, this study is essential to investigate the role of working memory capacity in enhancing the effectiveness of creative reasoning to support more meaningful mathematics learning. This study aims to examine the effect of prospective mathematics teachers' working memory capacity on their creative reasoning and its processes. This study employed a mixed-method sequential explanatory design. A total of 73 prospective mathematics teachers participated in the study, selected through cluster random sampling. The Operating Span Task (OSPAN Test) was used to assess working memory capacity. A previously developed problem-solving test was used to measure creative reasoning, based on the indicators of novelty, plausibility, and mathematical foundation. Quantitative data were analyzed using linear regression techniques, while qualitative data were analyzed through three stages: data condensation, data display, and conclusion drawing. The results indicate that working memory capacity significantly influences the creative reasoning ability of prospective mathematics teachers. Specifically, it was found that 14% of the creative reasoning demonstrated in problem-solving is attributable to working memory capacity. Prospective mathematics teachers with high working memory capacity demonstrate flexibility and fluency in generating new ideas to solve problems, are able to use and connect mathematical concepts appropriately, and provide logical arguments to support the validity of their ideas. In contrast, those with low working memory capacity do not exhibit these characteristics.

Keywords: Cognitive aspect; creative reasoning; mathematics problem.

Abstrak

Rendahnya pengembangan penalaran kreatif pada calon guru matematika diakibatkan adanya dominasi penggunaan penalaran imitatif serta keterbatasan kapasitas memori kerja dalam proses pemecahan masalah, sehingga penelitian ini menjadi urgen untuk mengkaji peran kapasitas memori kerja dalam meningkatkan efektivitas penalaran kreatif guna mendukung pembelajaran matematika yang lebih bermakna. Penelitian ini bertujuan untuk mengetahui pengaruh kapasitas memori kerja calon guru matematika terhadap penalaran kreatif dan prosesnya. Penelitian ini menggunakan desain mixed-method sequential explanatory. Sebanyak 73 calon guru matematika berpartisipasi dalam penelitian ini, yang diperoleh menggunakan cluster random sampling. Operating Span Task (OSPAN Test) diterapkan untuk menilai kapasitas memori kerja. Pada penelitian ini digunakan tes pemecahan masalah yang telah dikembangkan sebelumnya untuk menilai penalaran kreatif, dengan mempertimbangkan indikator penalaran kreatif: kebaruan (novelty), kelayakan (plausibility), dan dasar matematis (mathematical foundation). Analisis data kuantitatif dilakukan menggunakan teknik regresi linier, sedangkan data kualitatif dianalisis melalui tiga tahap: data condensation, data display, dan conclusion drawing. Hasil penelitian menunjukkan bahwa kapasitas memori kerja secara signifikan memengaruhi kemampuan penalaran kreatif calon guru matematika. Secara khusus, ditemukan bahwa 14% penalaran kreatif yang ditunjukkan oleh calon guru matematika dalam pemecahan masalah disebabkan oleh kapasitas memori kerja. Calon guru matematika dengan kapasitas memori kerja tinggi bersifat fleksibel dan lancar dalam menemukan ide-ide baru untuk memecahkan masalah, mampu menggunakan dan menghubungkan konsep matematika dengan benar, serta memberikan argumen logis untuk mendukung kebenaran ide yang dibuat. Sementara itu, calon guru matematika dengan kapasitas memori kerja rendah tidak menunjukkan hal tersebut.

***Kata kunci**: Aspek kognitif; masalah matematika; penalaran kreatif.*

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INTRODUCTION

Creative reasoning is a sequence of cognitive processes employed to formulate statements and arrive at conclusions while addressing a problem or task ((Boesen et al., 2018); (Norqvist et al., 2019)). In this context, creative reasoning is a logical thinking process encompassing a series of thoughts and the capacity to reason and draw conclusions. Many individuals may not possess a comprehensive understanding of creative reasoning or the methods to cultivate it, which can impede their ability to engage in innovative thinking and devise novel solutions. Furthermore, the development of creative reasoning often necessitates extensive practice and training.

Creative reasoning plays a crucial role for prospective mathematics teacher candidates. It fosters a deeper understanding of mathematical concepts through logical argumentation. Logical arguments support the conclusions and decisions derived from creative reasoning. As noted by Marchisio et al. (2022), creative reasoning is a logical thinking process that facilitates the attainment of conclusions. This cognitive approach enables prospective mathematics teachers to perceive mathematics from diverse perspectives, enhancing their comprehension of mathematical concepts. Such an understanding is instrumental in enabling them to articulate these concepts clearly to their students. Educators of prospective mathematics teachers should consider encouraging these prospective mathematics teachers to enable students to engage in volition-enabling prompts through problem-solving, which is a central component of mathematics teaching (Fu & Kartal, 2023). Furthermore, creative reasoning contributes to the enhancement of problem-solving abilities. Lithner (2017), creative reasoning is a cognitive framework that formulates opinions and leads to conclusions during problem-solving. Creative reasoning is pertinent to completing mathematical tasks, encompassing practice exercises, examination questions, and other related assignments. Further, argumentation constitutes a component of creative reasoning utilised to validate the correctness of the reasoning employed (Lithner, 2017).

The creative reasoning approach is more effective than the algorithmic one concerning memory retrieval and knowledge construction (Johansson, 2016). Lithner (2017) further states that creative reasoning is more efficient than imitative reasoning in completing specific tasks. Consequently, creative reasoning is a suitable method for addressing mathematical problems. Nevertheless, prospective mathematics teacher students are infrequently encouraged to employ creative reasoning when solving mathematical problems. Instead, they are predominantly guided to utilise imitative reasoning to complete their assignments. This trend adversely affects reasoning skills development among prospective mathematics teacher students, as problem-solving in mathematics education is often confined to conventional procedures. Furthermore, opportunities for the cultivation of creative reasoning are seldom provided in both mathematics practice tasks and routine exercises. In mathematics, it is also important to practice problem-solving and higher-order skills (Öztürk et al., 2020). The cognitive domain is related to problem-solving, skills essential for everyday life and other areas, including science and technology. The attention to individual differences and the provocations during the challenging and alternative phase

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stimulates the emergence of new ideas that contribute to improving individuals' mathematical creativity (Shodiq et al., 2023).

According to Lerik et al. (2020), direct objects in mathematics learning encompass facts, concepts, operations, and principles. Engaging with abstract mathematical objects necessitates cognitive activity for their retention. In higher education, mathematics is presented to students primarily through mathematical problems. Furthermore, creative reasoning significantly enhances problem-solving capabilities by strengthening critical thinking and metacognitive processes, which enable individuals to develop more effective, reflective, and innovative solution strategies (Liu et al., 2025). Solving these problems demands a foundational understanding of various mathematical domains, including geometry, statistics, and algebra, as well as the abstract objects inherent within these fields. In addition to possessing mathematical knowledge, students must develop problem-solving skills. Lerik et al. (2020) said that it posits that problem-solving constitutes a cognitive process wherein the brain endeavours to identify solutions to specific problems or to achieve designated objectives. According to Khusna et al. (2024), problem-solving is a cognitive process of the brain that involves finding solutions to a given problem or a way to achieve a specific goal. strengthening cognitive aspects through targeted training can significantly enhance students' creative reasoning in solving mathematical problems by improving their ability to generate flexible, origi-nal, and effective solution strategies (Ritter & Mostert, 2017). The findings of this study suggest that the creative reasoning approach is more effective than the algorithmic reasoning approach in terms of memory retrieval and know-ledge construction. Effective information processing is essential to problem-solving success and is closely linked to the functioning of working memory.

Working memory, integral to various cognitive tasks, is characterised by its limited capacity. Working memory is a system with a restricted capacity responsible for the active maintenance, manipulation, and retrieval of task-relevant information necessary for ongoing cognitive processes. Furthermore, working memory is significantly constrained in duration and capacity due to interference among stored representations, which affects individuals' ability to process and retain information effectively during complex cognitive tasks (Oberauer et al., 2016). Problem-solving tasks often demand substantial amounts of information and sustained attention, which underscores the limitations of working memory as a potential hindrance to effective infor-mation processing. During the problem-solving process, individuals must gather information that aids in comprehending the problem at hand. Successful problem-solving is contingent upon effectively executing this process, which is inherently linked to working memory capacity (WMC). Jarosz et al. (2019)emphasise that working memory capacity (WMC) is crucial for numerous cognitive processes, including problem-solving.

This study aims to examine the role of working memory capacity in supporting prospective mathematics teachers' creative reasoning during mathematical problem-solving. The research focuses on how students construct logical arguments, develop non-routine strategies, and formulate conclusions in solving mathematical tasks.

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METHOD

This research used a mixed-method sequential explanatory design. Quantitative methods were used to determine the effect of working memory capacity on creative reasoning, and qualitative methods were used to examine the creative reasoning process in problem-solving.

1. Sample

The sample selection method employed in this research was cluster random sampling. The sample comprised two clusters: second-year students and third-year students. One class was randomly selected from each cluster. Seventy-three mathematics education students (prospective mathematics teachers) from STKIP PGRI Bangkalan, Indonesia, aged between 18 and 23, participated in this study.

Data regarding working memory capacity were obtained through the OSPAN test, a computer-based assessment featuring automatic timing. For details see in Juniati and Budayasa (2020). This test includes mathematical operations such as addition, subtraction, multiplication, and division. The data obtained are presented in Table 1.

Table 1 Subject Selection Process

Number of participants	Working Memory Capacity Category	
	High	Low
73	35	38

Source: field study (2025)

Scores for creative reasoning are collected using a problem-solving test. The problem-solving assignment is an essay with geometry material. The test was developed considering creative reasoning indicators: novelty, plausibility, and mathematical foundation.

Andi has a house equipped with a large garden. In the middle of the garden, there is a rectangular fish pond. On the side of the pool, there is a 1-meter-wide road that surrounds it. The road will be installed with attractive gradations of ceramic shapes. The ceramic forms provided are a right triangle, with a right side length of 20 cm, a square with a side of 20 cm, a Rectangle with dimensions 40 cm x 20 cm, a Parallelogram with parallel side length = 40 cm, height = 20 cm, and s (hypotenuse) = 20√2 cm, Right trapezoid with parallel side lengths respectively 40 cm and 20 cm, and height 20 cm, Bishop's hat has a base length of 40 cm, parallel sides 20 cm and a height of 40 cm. Mr Andi's fish pond measures 2x3 meters. Andi wanted the ceramics installed without cutting to make it look beautiful and neat. Make the ceramic installation models as varied as possible on the road, provided all ceramic shapes must be installed. Explain your answer!

Figure 1. Problem-Solving Task

Figure 1 shows the problem-solving task provides participants with the opportunity to reason creatively so that they can complete the task based on the mathematical knowledge stored in their working memory and their creativity.

2. Data Analysis

This study analyses the OSPAN test's effectiveness in measuring working memory capacity. In this test, each number to be remembered is displayed for four seconds, during which participants are also required to perform specific calculations.

Upon completing the task, participants are allotted ten seconds to accurately recall and write down all the numbers they were instructed to remember. The working memory capacity score ranges from 0 to 100. This study employs the quartile separation technique outlined by Juniati & Budayasa

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(2020b) about the OSPAN task. Operation Span Task (OSPAN Task) measures working memory capacity. These OSPAN Task Results will be the basis for grouping the sample into two categories: high working memory capacity and low working memory capacity. Participants with OSPAN Task scores above 60% are included in the high working memory capacity category, and Participants with OSPAN Task scores less than or equal to 60% are included in the low working memory capacity category. While the instrument utilised is similar to existing tools, it features minor variations in the operations and numbers to be retained. The validity of the working memory assessment instrument is evaluated through content validity, which involves expert review to ascertain whether the instrument effectively measures its intended construct.

Additionally, the problem-solving test assesses creative reasoning by presenting participants with non-routine problems. An assessment rubric evaluates the creativity level demonstrated in each response.

Table 2 Assessment Criteria for Creative Reasoning in Non-Routine Problem-Solving Tasks

Assessment Aspect	**Description**	**Maximum Score**
Novelty	The ability to generate new ideas or strategies in problem-solving. The score is determined based on the flexibility and number of ideas produced; the more diverse the ideas, the higher the score.	30
Plausibility	The ability to provide logical arguments to support the validity of the ideas or strategies developed; the more logical the arguments, the higher the score.	30
Mathematical Foundation	Accuracy in applying mathematical concepts in solving problems.	20
Total Maximum Score		**80**

Non-routine problem solving tasks are assessed based on novelty, samples that are able to create new ideas or strategies in solving are given a maximum score of 30, this score is given based on the flexibility of new ideas created, the more ideas or strategies, the score will reach the maximum value. Another aspect is plausibility, this aspect is given a maximum score of 30. The more logical the arguments given to support the truth of the idea or strategy created, the maximum score will be. The final aspect is the mathematical foundation, in this aspect the sample is given a maximum score of 20. This aspect relates to the accuracy of using mathematical concepts in solving problems. The scoring for this test ranges from 0 to 80, with the final score calculated by dividing the total score obtained by the maximum possible score and multiplying by 100.

The data obtained was validated using the triangulation method by giving the problem-solving test again at different times to assess the consistency of the answers given by the prospective mathematics teacher. Qualitative data was analysed through condensation, exposure, and conclusion drawing.

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First, participant work and interview data are presented and grouped to consider their suitability. Then, the data is sorted and reduced, where information that contains information relevant to indicators of creative reasoning is used.

RESULTS AND DISCUSSION

1. Quantitative Analysis

This study examines the effect of working memory capacity on the creative reasoning abilities of prospective mathematics teachers in problem-solving and describes the creative reasoning process. The effect of working memory capacity on creative reasoning was analysed using multiple regression tests. The quantitative data derived from the regression analysis of working memory capacity (WMC) about the creative reasoning.

Table 3. Summary Output of Regression Analysis

Regression Statistics	
Multiple R	0.396703
R Square	0.157373
Adjusted R Square	0.145505
Standard Error	24.51496
Observations	73

Source: field study (2025)

Based on the data presented in Table 3, the regression model exhibits a multiple R-value of 0.396707, indicating a relationship between the independent and dependent variables. The R-squared value of 0.157373 suggests that the independent variable can account for approximately 15.7% of the variance in the dependent variable. This finding implies that the impact of working memory capacity on the creative reasoning abilities of prospective mathematics teachers in solving mathematical problems is categorised as low. Furthermore, the Adjusted R-squared value is 0.145505, indicating that 14% of the problem-solving creative reasoning exhibited by prospective mathematics teachers is influenced by working memory capacity. It was observed that working memory capacity positively affects mathematical performance, including basic and advanced mathematical skills and problem-solving abilities. At the same time, the remaining variance is attributed to other factors. Additionally, assessing working memory in children who have completed formal education strongly predicts reading and numeracy skills.

Table 4. Creative Reasoning in Mathematical Problem Solving and WMC, ANOVA

	df	**SS**	**MS**	**F**	**Significance F**
Regression	1	7969.237	7969.237	13.26033	0.000511
Residual	71	42669.8	600.9832		
Total	72	50639.04			

Source: field study (2025)

The data presented in Table 4 shows that the regression analysis yields one degree of freedom (df) for regression and 28 df for residuals. The analysis results indicate that the sum of squares (SS) for the regression is 7969.15, while the SS for the residuals is 42669.8, resulting in a total SS of 50639.04. The mean square (MS) is calculated by dividing the SS by the respective df for each component. In the case of regression, the MS is equivalent

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to the SS due to the singular df. The F-ratio, or F value, derived from this analysis is 13.26033, with a significance value of 0.000511. The F value and its significance are utilised to evaluate the null hypothesis, which posits that there is no relationship between the independent and dependent variables within the regression model. Given that the significance of F is below the conventional alpha level of 0.05, we can reject the null hypothesis. This leads to the conclusion that at least one of the independent variables exerts a significant effect on the dependent variable. Specifically, it suggests that working memory capacity significantly influences the creative reasoning abilities of prospective mathematics teacher students when addressing mathematical problems. Furthermore, working memory capacity has been observed to positively impact mathematical performance, encompassing basic and advanced math skills and problem-solving abilities (Price et al., 2007). Working memory capacity positively affected math performance (basic and advanced math skills, problem-solving skills) (Juniati & Bidayasa, 2022). Also mentioned that working memory capacity significantly influences the creative reasoning of prospective mathematics teachers in solving mathematical problems.

Table 5. Coefficients Output of Creative Reasoning and WMC

	Coefficients	**Standard Error**	**t Stat**	**P-value**	**Lower 95%**	**Upper 95%**
Intercept	32.51966	9.047989	3.594131	0.000597	14.47848	50.56083
WMC	0.472466	0.129746	3.641474	0.000511	0.21376	0.731172

Source: field study (2025)

The regression output presented in Table 5 shows the coefficients for each variable in the regression model. The intercept variable represents the estimated constant value in the regression model, while WMC denotes the coefficient for the independent variable, working memory capacity. The standard error quantifies the accuracy of the estimated coefficient; a smaller value indicates greater precision. The t-statistic, or t-value, assesses the significance of the variable's influence on the dependent variable, with higher values indicating greater significance. The p-value serves as a measure of the statistical significance of a coefficient; a p-value less than the conventional alpha level of 0.05 suggests that the coefficient is statistically significant. The confidence interval, comprising the lower and upper 95% bounds, indicates the range within which the actual population value is expected to lie with 95% confidence. The data analysis from this regression model reveals that the coefficient for WMC exhibits a relatively high t-statistic and a low p-value (0.000511), indicating a significant relationship between WMC and the creative reasoning abilities of prospective mathematics teacher students. This finding is corroborated by existing research on the relationship between children's working memory and their learning and achievement in mathematics (Bos et al., 2013). In the regression model represented by the equation $Y = 32.51966+0.472466X$, it can be interpreted that when X equals 0, Y equals 32.51966. If X takes on a

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positive value of 1, Y equals 32.51966+ 0.472466.

As the value of X increases, Y also increases, suggesting that a higher working memory capacity is associated with an elevated level of reasoning

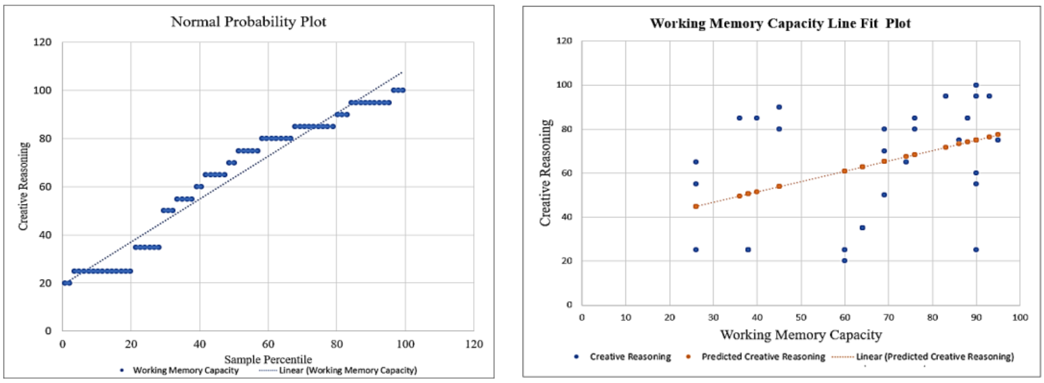

Figure 2. Normal Probability and Working Memory Capacity Line Fit Plot

Figures 2, present the data for the X and Y values. In this context, the X value is interpreted as a percentile, while the Y value corresponds to the numerical representation of that percentile. Percentiles divide data into one hundred equal segments, each representing a specific percentage of the total population. For instance, in the first row of data, variable Y's distri-bution and statistical characte-ristics are evaluated across the range of percentile data. It has been observed that working memory capacity significantly influ-ences the creative reasoning abilities of prospective mathematics teachers when addressing linear mathematical pro-blems; however, other factors also con-tribute to this creative reasoning process.

2. Creative Reasoning Process in Problem Solving

The regression test results show that working memory capacity influen-ces the creative reasoning of pros-pective mathematics teachers in problem-solving. In this way, resear-chers explored in more depth how the creative reasoning process in problem-solving in prospective mathematics teachers with high working memory capacity.

Prospective mathematics teachers with high working memory capacity understand the problem well, state the information in the problem and provide additional information. The process of understanding the problem is proven by providing information that all ceramic shapes must be installed and no cera-mics must be cut during installation; then, the prospective mathematics teacher uses mathematical concepts in the form of shape area and flat shape area to make it easier to solve the problem. This shows the prospective mathematics teachers ability to identify, store known information and connect mathematical concepts that will be used to solve problems. Prospective mathe-matics teachers with high working memory capacity have more infor-mation as cognitive resources that can be reused when solving problems with increasing complexity so that subjects can handle tasks well compared to subjects with low working memory capacity (Céspedes et al., 2016). In line with Jarosz et al. (2019) who stated that individuals with high WMC can focus

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on dealing with several cognitive disorders that hinder their thinking in solving problems. So you can eliminate information that is not relevant to the task at hand. Jarosz et al. (2019) said that apart from storing and managing information that underlies the problem-solving process, WMC also reflects control or attention in the problem-solving process. In the problem-solving process, high WMC has quite good attention control.

Table 6 Excerpts From Interviews With Prospective Mathematics Teachers With High Working Memory Capacity

Interview	Question and answers	Indicator
Researcher	How do you come up with this solution?	
Qorry's	...identified the information in the question. The shape of the ceramic, and then I thought about sketching an appropriate scale...	identified the information making a sketch
Researcher	Why need a sketch and scale?	
Qorry's	...to solve this problem, you do not need a formula; you can imagine and create a solution; making a sketch and an appropriate scale will make the solution easier...	You do not need a formula You do not need a formula.
Researcher	Are there other strategies?	
Qorry's	...Create a pattern by positioning the appropriate ceramic shape precisely...	Create a pattern by positioning
Researcher	Pattern: What is it for?	
Qorry's	...The pattern makes installation more manageable, and the results will be more beautiful and orderly...	makes installation easier beautiful and orderly

Source: field study (2025)

Table 6 explains that prospective mathematics teachers with high working memory capacity form ideas to solve problems based on the problems given. Able to understand the problem quickly, but not immediately know the solution steps that must be used to solve the problem. However, you can imagine that to solve the problem, you must install the ceramics side by side. Solving the questions is not by using formal methods but by drawing methods, and it does not require formulas. It is revealed that the choice of drawing strategy is based on the case presented in the problem. It was explained that the drawing method was chosen to solve the problem because, in the given problem, all ceramic shapes were required to be installed to cover the entire area and not determine the area. Furthermore, it was revealed that the choice of strategy was based on previous learning experiences, namely counting the number of right triangles in a square. Based on excerpts from the interview results, it can be seen that choosing a strategy based on one's abilities, drawing, making a scale and making a pattern for the prospective mathematics teachers can create a ceramic installation pattern to cover the entire edge of the pool. According to the prospective mathematics teachers, installation patterns will vary when making a pattern.

Besides that, the prospective mathematics teachers also creates a

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scale. With the scale, the prospective mathematics teachers can pair the patterns created so that there are not too many patterns to make. The prospective mathematics teachers also thought that making the scale would also pay attention to the symmetry of the area where the ceramic would be installed. The area where the ceramic will be installed is rectangular so that the prospective mathematics teachers creates folding symmetry from the rectangle. In this way, the prospective mathematics teachers only needs to make an installation pattern on 1 part; the other parts must adjust to the previous installation pattern.

When solving problems, prospective mathematics teachers implement drawing strategies and create scales and patterns until they find the expected results. In contrast to the solution method, the prospective mathematics teachers do not write down what is known in the problem given. However, the prospective mathematics teachers did not experience problems solving questions based on his chosen strategy. In solving the problem, the prospective mathematics teachers first draw a rectangular shape as the area where the ceramic will be installed, paying attention to the slanted side of the parallelogram, which is $20\sqrt{2}$ cm. This inlaid is the same as the slanted side of the triangle, right trapezoid and bishop's hat so that the fourth slanted side of these ceramic shapes can be combined. The prospective mathematics teachers also thought this method could be done on ceramic shapes with the same sides. The scale created by prospective mathematics teachers simplifies and speeds up the process of drawing variations in ceramic installations.

The prospective mathematics teachers make four patterns that will be used as installation variations. The first pattern consists of a triangular ceramic shape, a bishop's hat, and an angled trapezoid.

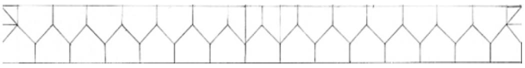

Figure 3. Pattern 1 form of Ceramic Installation

Figure 4. Pattern 2 form of Ceramic Installation

Qorry installed ceramic tiles with slanted sides. At the corners of the pattern, he installed triangular-shaped tiles to be more precise and form a rectangular pattern. According to him, this will make it easier to arrange various ceramic installation patterns and beautify the shape of the installation pattern. The second pattern is triangular, rectangular, trapezoidal, and triangular-shaped bishop hats. The four ceramic shapes are installed in such a way that they form a rectangular pattern. In the middle, Qorry placed two rectangles and an angled trapezoid. This is geometrically more symmetrical and looks beautiful.

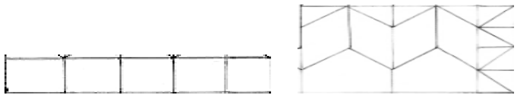

Figure 5. Patterns 3 and 4 of Ceramic Installation

The third pattern consists of the square. Using his reasoning, Qorry made a second pattern by focusing only on square ceramics. This is done to cover the edges so they are not missing and cannot be installed with ceramics or other patterns. Additionally, square-shaped ceramics are easily arranged according to the desired area size. At the same time, the fourth pattern consists of a parallelogram, a bishop's hat, and a triangle. These four patterns

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represent each ceramic form as a requirement in the problem. The four patterns represent each ceramic form as a requirement in the question. This fourth pattern is 1 m2 and is made to be installed on the right and left sides of the road. In all variations of ceramic installation, the fourth pattern is installed in four symmetrical positions. According to Qorry, pairing it in a symmetrical position will make it look beautiful.

She also noticed the aesthetic value of variations in ceramic installation patterns by installing parallelogram-shaped ceramics on the edges to look more beautiful and neat. Thus, it can be concluded that the prospective mathematics teachersmeets the novelty criteria in using creative reasoning in solving problems, namely forming ideas for solutions from things known to the problem given, connecting information known in the problem with previous knowledge as a new strategy for solving problems, generating ideas or new strategies that can solve problems are based on individual experience and abilities, implementing the chosen resolution strategy and generating new ways that tend to become new knowledge.

It is known that the prospective mathematics teachers argued that the drawing strategy was used to make it easier to solve the problem. Using the drawing method, the creative shapes will all be installed. How to draw can also provide the correct answer because the installation of all the ceramic shapes and covering the pool's edge can be seen clearly. Apart from that, a settlement strategy can be created by creating a scale. By using scales and patterns, apart from making the process of drawing ceramic installation patterns easier, it also provides aesthetic value to the variations in patterns created. Implementing the strategy used is a new idea in solving the problem, and I am confident that the answer is correct and makes sense. He also explained that the problem given could not be solved using mathematical formulas, and the method of solving the problem that would be used was not specified, so drawing, making scales, and making patterns were the correct choices to solve the problem. This supports the idea that the pattern and scale drawing strategy is the right choice for solving the problem.

Prospective mathematics teachers can make variations in the ceramic installation pattern by drawing and making scales and patterns. The time needed to draw variations of the ceramic installation is more efficient because when the pattern has been made, the prospective mathematics teachers can immediately adjust the overall drawing to follow the existing pattern so that the pool edge pattern will be installed with ceramics completely. Overall. The prospective mathematics teachers also provided a verification argument that the strategy used was correct and reasonable. The prospective mathematics teachers explained that the problem given was unusual and could not be solved with formal mathematics, so drawing and making patterns were the correct choices to solve the problem. The prospective mathematics teachers also explained that installing ceramics also needs to pay attention to the size of each side of the ceramic so that ceramics that have sloping sides can be installed side by side, as well as ceramic shapes that have the same size can be positioned side by side too, by drawing variations in the installation pattern will be visible. The prospective mathematics teachers also explained that adjusting a

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scale to the area of the pool's edge where the ceramic will be installed will make it easier to make patterns.

The scale also considers the size of the ceramic; in this case, the prospective mathematics teachers uses scale 1, the size of the square ceramic. The scale was chosen because the size of the ceramic shape was a multiple of the size of the square ceramic shape and ceramics with slanted sides of the same size, namely 20√2. The prospective mathematics teachers previously created a mounting pattern besides the drawing and scale. This pattern is designed to speed up the process of drawing ceramic installation variations. With the overall image pattern, all you have to do is adjust it to the pattern that has been created. The prospective mathematics teachers make patterns on several parts by paying attention to the scale that has been made. The overall drawing of variations in ceramic installation is made by drawing part of the edge of the pool, and the next side follows the drawing on the side that has been made. In this way, the time used is more efficient. Furthermore, it was stated that aesthetic value needs to be considered when installing ceramics, so this will only be visible if the ceramic installation image follows the pattern created. Thus, it is concluded that prospective mathematics teachers with high working memory capacity meet the plausibility criteria in solving problems using creative reasoning, namely by providing predictive and verification arguments in selecting ideas and solving strategies.

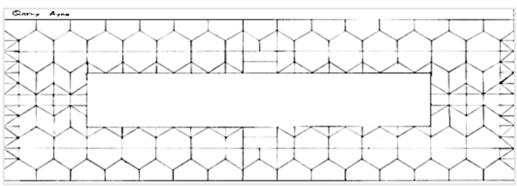

Figure 6. Ceramic Mounting Pattern for Prospective Mathematics Teachers with High Working Memory Capacity

In Figure 6, prospective mathematics teachers were able to provide reasons that the choice of strategy was based on identifying basic properties in mathematics. prospective mathematics teachers could identify the ceramics as square, rectangular, triangular, parallelogram, trapezoidal, and bishop's hat. In drawing ceramic installations, the prospective mathematics teachers first draws a square pattern. The reason the prospective mathematics teachers chose to install this type first was that ceramics that had sloping sides would be easier to position, and because they were the same size, they would be more precise; then, to make it easier to make patterns, the prospective mathematics teachers also placed square and rectangular ceramics. This reveals that in the problem-solving process, the prospective mathematics teachers uses one of the properties of a flat rectangular shape. The prospective mathematics teachers explained that the length of the ceramic side was 2 or 3 times the size of the other ceramic shapes. Apart from that, the slanted side of the ceramic is the same, namely 20√2; this makes it easier to install the ceramic. Thus, it can be said that prospective mathematics teachers with high working memory capacity can use previously known mathematical concepts correctly to solve problems.

The results showed that the creative reasoning of prospective mathematics teachers with high working memory capacity was flexible and fluent in generating ideas for solutions, able to identify the information contained in the problem, connect mathematical concepts well, and provide logical arguments for the ideas

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created. This is also supported by the findings that children with high WMC, by and large, have more progressed problem-solving techniques and higher arithmetic accomplishment than children with low WMC ((Anjariyah et al., 2022); (Céspedes et al., 2016)). This implies that when the issue's complexity increases, prospec-tive mathematics teachers with high WMC can use their data to control the impediments that get in their way. This happens because children with high WMC have more data. According to Palengka (2019), subjects with high working memory capacity use algorithms to solve the given problems. Working memory capacity (WMC) only affected the ability to solve complex problem-solving skills (Juniati & Budayasa, 2024). If the trouble of an issue increases, they can use the techniques they learned during formal tutoring to assist them, since students with high WMC have more cognitive assets (Céspedes et al., 2016). Moreover, this inquiry found that subjects with high WMC were superior at tackling issues than those with low WMC. This could be seen from the capacity of cognitive control to dispense with insignificant data and the capacity to unravel more complex issues. Students with high WMC can remember and manage information well, which supports the determination of more advanced problem-solving strategies and better attention control to find varied, appro-priate solutions (Anjariyah et al., 2022). All this happens because high WMC prospective mathematics teachers have more data than low WMC prospective mathematics teachers. In expansion, high WMC prospective mathematics teachers can keep their data in mind and handle it well, supporting the disclosure of more proficient problem-solving techniques. Prospective mathematics teachers with high working memory capacity can recover data from circumstances or data related to scientific concepts and utilise them appropriately to discover patterns when given numerical problems. High WMC is helpful in effective problem-solving (Jarosz et al., 2019). Other research shows that the creative mathematical reasoning of prospective teachers with high working memory capacity in solving problems on the research subject met the three criteria for creative mathematical reasoning: creativity, plausibility, and anchoring (Palengka, 2019). According to Hasan et al. (2025), perspective teacher with high working memory capacity are flexible and fluent in their thinking, encouraging them to use novel ideas to solve problems. In addition, they can put forth logical arguments grounded in correct basic mathematical concepts. However, high mathematical anxiety may interfere with their thinking ability and inhibit their performance. When faced with a complex mathematical problem, they make incorrect answers.

CONCLUSIONS

Working memory capacity signi-ficantly influences the creative reaso-ning abilities of prospective mathe-matics teachers when addressing linear mathematical problems. The creative reasoning of prospective mathematics teachers with high working memory capacity was flexible and fluent in generating ideas for solutions, able to identify the information contained in the problem, connect mathematical con-cepts well, and provide logical argu-ments for the ideas created. Overall, the study's results contribute to a new reasoning pattern in mathematics using the creative reasoning framework. This

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study provides additional information for prospective and mathematics teachers to develop creative reasoning as a learning requirement for higher-order thinking skills. It can help teachers and instructors design more effective learning strategies to improve students' working memory capacity and creative reasoning abilities. Intellectually challenging learning materials involve problem solving and divergent thinking and provide opportunities to explore new ideas that can be designed to support students' cognitive development. It can also be integrated into the classroom by designing problem-solving-based mathematics learning. An important factor in teaching creative reasoning skills is that teachers are burdened with tasks requiring higher-order thinking. Therefore, evaluating students' creative reasoning abilities using tests or measuring instruments that follow working memory capacity is necessary.

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