p-ISSN: 2086-4280
e-ISSN: 2527-8827

Creative Thinking Ability in Quadrilateral Learning with Pos Math Game

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Article received: 15-02-2024, revision: 12-03-2024, published: 30-04-2024

Abstrak

Berpikir kreatif merupakan salah satu keterampilan yang dilatihkan dalam pembelajaran matematika. Berdasarkan wawancara dengan pendidik di salah satu sekolah di Kabupaten Bandung, siswa masih sering menganggap matematika itu sulit dan membosankan. Siswa masih kesulitan memahami materi dasar salah satunya segi empat. Terdapat permasalahan dalam proses pembelajaran yaitu: Siswa mengalami keterbatasan dalam menjawab soal materi segi empat, dan partisipasi belajar siswa masih sangat rendah yang mengakibatkan kemampuan berpikir kreatif siswa kurang terlatih. Penelitian ini mengimplementasikan Permainan Pos Math yang mempunyai fasilitas untuk melatih keterampilan berpikir kreatif sebagai solusi dari permasalahan tersebut. Penelitian ini bertujuan untuk mendeskripsikan kemampuan berpikir kreatif siswa pada pembelajaran segiempat dengan menggunakan permainan pos math. Penelitian ini menggunakan pendekatan kualitatif dengan partisipan siswa kelas VII SMP sebanyak 41 orang. Instrumen tes digunakan untuk pengumpulan data. Lembar jawaban siswa dianalisis dengan menggunakan teknik constant-comparison. Berdasarkan hasil analisis diperoleh nilai rata-rata kemampuan berpikir kreatif siswa sebesar 83,17 sehingga termasuk dalam kategori sangat kreatif. Simpulan utama penelitian ini adalah bahwa post-math game sangat baik digunakan dalam pembelajaran matematika, khususnya untuk materi segi empat. Salah satu implikasi hasil penelitian ini adalah peneliti dapat menawarkan penerapan post-math game untuk pembelajaran segi empat pada kelas yang relevan.
Kata Kunci: Berpikir Kreatif; Game-Based Learning; Pos Math.

Abstract

Creative thinking is one of the skills trained in mathematics learning. Based on interviews with educators at one of the schools in Bandung Regency, students still often think mathematics is difficult and boring. Students still have difficulty understanding basic material, one of which is quadrilaterals. There are problems in the learning process, namely: Students experience limitations in answering rectangular material questions, and student learning participation is still very low, which results in students' creative thinking abilities being poorly trained. This research implements the Pos Math Game which has facilities for practicing creative thinking skills as a solution to this problem. This research aims to describe students' creative thinking abilities in quadrilateral learning using pos math games. This research used a qualitative approach with 41 class VII junior high school students as participants. Test instruments were used for data collection. Students' answer sheets were analyzed using the constant-comparison technique. Based on the results of the analysis, the average score for students' creative thinking abilities was 83.17, so it was included in the very creative category. The main conclusion of this study is that post-math games are very good to use in learning mathematics, especially for quadrilateral material. One implication of the results of this study is that researchers can offer the application of post-math games for quadrilateral learning in other classes.
Keywords: Creative thinking; Game-Based Learning; Pos Math.

I. INTRODUCTION

The ability to think creatively is one of the skills taught in mathematics learning (Faiziyah, Hanan, & Azizah, 2022). Universally, creative thinking is one part of 21st-century skills. Learning is a vehicle for adapting to changing demands, so thinking skills must be trained, including in learning mathematics. Learning mathematics cannot be separated from the ability to think creatively (Febrianingsih, 2022). Algebraic manipulation is a method used to determine the relationship between concepts. This algebraic manipulation is a form of creative thinking. We can conclude that individuals who are good at mathematics are included in the creative or very creative category. They are able to express new conditions based on the results of their thoughts, this is very creative (Faturohman & Afriansyah, 2020).

Much new knowledge is produced as a product of creative thinking abilities (Dalilan & Sofyan, 2022; Salsabila, Rahmi, & Delyana, 2023). Especially in mathematics content, technological developments are proof of this. Digitalization requires a mathematical foundation developed for specific purposes. Gradually the algorithm was designed until a very sophisticated technology was created. The design of this technology requires mathematical skills that are proficient in manipulating algebra so that new products are created (Zubaidah et al., 2023). This is part of creative thinking.

Mathematics learning does not aim to obtain sophisticated new products (Sari, Sukestiyarno, & Walid, 2022). Learning mathematics trains you to gain the ability to produce new ideas that have the potential to develop as thinking skills (Handayani, 2023). Skills trained to produce new ideas, especially in learning mathematics, are learning goals. Ideally, discussions in learning are able to reveal the level of students' creative thinking abilities (Sari & Afriansyah, 2022). Next, the teacher can provide notes or programs to practice these skills.

According to Rohim, Rahmawati, & Ganestri (2021), the teaching and learning process in Indonesia in general has not succeeded in changing students' academic thinking patterns and behavior. This can be seen from the thinking perspective of students or graduates who do not show significant differences compared to those who have not received formal education. Efforts to improve the quality of human resources are the main challenge for every educational institution. Ideally, learning at school should develop both hard skills and soft skills for each student (Fernandes, Jardim, & Lopes, 2021). However, in reality, schools tend to focus more on strengthening hard skills through mastering theory, while developing soft skills such as the ability to think creatively and solve problems is still not optimal. According to Ndiung, Dantes, Ardana, & Marhaeni (2019), creative thinking skills involve the ability to identify, analyze, and solve problems in a creative and logical way, so that they can produce the right decisions and considerations.

Improving students' creative thinking abilities can be done with more fun learning methods, such as game-based learning (Nurhanifah, 2022; Rozi, 2023). This is in line with the learning principles of Gagne's theory, which states the need for

p-ISSN: 2086-4280
e-ISSN: 2527-8827

challenges to motivate students to learn. With this method, students will not feel burdened to think harder. In addition, the use of game-based learning can increase self-confidence and cooperation among students.

Referring to the research practice conducted by Kosasih et al. (2022) who developed a game pattern in mathematics learning. The study developed a game called Tic-Tac Log and succeeded in attracting students' interest in learning mathematics. Referring to the study, this study developed a new form of game to facilitate students' creative thinking exercises. One of the objectives of this study is to produce an interesting game that helps students' mathematics learning process, especially in training their creative thinking skills. Another basis for this study is the unavailability of rectangular teaching materials that integrate games and train students' creative thinking skills. Therefore, learning that integrates games and facilitates creative thinking exercises is important to implement.

Based on the results of interviews with Mathematics Subject educators at one of the schools in Bandung Regency, learning using game-based learning methods is rarely used because apart from educators having to determine the game first, educators also need to match it with the material. Games that have been created, but failed to implement. However, if learning is carried out using game-based learning, it is certainly a good thing because it can improve many aspects. Students become happy and can stimulate their curiosity to find solutions to the problems given.

Games that are suitable for learning are games that are educational for students. In this research, the type of game chosen was Pos Math, which is a game where students have to visit each post to solve problems. Researchers chose this game because it was considered suitable as a mathematics learning medium that aims to improve students' creative thinking abilities. This game is effective for testing students' understanding of the material studied.

Based on the previous description, this research aims to describe students' creative thinking skills in quadrilateral learning. The researcher applied a post-meath-based learning design to facilitate students' creative thinking skills in grade VII. In its use, students solve problems about quadrilaterals. Therefore, this study was conducted to answer the question, what are the students' creative thinking skills in learning quadrilaterals using math posts?

II. METHOD

A qualitative research approach is used to answer how students' creative thinking abilities are in learning quadrilaterals using the post math method. Creative thinking has been trained in innovative learning. Based on this research approach, this study describes students' creative thinking achievements in learning quadrilaterals that are implemented. Learning is carried out in one of the junior high schools in West Java. The data collection process at the school was carried out from December 2023 to March 2024. Data collection was

carried out using a test instrument. The evaluation test is a test carried out to determine the level of ability and success of student learning based on learning objectives. In this study, the test was carried out in the form of essay questions with different levels of difficulty and paying attention to indicators of creative thinking abilities. Data analysis was carried out using the Constant-comparison technique, in this study it was carried out by matching the creative thinking indicators with the answers presented by students. Data tabulation was carried out to group students' creative thinking achievements. The results of the data tabulation were used to obtain an overview of students' thinking achievements based on the category of creative thinking abilities in Table 1.

The learning outcome data that has been obtained is analyzed by referring to Table 1. Based on Table 1, students are declared creative if the evaluation test results have a percentage value ≥ 61%.

Table 1.
Criteria for Students' Creative Thinking Ability Level

Percentage	Level of Creative Thinking Ability
81% s.d 100%	Very creative
61% s.d 80%	Creative
41% s.d 60%	Quite Creative
21% s.d 40%	Less Creative
0% s.d 20%	Not Creative

Source: (Riduwan, 2020)

III. RESULT AND DISCUSSION

A. Results

Game-based learning is deliberately created to support learning media because it is considered more interesting than conventional teaching and learning processes (Dewi & Listiowarni, 2019). Game-based learning is a method designed to support the learning process (Maulidina, Susilaningsih, & Abidin, 2018). According to De Freitas (2006), the use of games in learning has several benefits, including (a) motivating and involving all students in learning; (b) training students in skills such as reading and arithmetic; (c) as a therapeutic medium to overcome cognitive difficulties; (d) role simulation before implementing it in real life; and (e) empower students.

Game-based learning that involves students aims to increase learning activities through interesting media, increase students' attention and interest, and create an interactive and collaborative learning environment (Trajkovik, Malinovski, Stojanovska, & Vasileva, 2018). The stages of game-based learning in learning are: (1) choose games according to the topic; (2) explanation of concepts; (3) regulations; (4) play games; (5) summarize knowledge; and (6) reflect (Sembiring & Listiani, 2023). Pos Math is a game created to support mathematics learning in facilitating students' creative thinking abilities. Implementing pos math in learning has the potential to improve the quality and effectiveness of learning. The application of pos math can be done indoors or in open spaces. Pos math can be used at various levels and with various materials according to the needs of educators. Pos Math-based learning consists of 4 syntaxes, namely (a) explanation of game objectives and game instructions; (b) group formation; (c) implementation; and (d) evaluation and reflection.

In recent years, many studies have shown that game-based learning is very

p-ISSN: 2086-4280
e-ISSN: 2527-8827

effective when applied to learning. Game-based learning has an important role in influencing student motivation, making students feel happier, more involved, more challenged, and more cooperative with their friends (Youling, Chen, & Deng, 2024). Game-based learning, especially card games, can increase attention, motivation, and curiosity (Alotaibi, 2024).

Pos Math is a game created to support mathematics learning in facilitating students' creative thinking abilities. The material contained in the pos math supports creative thinking exercises. Math post-based learning can be done indoors or in open spaces. Pos math can be used at various levels and with various materials according to the needs of educators.

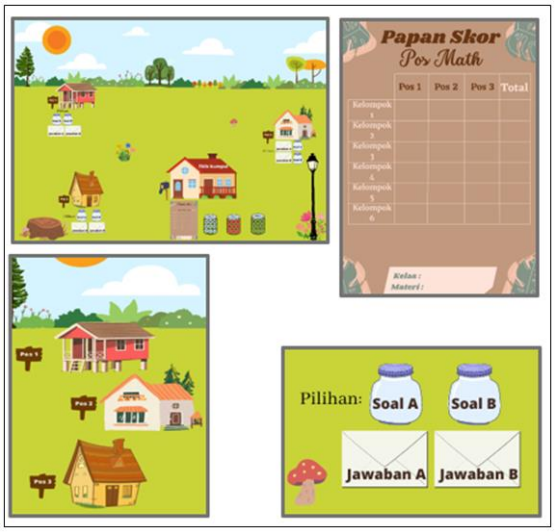

Figure 1. Pos Math Design.

The mathematics post is a learning medium that has three desks as in Figure 1. Each post has a different level of difficulty. The three desks can be described as follows: (a) desk 1 regarding the meaning and types of quadrilaterals; (b) desk 2 regarding the properties of quadrilaterals; and (c) desk 3 regarding the area and perimeter of a quadrilateral taking into account indicators of creative thinking abilities. Pos math are used to test students' understanding of quadrilateral material. In pos math activities, students are given the challenge to complete a package of questions that can be selected in each desk within a certain time period to get the highest score. The scores obtained by students will be listed on the scoreboard.

The results of the study, especially those related to the students' creative thinking ability test, are presented in Tables 2 to 5. More than 70% of students in one class were able to fulfill the creative thinking indicators in the form of fluency, flexibility, originality, and elaboration.

B. Discussion

Creative thinking is the ability to find new things that are different from what already exists. Finding something new does not mean that other people do not know, but it is new for yourself and not for others (Amelia, Aripin, & Hidayani, 2018). Previous research shows that creative thinking is about creating something new, useful, and unique that no one else has ever thought of (Nursa'adah & Rosa, 2016). According to Herdani & Ratu (2018), the ability to think creatively is a form of thinking of someone who dares to put forward ideas and produce new ideas, methods, and products that are effective, imaginative, discontinuous, and flexible. According to Amelia, Aripin, & Hidayani (2018), creative thinking ability has several indicators, namely, fluency, flexibility, originality, and elaboration.

Amelia, Aripin, & Hidayani (2018) argue that there are 4 indicators of creative thinking ability which are expressed by, namely, fluency means students' skills in solving existing problems. Flexibility means the student's ability to provide various solutions. Then originality is the way students find or provide unusual or unique solutions, while elaboration is the ability to detail problems or provide input on ideas so that they can enrich their knowledge.

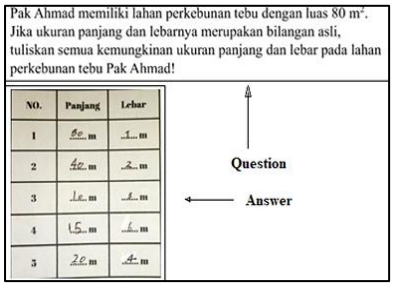

Figure 2. Answers to the Fluency Aspect.

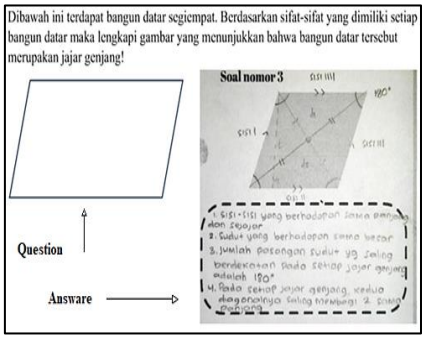

Figure 2. Answers to the Elaboration Aspect.

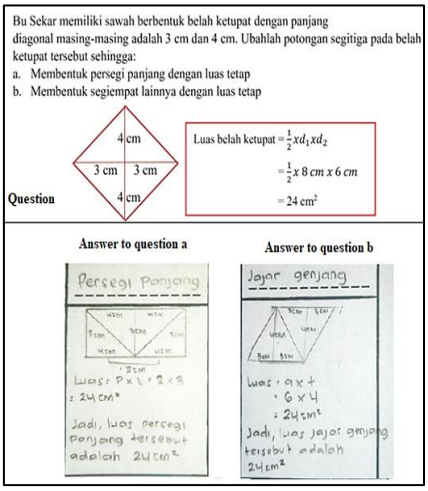

Figure 4. Answers to the Flexibility and Originality Aspect

In this research, students' answers were obtained by answering creative thinking questions in the Pos Math game. In Figure 2, the question presented requires students to give more than one and varied answers. In the ability to think creatively, especially the Fluency aspect, students can see answers that give the right answers.

Figure 3 shows students' answers in expressing thinking skills, and adding or detailing an idea so as to improve the quality of the idea (elaboration). Figure 4 shows students' answers in seeing a problem from different points of view (flexibility). Still, in Figure 4, there are also student answers that show the skill of providing new ideas in solving problems or providing answers that are different from the usual ones in answering a question (originality).

Analysis of the data obtained has been carried out to examine students' creative thinking abilities. This test was taken by 41 students. Complete details of the evaluation test results for students' creative thinking abilities are presented in Table 2. Based on the results of the analysis, the average score for the creative thinking ability test results was 83.17.

Based on Table 3, it is known that the maximum score obtained is 100 and the minimum score is 59. So the range of maximum scores (Range) that may be obtained is 100-59 = 41. The number of class intervals uses the formula k (number of class intervals) = 1 + (3.3) log n (amount of data), then we get k = 1 + (3.3) log 41 = 6.32 rounded to 6. So the number of class

p-ISSN: 2086-4280
e-ISSN: 2527-8827

intervals is 6. Then the length of the class interval uses the data range/number formula interval class, then we get R/k = 41/6 = 6.83 rounded to 7. So we get a frequency distribution table of test results evaluating students' creative thinking abilities which can be shown in Table 2.

Table 2.
Evaluation Test Results for Students' Creative Thinking Ability

Creative Thinking Ability	Score		
	Minimum	Maximum	Average
Fluency	20	25	98.44
Flexibility	12	25	78.83
Originality	10	25	76.00
Elaboration	10	25	79.94

Table 3.
Description of Creative Thinking Test Statistics

No.	Creative Thinking Test	Score
1.	Maximum score	100.00
2.	Minimum score	59.00
3.	Average	83.17
4.	Median	83.00

Table 4 shows the distribution of creative thinking ability test results. Visualization in diagram form is presented in Figure 5.

Table 4.
Frequency Distribution of Tests for Evaluation of Students' Creative Thinking Ability

Class Interval	Middle Value	Frequency	Relative Frequency
59 - 64	61.5	4	9.76%
65 - 70	67.5	2	4.88%
71 - 76	73.5	8	19.511%
77 - 82	79.5	6	14.63%
83 - 88	85.5	7	17.07%
89 - 94	91.5	5	12.20%
95 - 100	97.5	9	21.95%

Table 5.
The average score for each indicator of creative thinking ability

No.	Creative Thinking Ability	Average	Classification
1.	Fluency	98.44	Very Creative
2.	Flexibility	78.83	Creative
3.	Originality	76.00	Creative
4.	Elaboration	79.41	Creative

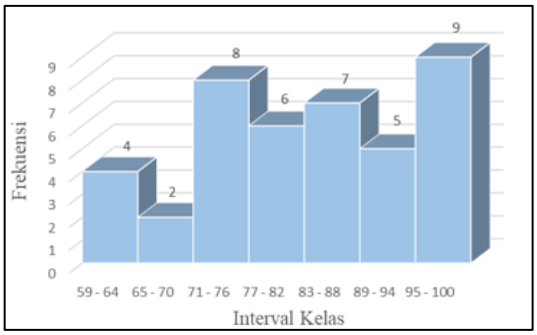

Figure 3. Frequency Distribution Histogram of Creative Thinking Ability Evaluation Tests.

Based on Figure 5, it can be seen that the highest frequency of students' creative thinking ability test results is in the 95 - 100 interval, as many as 9 students and the least is in the 65 - 70 interval, as many as 2 students.

Based on Table 4, the average test score evaluating students' creative thinking abilities is 83.17. Next, the score is converted into ideal mean criteria, the score is located in the interval $74.99 \leq 83.17 < 100$, meaning it is included in the very effective category. In other words, post-math-based rectangle learning to facilitate creative thinking skills can achieve learning goals. Based on data from the evaluation test results of students' creative thinking abilities in Table 2, the average score obtained for each indicator of creative thinking abilities along with the

classification of levels of creative thinking abilities refers to Table 1.

In Table 5 it can be seen that the percentage of learning outcomes exceeds 61%. This means that students' abilities are classified as creative or very creative. The average score of the students' overall creative thinking ability test results was 83.17. After the average is converted to the criteria for the level of creative thinking ability, the average score of the creative thinking ability evaluation test is included in the very creative category. Thus, the creative thinking abilities of students who have carried out pos math-based rectangular learning are classified as very creative.

The use of post-math-based learning design in the learning process can facilitate students' creative thinking abilities. The pos math collaborates on creative thinking questions. The creative thinking ability evaluation test is carried out to measure students' creative thinking abilities (Dalilan, 2023). This creative thinking ability test is carried out during learning and after learning. Group creative thinking tests are carried out during learning. Meanwhile, individual creative thinking tests are carried out after learning.

Based on Table 5, the average evaluation test score for students' creative thinking abilities in the fluency aspect is 98.44, the flexibility aspect is 78.83, the originality aspect is 76.00, and the elaboration aspect is 79.41. The overall average score obtained from 41 students was 83.17. According to Riduwan (2020), the average score is included in the very creative category.

These results support the findings of research that applies game-assisted learning. Winatha and Setiawan (2020), describe the positive influence of game-based learning models on student motivation and learning achievement. The results obtained from this research indicate that there is a positive influence of the game-based learning model on motivation and learning achievement. This research has similarities with researchers, namely using games-based learning in learning. However, the difference is that the analysis used in this research is motivation and learning achievement, while researchers analyze students' creative thinking abilities. The other relevant research is research conducted by Muslim, Kosasih, Saputra, & Ahmatika (2023), that learning through games helps achieve student learning outcomes. Based on the statement above, the creative thinking abilities of students who have carried out post-math-based rectangular learning are included in the very creative category.

The results of this study are relevant to similar studies that have been conducted previously. Yusof and Sharill (2021) integrated non-digital games in mathematics learning, the results were very positive in helping to improve students' mathematical skills. Likewise, Hui and Mahmud (2023) who integrated games in mathematics learning, concluded that the class was more effective. Other researchers Erşen and Ergül (2022) studied the application of games in mathematics learning, stating that the results were very positive. Debrenti (2024) conducted a research practice integrating non-digital

and digital games in mathematics learning, the results were that students were happy.

IV. CONCLUSION

Students' creative thinking abilities after pos math-based rectangular learning obtained an average score of 83.17 from 41 students, included in the creative category. The average score for each aspect of creative thinking ability is fluency aspect 98.44; flexibility aspect 78.83; originality aspect 76.00; and elaboration aspect 79.41. Based on research results, post-math-based rectangular learning designs can facilitate the development of student's creative thinking abilities. For further application, the author provides the following suggestions pos math learning design is suggested as an alternative to rectangular material, enrich other higher order thinking exercises, and develop pos math game in digital form.

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