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Research Article

Creative Problem-Solving Learning Model Assisted by Articulate Storyline 3 Media on Students' Mathematical Creative Thinking Ability

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ABSTRACT

The low level of students' mathematical creative thinking ability is the main focus of this study. Based on interviews and observations, students were found to have difficulties solving problems that require creative thinking. This research aims to investigate the effect of the Creative Problem Solving (CPS) learning model assisted by Articulate Storyline 3 media on students' mathematical creative thinking ability. A quantitative approach was used with a quasi-experimental method and Non-Equivalent Control Group Design. The research sample consisted of two seventh-grade classes at SMP Negeri 2 Dewantara, with class VII-A as the experimental group and VII-B as the control group. The instruments included a mathematical creative thinking ability test and observation sheets for both teachers and students. Data analysis was conducted using the Mann Whitney non-parametric test. The results showed that the Asymp. Sig. (2-tailed) value was 0.001 < 0.05, indicating a significant difference between the experimental and control groups. Therefore, the CPS model assisted by Articulate Storyline 3 had a positive impact on improving students' mathematical creative thinking. The model facilitated students in exploring ideas, thinking in alternatives, and developing open-ended problem-solving strategies, making it a relevant alternative for mathematics learning at the junior high school level.

Keywords: Learning Model; Creative Problem Solving; Articulate Storyline 3; Mathematical Creative Thinking Ability

1. INTRODUCTION

Mathematics plays a vital role in developing students' logical, critical, and systematic thinking skills. Through mathematics instruction, students are equipped to understand concepts, solve problems, and apply knowledge to real-world contexts. According to the National Council of Teachers of Mathematics (NCTM, 2000), there are five key mathematical competencies that students should master: problem-solving, communication, connections, reasoning, and representation. In relation to these competencies, creative mathematical thinking is considered essential-particularly when dealing with non-routine problems that demand innovative solutions (Arifuddin et al., 2022). Despite its importance, several studies indicate that Indonesian students' creative mathematical thinking skills remain relatively low. The 2022 PISA results ranked Indonesia 69th out of 81 participating countries, with an average mathematics score of 366 (OECD, 2023). Similarly, the 2019 TIMSS assessment placed Indonesia 46th out of 51 countries, with a score of 397 compared to the international average of 500 (Mullis et al., 2019). These findings underscore the urgent need for instructional strategies that cultivate higher-order thinking skills, especially creativity. (Fayesa et al., 2023) argue that the lack of open-ended problem-solving and idea exploration in classroom settings contributes to this stagnation.

One promising approach that has gained attention in enhancing students' creative capacities is the Creative Problem Solving (CPS) model. This model facilitates divergent thinking by guiding learners through a systematic sequence of stages, including problem identification, idea generation, and solution implementation (Puccio & Keller-Mathers, 2007). Through its emphasis on open-ended exploration and structured creativity, CPS enables students to think flexibly, generate multiple solutions, and refine their ideas in a logical and innovative manner. Research conducted by Pramestika et al. (2020) revealed that the application of the CPS model significantly improved students' creative thinking in mathematics. Similarly, Faroh et al. (2022) also found that CPS had a positive impact on students' ability to develop original and effective problem-solving strategies in mathematical tasks.

In addition to instructional models, the selection of appropriate learning media also plays a critical role in developing students' creativity. Studies show that interactive and contextual media—such as educational games, problem-based puzzles, and cultural content can improve students' motivation, engagement, and mathematical creativity. For example,

Nufus & Mursalin (2020) demonstrated that mathematics-based educational games helped change students' negative perceptions and made learning more enjoyable. Rabiyanti et al. (2024) reported that the use of puzzles in math instruction improved critical thinking and independence. Likewise, Simanjuntak et al. (2024) found that integrating local culture into learning through gamification boosted conceptual understanding and creative reasoning. These findings emphasize that a dynamic, student-centered environment is key to fostering creative thinking skills. However, the integration of CPS with interactive digital media remains underexplored. Articulate Storyline 3 is a digital tool capable of delivering engaging and interactive learning content while supporting students' active involvement (Erlangga et al., 2023). Nevertheless, limited research has specifically investigated the use of CPS combined with Articulate Storyline 3 in mathematics instruction—particularly on the topic of circle diagrams.

Preliminary observations conducted at SMP Negeri 2 Dewantara revealed that seventh-grade students continue to struggle with key aspects of creative thinking, including fluency, flexibility, originality, and elaboration. Many students were unable to solve problems that differed from worked examples and appeared passive in generating their own ideas. Therefore, this study proposes the implementation of the CPS model supported by Articulate Storyline 3 as an interactive and contextual instructional approach to enhance students' creative mathematical thinking. In line with these findings, and based on the previously stated research problem, the purpose of this study is to describe the effect of the Creative Problem Solving (CPS) learning model assisted by Articulate Storyline 3 media on the mathematical creative thinking ability of seventh-grade students at SMP Negeri 2 Dewantara.

The Creative Problem Solving (CPS) Intructional Model

The Creative Problem Solving (CPS) learning model, originally developed by Alex Osborn, serves as a structured approach to stimulate creative thinking in problem-solving processes. This model involves several stages that guide students in identifying problems, generating diverse ideas, evaluating potential solutions, and implementing the most effective strategies. In the educational context, CPS has been adapted to support the development of students' creative and critical thinking skills in addressing complex challenges (Treffinger et al., 2023). In mathematics education, CPS is applied through six key phases: Objective Finding, Fact Finding, Problem Finding, Idea Finding, Solution Finding, and Acceptance Finding. These stages offer a flexible and open-ended framework that encourages students to generate innovative solutions, thereby enhancing their mathematical creative thinking abilities in a more meaningful and structured manner (Panuntun Hsm et al., 2021). The details of each phase and the corresponding student activities are outlined in **Table 1**.

Table 1. Steps of the Creative Problem Solving Learning Model

Stages	Student Activities
Objective Finding	Students work in diverse-thinking groups to receive a broad problem from the teacher and collaboratively identify various emerging issues.
Fact Finding	Students organize data to identify patterns related to problem-solving.
Problem Finding	Students determine the characteristics of appropriate steps for solving the problem.
Ide Finding	Students formulate several possible solution options to address the problem.
Solution Finding	Students explore the proposed answers based on predefined criteria to determine the most appropriate solution.
Acceptance Finding	Students draw final conclusions based on the chosen problem-solving process.

Articulate Storyline 3 as a Learning Media

Articulate Storyline 3 is an interactive authoring tool designed to support the development of multimedia-based e-learning content. As highlighted by Donnellan (2021), this platform enables the creation of engaging instructional materials by combining visual, audio, and interactive components into a single learning environment. Additionally, Mauliddiyah (2021) notes that its interface, which closely resembles Microsoft PowerPoint, makes it user-friendly and accessible for educators when designing structured and visually appealing learning content.

Mathematical Creative Thinking Skills

Mathematical creative thinking ability refers to students' capacity to generate new mathematical ideas, processes, or products, even if these are not globally original. This ability involves recognizing and selecting acceptable mathematical patterns and models (Bicer, 2021). It also includes the creation of unique and innovative solutions through various strategies, procedures, and heuristics that reflect flexible thinking (Suherman & Vidákovich, 2024). This skill emphasizes not only achieving correct answers but also using diverse perspectives and exploring original strategies (Astria & Kusuma, 2023). The development of creative thinking in mathematics learning is essential, as it relates to students' ability to approach

problems in varied and meaningful ways (Laksono & Effendi, 2021). Creative thinking also supports students in producing new ideas and alternative solutions in problem-solving situations (Fadlilah & Siswono, 2022).

Table 2. Indicators of Creative Thinking

No	Measured Aspect	Indicators of Mathematical Creative Thinking
1.	Fluency	1. Able to express ideas from various viewpoints 2. Able to identify multiple alternative solutions
2.	Flexibility	1. Able to approach problems from different angles 2. Able to generate diverse strategies
3.	Originality	1. Able to produce unique and novel ideas 2. Able to formulate original strategies in a structured manner
4.	Elaboration	1. Able to develop and refine ideas 2. Able to explain thoughts in detailed and organized wasy

Source: (Utami et al., 2020)

3. RESEARCH METHOD

This study employed a quantitative approach with a quasi-experimental design, as data were collected and analyzed using statistical methods to test predetermined hypotheses (Sugiyono, 2021). The design applied was the Non-Equivalent Control Group Design, a type of quasi-experiment where the experimental and control groups are not randomly assigned (Sugiyono, 2021). Both groups were given a pretest and posttest to evaluate the effectiveness of the treatment on students' mathematical creative thinking skills.

Table 3. Non-equivalent Control Group Design

Class	Pretest	Treatment	Posttest
Experimental	O_1	X	O_2
Control	O_1	-	O_2

Source: Refined (Sugiyono, 2021)

Note:

X	:	Treatment using the Creative Problem Solving (CPS) learning model
O_1	:	Pretest of the experimental class and control class
O_2	:	Posttest of the experimental class and control class

The research was conducted at SMP Negeri 2 Dewantara with the entire student body as the population. The sample was selected using purposive sampling, with Class VII A as the experimental group and Class VII B as the control group. Data were collected through observation of teacher and student activities and tests to measure students' mathematical creative thinking skills before and after treatment. The research instrument underwent a series of tests, including validity, reliability, discrimination power, and difficulty level, using SPSS 25 software. The validity test was conducted to ensure that the instrument accurately measured the intended construct, while the reliability test assessed the consistency of the measurement results (Sugiyono, 2021). The discrimination power test aimed to determine the extent to which each item could distinguish between students' abilities, whereas the difficulty level test classified items into easy, moderate, or difficult categories (Augustia & Agustia, 2025). Based on the test results, of the eight items developed, four were found to be valid, with a Cronbach's alpha reliability coefficient of 0.747, indicating a reliable category. The discrimination power analysis showed that items 1, 2, and 3 were in the good category, item 4 was very good, while items 5 through 8 were classified as poor. The difficulty level analysis indicated that item 1 was easy, items 2, 3, and 4 were moderate, and items 5 and 6 were difficult. Before hypothesis testing, assumption tests (normality and homogeneity) were conducted. Since the data were not normally distributed, hypothesis testing used the non-parametric Mann–Whitney U test.

4. RESULTS AND DISCUSSION

3.1 Description of Creative Thinking Ability

Based on the quantitative data obtained from the test instrument used to measure students' mathematical creative thinking ability, the posttest scores of the experimental and control groups are presented in the **Table 4**.

Table 4. Creative Thinking Data On Posttest

Class	Score	N	X_{Min}	X_{Max}	$\bar{X}$	S. deviation	Average Percentage
Experimental	Posttest	19	3	12	10,53	2,038	80,97%
Control	Posttest	19	2	12	8,42	2,434	64,77%

Based on **Table 4**, the posttest results in the experimental class, which consisted of 19 students, showed a minimum score of 3 and a maximum score of 12, with a mean of 10.53, a standard deviation of 2.038, and an average percentage score of 80.97%. Meanwhile, in the control class, which also consisted of 19 students, the minimum score was 2 and the maximum score was 12, with a mean of 8.42, a standard deviation of 2.434, and an average percentage score of 64.77%.

3.2 Normalitas Test

Normality testing was conducted to determine whether the posttest data on students' mathematical creative thinking skills were normally distributed. The normality test was performed using the Shapiro–Wilk test with the assistance of SPSS version 25. The results of the normality test are presented in the following table.

Table 5. Posttest Normality Test Results

Class	Shapiro-Wilk		
	Statistic	df	Sig
Experimental	0,636	19	0,000
Control	0,896	19	0,145

Based on **Table 5**, the significance value of the normality test in the experimental class was 0.000. This indicates that the normality test criterion for the experimental class is < 0.05, thus H_0 is rejected, meaning the data are not normally distributed. In contrast, the control class obtained a significance value of 0.145, which meets the criterion of ≥ 0.05; therefore, H_0 is accepted, and the data are normally distributed. Since the experimental class does not meet the assumption of normality, hypothesis testing cannot be conducted using a parametric test. Therefore, a non-parametric test, namely the Mann–Whitney U test, was employed.

3.3 Mann-Whitney Test

Hypothesis testing was conducted to determine whether a statement or assumption proposed in the study could be accepted or rejected based on the obtained data. The results of the hypothesis test related to students' mathematical creative thinking skills are presented in the **Table 6.**

Table 6. Posttest Hypothesis Results

Test Statistics[a]

	Results
Mann-Whitney	67.500
Wilcoxon W	257.000
Z	-3.361
Asymp. Sig. (2-tailed)	.001
Exact Sig. [2*)1-tailed Sig.)]	.000[b]

As presented in **Table 6**, the obtained significance value was 0.001. According to the hypothesis testing criteria, since the Asymp. Sig. (2-tailed) value is less than 0.05, H_0 is rejected. These findings indicate that the Creative Problem Solving (CPS) learning model supported by Articulate Storyline 3 has a statistically significant effect on students' mathematical creative thinking skills.

These findings are supported by the results of hypothesis testing, which indicate that the mathematical creative thinking ability of students in the experimental class was higher than that of the control class. This result aligns with the study conducted by Munthe et al. (2023), which demonstrated that the implementation of the Creative Problem Solving (CPS) learning model had a positive effect on students' creative thinking skills. Similarly, Napila et al. (2024) reported that the application of the CPS model assisted by GeoGebra significantly enhanced students' mathematical creative thinking ability. In addition, Wapa et al. (2024) found that the CPS model was effective in improving students' learning outcomes, with 75% of students in the experimental class showing progress compared to only 50% in the control class. Azizah & Santoso (2023) also revealed that the CPS model improved students' creative thinking through a more active, enthusiastic, and engaging learning process. The Creative Problem Solving learning model is a problem-oriented approach that involves stages of understanding the problem, generating creative solutions, and evaluating the chosen solution. This model emphasizes active student engagement in generating ideas, testing solutions, and collaborating in groups to achieve better understanding.

Moreover, the CPS model has a positive impact on fostering creativity, communication skills, and collaboration, which are essential competencies in 21st-century learning.

5. CONCLUSION

Based on the results of the study on the effect of the Creative Problem Solving (CPS) learning model assisted by Articulate Storyline 3 on students' mathematical creative thinking skills, it can be concluded that the learning model has a significant influence. The results of the Mann–Whitney U test showed a significance value (Sig. 2-tailed) of 0.001. Since this value is below the significance level of 0.05 (0.001 < 0.05), the alternative hypothesis (H_1) is accepted. Thus, there is a significant effect of using the CPS learning model assisted by Articulate Storyline 3 on students' mathematical creative thinking abilities.

RECOMMENDATIONS

Based on the results of this study, it is recommended that schools support the implementation of the CPS model assisted by digital media as an effort to enhance students' mathematical creative thinking skills. Teachers are encouraged to utilize CPS assisted by Articulate Storyline 3 as an interactive learning alternative to strengthen conceptual understanding and student engagement, as well as to continue exploring other innovative teaching strategies. This study is also expected to foster students' motivation, self-confidence, and active participation in problem-based learning. Future researchers are advised to expand the scope of materials and educational levels, and to ensure the availability of adequate supporting facilities in order to achieve more optimal and comprehensive results.

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