Pedagogika:Jurnal Pedagogik dan Dinamika Pendidikan
P-ISSN 2252-6676 E-ISSN 2746-184X, Volume 12, No. 2, Oktober 2024
doi: https://doi.org/10.30598/pedagogikavol12issue2year2024
https://ojs3.unpatti.ac.id/index.php/pedagodika,
email: jurnalpedagogika@gmail.com

ELEMENTARY SCHOOL STUDENTS' CREATIVE MATHEMATICAL THINGKING ABILITY THROUGH THE COLLABORATIVE PROBLEM-SOLVING MODEL

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Submitted: 25 September 2024 Accepted: 27 Oktober 2024

Abstract; This research aims to analyze the influence of the Collaborative Problem Solving (CPS) model on mathematical creative thinking abilities (MCTA). The approach used is quasi-experimental with a one-group pretest-posttest design and tested using a paired sample t-test. The research involved 21 fifth-grade students at state elementary school 1 Tual, Maluku Province, Indonesia. The research results show that the CPS model influences MCTA capabilities. By analyzing N-gain, it is found that all KBKM indicators have increased. The fluency indicator increased by 11%, flexibility achieved an increase of 14%, and originality increased by 2%, where all three indicators increased in the low category. This increase is due to the effective use of the CPS learning model. The CPS model triggers students to collaborate in a structured manner, interact, and work together to construct mathematical ideas. In collaborating, students are also encouraged to find various creative ideas for solving mathematical problems.

Keywords: CPS Model, MCTA, Mathematical Idea Construction, Creative Mathematical Thinking, Thinking Ability

KEMAMPUAN BERFIKIR KREATIF MATEMATIS SISWA SEKOLAH DASAR MELALUI MODEL KOLABORATIF PROBLEM SOLVING

Abstract; Penelitian ini bertujuan untuk menganalisis pengaruh model Collaborative Problem Solving (CPS) terhadap kemampuan berpikir kreatif matematis (MCTA). Pendekatan yang digunakan adalah quasi eksperimen dengan desain one-group pretest-posttest dan diuji menggunakan uji beda berpasangan (*paired sample t-test*). Penelitian ini melibatkan 21 siswa kelas V di Sekolah Dasar Negeri 1 Tual, Provinsi Maluku, Indonesia. Hasil penelitian menunjukkan bahwa model CPS berpengaruh terhadap kemampuan MCTA. Berdasarkan hasil analisis nilai N-gain diketahui seluruh indikator KBKM mengalami peningkatan. Indikator kelancaran meningkat sebesar 11%, fleksibilitas mencapai peningkatan sebesar 14%, dan orisinalitas meningkat sebesar 2%, dimana ketiga indikator tersebut meningkat pada kategori rendah. Peningkatan ini disebabkan oleh efektifnya penggunaan model pembelajaran CPS. Model CPS memicu siswa untuk berkolaborasi secara terstruktur, berinteraksi, dan bekerja sama untuk membangun ide matematika. Dalam berkolaborasi, siswa juga didorong untuk menemukan berbagai ide kreatif untuk menyelesaikan masalah matematika.

Kata Kunci: Model CPS, MCTA, Konstruksi Ide Matematika, Berpikir Kreatif Matematika, Kemampuan Berpikir

INTRODUCTION

Creativity is important for students to have when learning mathematics so that they can be actively involved in exploring creative ideas for solving problems. Piirto (2011) one of the scopes of creativity is the ability to think creatively. According to Treffinger, et al (2011; Vendiktama, 2016) there are four indicators of creative thinking ability, namely: (1) fluency; (2) flexibility; (3) originality; and (4) elaboration. To measure MCTA based on the concept of speed, three indicators are used: fluency, flexibility, and originality. Silver (2017; Huriyah, 2017) fluency is the student's ability to produce many alternative answers in solving problems, flexibility is the student's ability to use different ways to solve problems, and originality refers to the student's ability to examine methods or answers and produce something new. Creative thinking in mathematics is solving mathematical problems in a different way from what the teacher teaches in class and is the result of students' thinking. (Lince, 2016; Yulianto et al, 2021). Creative thinking is thinking that leads to the acquisition of new insights, new approaches, new perspectives, or new ways of understanding things (Mc Gregor, 2007; Sholihah, 2022).

The resulting new method requires students to construct ideas in solving mathematical problems or design something that exists to be more unique. Students with creative thinking abilities can understand mathematical concepts well in learning. Tabach & Friedlander (2017; Agustina et al, 2023) students with creative mathematical thinking abilities influence their understanding of the mathematical concepts being studied because, with high levels of creative thinking, students can solve problems with flexible and creative thinking and are not tied to what the teacher says. teach.

Initial research studies found that one of the problems was that teachers had not optimized students' creative thinking abilities by giving mathematics questions which could trigger an increase in MCTA. Teachers also need to involve students in active learning by paying attention to students' different abilities. Apriansyah & Ramdani (2018) emphasized that: (1) so that students can think creatively, students are often trained with questions that contain indicators of creative thinking; and (2) provide students with an understanding that you can answer a mathematics problem in various ways, not stick to just one method. Pratama (2022) students should be actively involved in learning so that learning will be fun and it is hoped that students will understand better and the knowledge they gain will be stored in their memory longer.

Students' creative thinking abilities can be improved through the application of innovative learning models. Abdurrozak, et al (2016) found an increase in students' creative thinking abilities by using the PBL model. Tarlina & Afriansyah (2016) increased the creative thinking abilities of students who received Creative Problem Solving learning better than students who received conventional learning. Magelo, et al (2020) open-ended learning models have a more positive influence on students' creative mathematical thinking abilities in terms of the level of learning motivation.

One creative learning model that is seen as being able to improve students' creative mathematical thinking abilities is the Collaborative Problem Solving (CPS) model. Nelson (1999; Ke Lu & Chun Lin, 2017) the CPS learning model integrates two learning approaches, namely cooperative and problem-based learning, where the CPS model encourages students to learn by doing and emphasizes the authenticity of a collaborative learning environment, emphasizing that with collaboration students become active in learning because of the emphasis on the results of individuals' free thinking and their ability to solve problems.

The CPS model requires students to collaborate and be individually responsible, interact, and work together as a structure in constructing creative ideas so that students are encouraged to find various opinions in solving mathematical problems through flexible collaboration (Takaria & Talakua, 2018). In CPS students are required to: (1) Engagement; (2) Exploration; (3) Transformation: (4) Presentation and; (5) Reflection (Reid et al, 1989; Takaria & Talakua, 2018). The important stages in the collaboration model are Exploration and reflection. At this stage, students are trained to become strong individuals in constructing creative ideas, which are built through a process of interaction and collaboration as a structure both individually and in groups.

METHOD

The method used in this research is quantitative with a quasi-experimental type of research. The research involved 21 fifth-grade students at State Elementary School 1, Tual City, Maluku Province, Indonesia. The research design uses One Group Pretest Posttest, as presented in Figure 1 which was adapted from Creswell (2010).

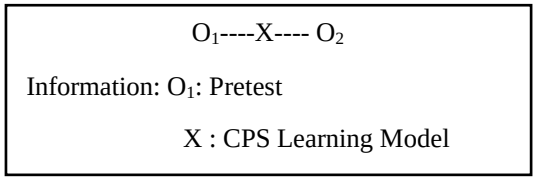

Figure 1. One Group Pretest Posttest Design

The design in Figure 1 shows that a pretest (O1) is carried out first. After carrying out the pretest, the next step is to apply the CPS (X) learning model and then carry out the posttest (O2). Analysis of the influence of the CPS learning model on MCTA uses the paired sample t-test, but first, the prerequisite tests for normality and homogeneity of the data are carried out. In analyzing the increase in creative thinking abilities, the normalized-gain formula is used (Meltzer, 2002; Takaria & Talakua, 2018).

$$N - gain = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Possible\ Score - Pretest\ Score}$$

Furthermore, the normalized-gain results are confirmed in Table 1. (Hake, 1998; Pattimukay, et al, 2023).

Table 1. N-gain Value Criteria

N – gain (<g>)	Classification
g ≥ 0,70	High
0,30 ≤ g < 0,70	Currently
g < 0,30	Low

RESULT AND DISCUSSION

Result

To analyze whether there are differences in the creative thinking abilities of class V students at Tual 1 State Elementary School on speed material after applying the CPS model, the paired sample t-test was used. The first step taken was to determine the research hypothesis design.

Hypothesis:

Ho: There was no difference in MCTA before and after the CPS model was implemented.

H1: There are differences in MCTA before and after the CPS model is implemented.

Before testing the hypothesis using the paired sample t-test, a prerequisite test was first carried out to see the normality and homogeneity of the pretest and posttest data for

creative thinking abilities. Table 3 presents the results of data normality and homogeneity testing.

Table 2. Data Normality and Homogeneity Test

Test	**Uji Normalitas**		**Uji Homogenitas**	
	Kolmogorof Smirnov		Levene test	
	(Sig Value)	Decision	(Sig Value)	Decision
Pretest	0,084	Normality	0,116	Homogeneity
Posttest	0,165			

Table 2 shows that the pretest and posttest creative thinking abilities are normally and homogeneously distributed. After the prerequisite tests have been met, the next step to see whether there is a difference in creative thinking abilities before and after the CPS model is applied is to use the paired sample t-test. Table 3 presents the test results.

Table 3. Paired Sample t-test

Test	Sig. (2-tailed)	Decision
pretest – posttest	0.000	H_1 accepted

Table 3 shows that by using the paired sample t-test, a sig (2-tailed) value of 0.000 < 0.05 was obtained, so a decision was made to reject Ho and accept H1, meaning that there was a difference in MCTA before and after the CPS model was applied.

To analyze the increase in creative thinking abilities in terms of indicators: (1) fluency; (2) flexibility; and (3) originality, N-gain is used. Table 4 presents the percentage increase in creative thinking abilities based on the indicators and characteristics developed (Munandar, 1999; La Moma, 2015).

Table 4. Percentage of Improvement in MCTA Indicators

Indikator	Characteristic features	N-gain value	Percentage Increase	Classification
Fluency	Many answers Work faster	0,11	11%	Low
Flexibility	Variations in answers To a question Presentation of concepts in different ways	0,14	14%	Low
Originality	Another answer in answering something question. Make unusual combinations of parts or elements in problem solving	0,02	2%	Low

Discussion

MCTA in mathematics learning is important for students to have when solving challenging mathematics problems. Students with creative thinking abilities can be actively involved in exploring various ideas through collaboration. The collaboration process carried out by students goes through stages: (1) engagement; (2) exploration; (3) transformation; (4) presentation; and (5) reflection. In collaborating to solve mathematical problems with the concept of speed, the first step taken is that students are distributed into ideal groups, and a transformation of ideas occurs through the results of the exploration of the problems given. Creative ideas are then combined to be presented as the result of group work. In the final process of problem-solving, students reflect to evaluate the strengths and weaknesses of the results of the collaboration.

The results of the collaboration have an impact on increasing fluency, flexibility, and originality indicators. At the fluency stage, students can provide many answers and work faster to solve speed concept problems. For the flexibility indicator, students can provide varied answers to a question and can present concepts in different ways. Meanwhile, as an indicator of originality, students can provide other answers and create unusual combinations of parts or elements for the mathematical problems being solved.

It was also revealed that the CPS model influenced increasing MCTA; this was shown after testing using a paired sample test. The CPS model can improve MCTA both as a whole class and for each indicator. The fluency, flexibility, and originality indicators achieved an increase in the low category. Even though the increase is in the low category, this shows that the CPS model is effective in solving students' mathematical problems. According to Fiore et al (2017), a problem can be solved through collaboration, which makes learning more efficient or effective.

The problem with the low increase in students' MCTA is that students are not accustomed to solving problems oriented towards increasing creative thinking abilities. This requires teachers to develop test instruments that contain indicators of contextually based mathematical creative thinking related to students' real lives and can be applied in mathematics learning. Silver (1997; Salim et al, 2017) several experts have developed instruments to measure students' MCTA, such as Balka developing the Creative Ability Mathematical Test (CAMT) instrument and Torrance developing the Torrance Tests of Creative Thinking (TTCT) instrument. This instrument is in the form of a task to create

mathematical problems based on the information contained in the questions related to the daily situations given.

MCTA-oriented questions provide opportunities for students to develop their creative thinking abilities and are better if applied using creative learning models, one of which is the CPS model. In the OECD (2013; Qiwei et al, 2017) the CPS model is an innovative domain and refers to the capacity of a student to effectively engage in a process in which two or more students attempt to solve a problem by sharing the understanding and effort required to reach a solution together. combining their knowledge, skills, and efforts to achieve those solutions.

CONCLUSION

Referring to the research results obtained, several things can be concluded as follows:

1. There is an influence of the CPS model on increasing the creative thinking abilities of fifth-grade elementary school students on the concept of speed.
2. The CPS model can improve creative thinking abilities in all indicators, where the fluency indicator increases by 11%, flexibility by 14%, and originality by 2%. All three indicators increased in the low category.

   The CPS model is effective in improving creative thinking abilities because it requires students to collaborate, and be individually responsible, interact, and work together as a structure in constructing creative ideas. This triggers students to find diverse opinions in solving mathematical problems on the concept of speed through flexible collaboration.

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