Pegem Journal of Education and Instruction, Vol. 12, No. 4, 2022 (pp. 29-38)

RESEARCH ARTICLE WWW.PEGEGOG.NET

The Effectiveness Open-Ended learning and Creative Problem Solving Models to Teach Creative Thinking Skills

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Abstract

Creative thinking skills are part of globalization era education and can be applied by implementing innovative learning models. This study aims to test the effectiveness of the open-ended learning and creative problem solving models to teach students' creative thinking skills on learning mathematics in elementary school. This research applied quantitative research with quasi-experimental method. Jebres District, Surakarta, Indonesia is the research area. Fourth grade elementary school students became the sample of this study. This study used a stratified cluster random sampling technique. After sampling, the research sample amounted to 270 students. Data collection techniques used test techniques, observation, and documentation studies. From the test results, this study found the result that the observation test value was 32.79 or more than the critical area of 3.02. Thus, the open ended learning and creative problem solving learning model affects creative thinking skills. In the comparative test, the open ended learning model is more effective than the creative problem solving and direct instruction models, and the creative problem solving learning model is more effective than the direct instruction model. These findings can be used as a guide for teachers to apply open learning models for their learning or creative problem solving models that are proven to affect creative thinking skills.

Keywords: Open-ended learning, creative problem solving, direct instruction, creative thinking skill

Introduction

Technological advances in the 21st-century influence every field such as education. The developments require efforts to meet needs both based on context and knowledge (Dewanto et al., 2018). In this era, education requires new concepts, actions, or thinking development. Thus, human resources must have good quality to balance the existing needs. To keep pace with the 21st-century demands, the government adds teaching formulations with HOTS components, known as 4C (Critical, Creative, Communicative, and Collaborative) (Rais et al., 2021; Yıldırım & Uzun, 2021). 4C is implemented in the 2013 curriculum policy where students are directed to think at a higher level. These four components are pivotal. However, what is still a scourge and difficulty for teachers is how to develop students' creative thinking skills.

Creative thinking serves as the basis for producing innovative students, who can find alternatives to increasingly complex problems or challenges in the future. In line with that, according to (Gilakjani, 2011), creative thinking is imaginative thinking in solving a problem. Creatively thinking skills need to be developed from an early age, not least in learning mathematics (Sya'Roni et al., 2020)unusual, and unique methods. This research aimed to explore the development of mathematics learning instruments with the flipped classroom-blended learning based on lesson study for learning community and its implementation effect on students' creative thinking skill. This research is multiphase mixed method research. This research was begun by research and development using 4D models to develop the learning instruments. Furthermore, a quantitative quasi-experimental research was conducted with non-equivalent pretest-posttest control group design. This research subject were 96 students on Class VIII at State Junior High School 2 Panji 2019/2020 academic year, consist of three treatment classes with two experiment classes and one control class. The research data were collected by questionnaire, observation, test, and interview. The research data were analysed statistically by Kruskal Wallis test. The results of this research show that (1. This shows that students can see several possibilities and guesses and find new strategies in solving a problem in mathematics. Creative thinking skills need to be measured to diagnose the level of students' abilities and provide motivation for students to develop their creative thinking skills (Sulistiyarini et al., 2020). Creative learning is also needed for children so that they feel happy and feel at home to take part in learning in class (Atun & Latupeirisa, 2021).

Students should have creative thinking skills. Creative thinking skills are also one of the competencies included

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How to cite this article: Kartikasari SA, Usodo B, Riyadi (2022). The Effectiveness Open-Ended learning and Creative Problem Solving Models to Teach Creative Thinking Skills. Pegem Journal of Education and Instruction, Vol. 12, No. 4, 2022, 29-38

Source of support: Nil

Conflict of interest: None.

DOI: 10.47750/pegegog.12.04.04

Received : 17.12.2021

Accepted : 15.05.2022 **Published:** 01.10.2022

in 21st century education (Chalkiadaki, 2018). As is well known, there are four 21st century skills that students need to possess. These skills are critical thinking skills, creative thinking, communicative, and collaborative. The need for creative thinking skills is also in line with the expectations of education officials so that students have these skills. In the 2013 curriculum, there is a policy regarding the requirement for students to have high-level skills. This is stated in the Minister of Education and Culture Regulation Number 37 of 2018 (Regulation of The Minister of Education and Culture Republic of Indonesia Number 37 of 2018 Concerning Amendment to Regulation of The Minister of Education and Culture Number 24 of 2016 Concerning Core Competencies and Basic Lessons in The 2013 Curriculum, 2018). The regulation contains curriculum objectives to achieve four competencies. One of them is the skill aspect. Possession of creative thinking skills will greatly assist students in learning in class. In addition, the number of students with creative thinking skills is the government's first step to take part in global competition through the Asean Economic Community (AEC) program (Yahiji et al., 2019). The program fully supports the superior output of students with their creative thinking skills. Students are expected to have every component or indicator contained in creative thinking skills.

Creative thinking skills need to be measured to diagnose the level of students' abilities and provide motivation for students to develop their creative thinking skills. Torrance states that creative thinking is a process that involves elements of fluency, flexibility, originality, and elaboration (Friedel & Rudd, 2006). According to Torrance (Appulembang, 2017), fluency is the ability to produce several answers; flexibility is the ability to generate varied ideas; originality is the ability to produce original and unique ideas; elaboration is the ability to detail, assess, develop, and enrich ideas. Creative thinking has features that characterize creative thinking. According to Guilford (Farida, 2016), four features characterize creative thinking; they are (1) fluency, (2) flexibility, (3) originality, and (4) elaboration.

However, Indonesia is a country with a relatively low level of creativity, this statement based on the 2015 Global Creativity Index (GCI) shows that Indonesia is ranked 115 out of 139 countries (Gunay & Kazazoglu, 2016). In addition, the 2015 PISA results show that Indonesia is ranked 65th out of 72 other countries. Indonesia's position is still below other countries in Southeast Asia that are members of PISA (Argina et al., 2017). In this study, the researcher performed a test to determine the creative thinking skills of the fourth-grade students of one elementary school in Surakarta. In this test, the questions given were related to creative thinking skills. The researcher wants to get in-depth information about the students' creative thinking skills in solving math problems. The test results show that their creative thinking skills are still low.

The researcher analyzed the students' answers on the given mathematics description test. They reflect the students' creative thinking skills that are still low. For fluency, of the 27 participating students, only 26% were able to meet the indicators. Students have not been able to come up with more than one idea in solving mathematical problems. For flexibility, only 23% of the students can meet the indicators. The students have not been able to determine more than one way to solve mathematical problems. For originality, only 27% of the students can meet the indicators because the method used in solving the problem is still general. Meanwhile, for elaboration or problem-solving skills, only 21% of the students had met the indicators. In this aspect, they find difficulties because they have not been able to explain the solution in detail.

Based on the results of observations, the students' low creative thinking skills are caused by the mathematics learning carried out by the teacher which is still slightly stimulating towards increasing students' creative thinking skills. The teachers used lecturing and question-and-answer methods in teaching, which are less varied, and learning was teacher-centered (Khairuddin, 2014). Li & Schoenfeld (2019) also explains that learning mathematics is dominated by lectures, which causes students to be passive. This makes them not creative because they only listen and solve problems the same way teachers solve problems. Students are receiving more information and less active in learning. Furthermore, previous researchers also revealed that there was student dissatisfaction and their anxiety during learning (Hidayat et al., 2018). This is due to the quality of the services provided has not been maximized. There is another fact that teachers are less able to foster student interest (Bardach & Klassen, 2020) in the process of problem solving, self-control and reflection (Petrulytė et al., 2020) in the past few years.

During the implementation of the 2013 curriculum, teachers often experience problems in choosing learning models because they need to adapt the model to thematic learning. Previous findings reveal that most elementary school teachers have difficulty adjusting learning models because of integrated subjects (Fauziah et al., 2020a). In teaching, they must apply the same model to teach different materials (Lukman, 2017). This leads to teacher's problems so that they are not consistent in applying the learning model. Therefore, it is necessary to test the learning model to develop higher-order thinking skills (HOTS).

One of the learning models that can support students' creative thinking skills is the Open-Ended Learning (OEL) model. According to Doncieux et al. (2018)i.e., when its states, actions and reward are defined, Markov Decision Processes (MDPs, OEL is a learning process in which the goals and desires of individuals/students are built and achieved openly. It can also refer to ways to achieve the learning objectives. OEL is a learning process that offers a learning process that begins

with giving problems related to the concepts to be discussed (Hafidzah et al., 2021)medium and low; 3 and presenting a problem that has many solutions (many correct answers) and various ways of solving it (Shimada, 2017). Through this model, students' curiosity will arise because the problems given can create situations that pose challenges for them so that they are motivated to be actively involved in learning. According to Rogers (2021), the steps of the OEL model are: (a) presenting a problem, (b) designing learning, (c) paying attention to and recording student responses, (d) guiding and directing students, and (e) drawing conclusions.

Creative Problem-Solving learning model is a cooperative learning model by dividing into small groups which later can work together in finding ways to solve a mathematical problem followed by strengthening creativity in learning mathematics with the learning steps, namely problem clarification, opinion expression, evaluation, and implementation (Heliawati, 2021). Through this model, students' curiosity will arise because the problems given can create situations that pose challenges for them so that they are motivated to be actively involved in learning (ElAdl & Polpol, 2020). This model is called a model in learning mathematics that presents a problem that has many solutions (many correct answers) and various ways of solving it (Shimada, 2017). The results show that the CPS model can improve students' creative thinking skills (Montag-Smit & Maertz, 2017).

A relevant study was conducted by Sompong (2018) that creative thinking skills can be improved after a collaborative and problem-based learning model is applied. In line with that, Ndiung et al. (2019) explains that creativity grows if the learning environment is supported by models that trigger creative thinking, such as creative learning. In his study, Ndiung suggested applying a creative learning model to support the development of students' mathematical creative thinking skills. Doncieux et al. (2018)i.e., when its states, actions and reward are defined, Markov Decision Processes (MDPs developed a concept about OEL. It was found that the concept of OEL as a change in the development of the latest model should be developed. The same thing was also expressed by (Titikusumawati et al., 2019). She analyzed creative thinking skills through the problem-posing model in mathematical problems. She suggests future researchers apply other learning models to improve creative thinking skills.

From here, no findings are truly like this study. This study uses two variables, OEL and CPS models (independent variable) and creative thinking skills (dependent variable). This study was also conducted in elementary schools, especially fourth grade. The previous studies rarely choose students as the participants. Elementary school students need special attention from the researchers because they still need guidance to develop and maximize their thinking skills. This makes this study more interesting because it has never been done. This study uses OEL and CPS models which have the advantage of improving students' HOTS.

The formulation of the research problem is whether the Open-Ended Learning (OEL) and Creative Problem Solving (CPS) models to teach students' creative thinking skills in learning mathematics in elementary schools?. This study aims to test the effectiveness of the Open-Ended Learning (OEL) and Creative Problem Solving (CPS) models to teach students' creative thinking skills in learning mathematics in elementary schools. The hypothesis of this research is that the Open-Ended Learning (OEL) model is more effective than the Creative Problem Solving (CPS) model to teach students' creative thinking skills in learning mathematics in elementary schools and the Creative Problem Solving (CPS) model is more effective than the Direct Instruction (DI) model to teach students' creative thinking skills in learning mathematics in elementary schools.

Method

Research Design

This study uses quantitative approach, the process of finding knowledge using numbers as a means of finding information. Quasi-experiment was used. The quasi-experimental method is defined as a method that has a control group but is not fully functional to control external variables that affect the implementation of the experiment (Creswell, 2013). This method is used because the researcher cannot control all the variables. This quasi-experiment can be used if it can control at least one variable even though it is in the form of matching its characteristics. The research design is presented in Table 1.

In experimental research, students were divided into a control group and an experimental group. The experimental group consisted of students from six elementary schools as the research sample. The experimental group will receive learning using the OEL and CPS learning models. The OEL learning model was implemented in three elementary schools and the CPS learning model was also implemented in three elementary schools. Meanwhile, the control group was implemented in three schools and the DI learning model was applied.

Population and Sample

This study took place in one elementary school in Jebres District. Population is a generalization area consisting of objects/subjects that have certain qualities and characteristics

Table 1.: *Research Design*

Group	*Treatment*	*Post-Test*
Experiment 1	X1	O1
Experiment 2	X2	O2
Control	X3	O3

determined by the researcher to be studied and concluded (VanderStoep & Johnston, 2009). The population in this study was the fourth-grade students of one elementary school in Jebres District.

Sample is part of the number and characteristics possessed by the population. The sample in this study consisted of nine elementary schools which were divided into experimental group 1, experimental group 2, and control group. The total number of students is 270. The experimental group 1 consisted of 90 students, the experimental group 2 89 students, and the control group 89 students.

The sampling technique used is the stratified cluster sampling technique. This technique is a sampling process that combines the characteristics of stratified random sampling and simple cluster sampling. In the stratified cluster sampling technique, the population is classified into homogeneous strata so that the group becomes heterogeneous with other groups. The next process is the selection of clusters from each strata. The process of grouping the population into strata so that the samples taken can represent good population characteristics. Furthermore, the population in each stratum is grouped into several clusters. There are stages that are carried out in sampling. First, the population is divided into several sub-populations (stratum). The second is to divide the population into the main sampling unit or m_h at random. The third stage is to randomly select the MH group as the sample. The fourth stage is selecting a sample randomly. Fifth, conduct an assessment and conclude the sample results.

Data Collection

Test was used to collect the data of students' mathematical creative thinking skills. The type of test is a description test with measurement material. There are eight test items used. The validation of the creative thinking skill test instrument in this study was carried out with content validity. Content validity was carried out to determine the ability of an instrument to measure the content (concept) to be measured. The researcher used expert judgment to determine the validity level of the instrument to be used. The experts evaluated the items by considering various criteria such as the suitability of the material, the construct, and the language used. This assessment was carried out by 8 experts to validate the instrument. There are 6 experts in this study, 4 lecturers with Doctoral degrees who are experts in mathematics and 2 experts who are fourth-grade elementary school teachers with years of teaching experience. The data were calculated using the product-moment correlation formula. The test item is valid if the product-moment correlation index (r_{xy}) is greater than or equal to 0.30.

Next, the researcher calculated the test reliability score with the Alpha formula to show the extent to which the instrument can be trusted in research. A test is good if the reliability score is between of 0.7 to 1. Through the calculation of the Cronbach's Alpha formula, the result of the reliability calculation reached 0.774. It can be concluded that the test instrument is feasible for use.

Based on Table 2 above, from the 8 questions tested, the researcher took all 8 items that had met the validity, level of difficulty, discriminating power, and reliability, and had represented each indicator of creative thinking skills.

Data Analysis

Data analysis in this study was conducted to test the hypothesis. It was carried out in two stages, namely the prerequisite tests for data analysis and the test of data analysis or hypothesis testing. The prerequisite tests for data analysis include normality and homogeneity tests.

Normality test is carried out to test whether the sample comes from a population that is normally distributed or not (Budiyono, 2017). In this analysis, the normality test with the Lilliefors method was used because the data were not in the data frequency distribution. The results are as follows:

Table 3 shows that all conclusions obtained show that the sample is normally distributed because the observation score in each learning model exceeds the table score so that H_0 is accepted. It means that the sample is normally distributed.

Table 2.: The results of validity of test questions for creative thinking skill test instrument

No	*Validity*	*Discriminating Power*	*Level of Difficulty*	*Reliability*
1	Valid	Medium	Good	Reliable
2	Valid	Medium	Good	
3	Valid	Medium	Good	
4	Valid	Medium	Good	
5	Valid	Medium	Good	
6	Valid	Medium	Good	
7	Valid	Medium	Good	
8	Valid	Medium	Good	

Table 3.: Normality Test of Creative Thinking Skills

Learning Model	Observation Score	Table Score	Decision	Conclusion
Open-Ended Learning	0.0779	0.0934	H0 is accepted	Normally distributed sample
Creative Problem Solving	0.0696	0.0924	H0 is accepted	Normally distributed sample
Direct Learning	0.0889	0.0934	H0 is accepted	Normally distributed sample

Homogeneity test is conducted to determine whether the variances of several populations are the same or not (Budiyono, 2017). In this study, Bartlett test was used for testing homogeneity. The homogeneity test of variance was carried out on the dependent variable data, namely students' creative thinking skills. Variance test was used for the homogeneity test of the variance of this data writing.

Based on the table above, the homogeneity test of the observed data from the creative thinking skill test shows that the observer's score is less than the table score. Therefore, H_0 is accepted, or the sample comes from a population with the same variance.

The data analysis test used is one-way Analysis of Variance (ANOVA) with unequal cells. It aims to see the effect of the independent variable on the dependent variable by comparing the mean of several populations. In testing the hypothesis, several stages are carried out. First, the researcher determined H_0 and H_1 to test the population characteristics of the research sample. The description of H_0 and H_1 in this study are:

H_0 : $\alpha i = 0$, for each i = 1, 2, 3, ..., p
(there is no effect of learning model on creative thinking ability)

H_1 : there is at least one αi non-zero
(there is an influence of the learning model on the ability to think creatively)

Second, the researcher determines the significance level (α) = 5%, which means the risk of making a decision error is 5%. Third, the researcher determines the test criteria used. Fourth, the researcher determined the statistical test used using two-way analysis of variance with the help of Microsoft excel. Fifth, the researcher calculates the value of the test statistic by analyzing the output of the statistical test compared to the value of the statistical table. The technique used is the analysis technique of two unequal cell paths. Sixth, the researcher draws conclusions according to the test criteria.

The multiple comparison tests was used as a follow-up to the one-way ANOVA to find out the difference in the mean of each pair of rows, columns, and cells, and the researcher only knew that the treatments studied did not have the same effect. The researcher did not know which treatment significantly different effect from the others had, so it is necessary to do a double comparison test using the Scheffe method.

Findings

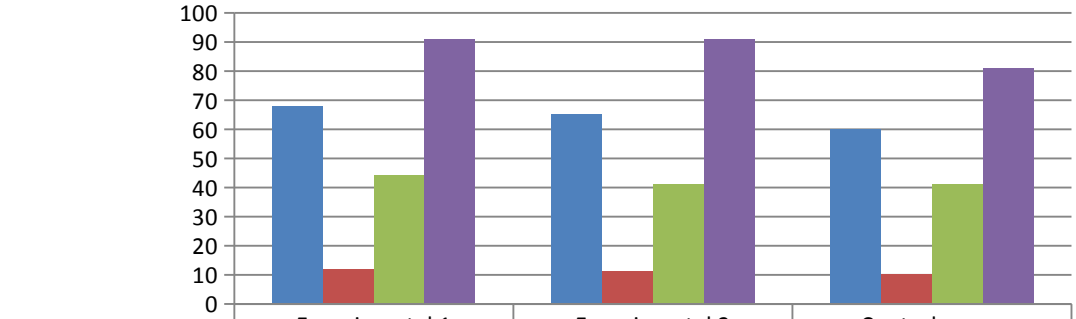
This study aims to determine the effectiveness of the OEL and CPS models on the creative thinking skills of fourth-grade students at elementary school. Before doing the treatment, the researcher first conducted a pre-test to determine the students' initial abilities. The results of the pre-test are as follows:

The results in graph 1 show that experimental group 1 got the highest average score and a higher minimum and maximum score than the experimental group 2 and the control group. These results are not optimal yet because the OEL, CPS, and DI models have not been implemented.

Next, the researcher conducted a post-test of creative thinking skills. These results are compared with the pre-test results. The results of the post-test scores for each class are presented in the following graph.

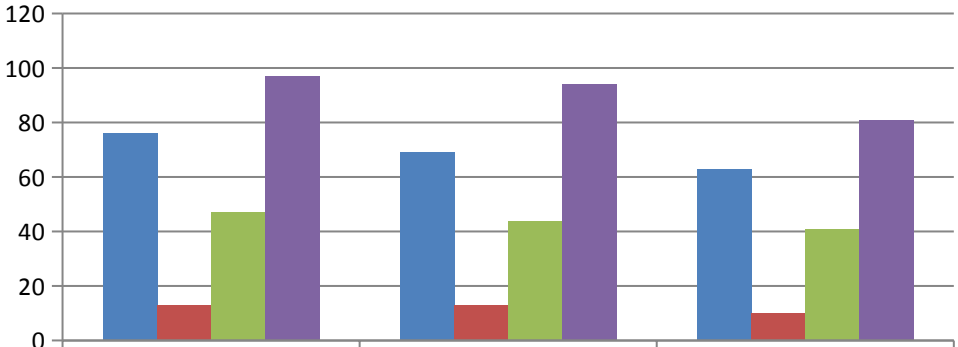
Table 4: Homogeneity Test of Creative Thinking Skills

Group	*Observation Score*	*Table Score*	*Decision*	*Conclusion*
Experimental Control	3.453	5.991	H0 is accepted	Homogeneous



	Experimental 1	Experimental 2	Control group
Mean	68	65	60
Standard Deviation	12	11	10
Min	44	41	41
Max	91	91	81

Graph 1: Pre-Test Results of Each Group



	Experimental 1	Experimental 2	Control
Mean	76	69	63
Standard Deviation	13	13	10
Min	47	44	41
Max	97	94	81

Graph 2: Post-Test Results of Each Group

Table 5: Comparison of Pre-Test and Post-Test Results of Each Group

	Pre-Test				*Pre-Test*			
Group	*Standard Deviation*	*Mean*	*Min*	*Max*	*Standard Deviation*	*Mean*	*Min*	*Max*
Experimental 1	12	68	44	91	13	76	47	97
Experimental 2	11	65	41	91	13	69	44	94
Control	10	60	41	81	10	63	41	81

Table 6: The Result of One-Way Analysis of Variance with Unequal Cells

Source	*Number of Squares*	*Degrees of Freedom*	*Average Square*	*The Result of Statistics Test*	*Critical Limit*	*P*
Learning Model	7.448.82	2	3.724.41	32.79	3.02	< 0.05
Error	30.330.18	267	113.60	-	-	-
Total	37.779.00	269	-	-	-	-

Graph 2 provides information that the OEL model gets an average score that is superior to the other two models. In addition to its mean, the OEL model also has higher minimum and maximum scores. It obtains the highest score of 97 and the lowest score of 47. Meanwhile, students learning with the CPS model get a maximum score of 94 and a minimum score of 44. Students learning with the DI model even get a lower score. The maximum score obtained is only 81 and the minimum score is 41. Based on the two charts above, the comparisons of pre-test and post-test results are described as follows:

Table 5 shows concludes that each group has an increased score. However, the students in experimental group 1 who had applied the OEL model had a significant increase. Thus, the OEL model has succeeded in increasing students' creative thinking skills. Even though the result had been known, the researcher still had to do prerequisite tests to find out its validity and reliability.

After calculating a series of prerequisite tests, the researcher proceeded to calculate the one-way ANOVA with unequal cells. The results of the calculation of the one-way ANOVA with unequal cells are presented in Table 6..

Table 6 shows that all the observed/calculated values are greater than the table scores (the reference scores in the Lilliefors table). From all the results of this analysis, it is decided that all H_0 are rejected. It is concluded that there are differences between the three learning models after being applied to the creative thinking skills of the fourth-grade students at elementary school. Due to differences or

Table 7: Multiple Comparison Summaries (Learning Model)

Hypothesis	*The Result of Statistics Test*	*Critical Limit*	*P*
OEL = CPS	22.33	6.06	< 0.05
CPS = DI	15.52	6.06	< 0.05
OEL = DI	74.86	6.06	< 0.05

interactions, the researcher continued the Scheffe test. This test is to compare which learning model is better for creative thinking skills. Table 7 below is a summary of the multiple comparisons of each learning model.

Table 7 shows that the statistical value for each hypothesis exceeds the value of the critical area. The largest statistical results were obtained on the first hypothesis that the OEL model was more effective than the CPS model. Thus, it can be concluded that the OEL model is more effective than the CPS model, the CPS model is more effectively applied than the DI model, and the OEL model is more effective than the DI model. This is because the statistical value obtained in each model is more than the critical area value.

Discussion

Based on the findings, it is known that the OEL and CPS models affect creative thinking skills. This is due to several factors. The OEL model has the advantage of encouraging students to act actively so that they can express their ideas. In addition, the OEL model also triggers the motivation of students to uncover a problem to completion according to their experience. In his research, Hafidzah et al. (2021)medium and low; 3 states that students who study with the OEL model can overcome mathematical problems.

In line with that, the proof that the CPS model influences creative thinking skills is also influenced by the advantages of the CPS model. The CPS model can facilitate students to design an invention, solve problems, and evaluate the results of their investigation. Through the CPS model, students are allowed to understand concepts by solving a problem, become active in learning, develop their thinking skills and problem-solving abilities, and can apply their knowledge to new situations (Fauziah et al., 2020b).

Thus, it is not surprising that the OEL and CPS models are proven to affect the creative thinking skills of elementary school students. This finding is per the findings of Tanjung et al. (2020) that the OEL model influences problem-solving skills. In line with that, Emara et al. (2018) suggests that the OEL model can change student behavior after being integrated with problem-solving-based models like CPS. Furthermore, Heliawati (2021) said that the CPS model through open-ended experiments could improve students' scientific understanding and attitudes.

In addition to the effect of the OEL and CPS models on creative thinking skills, this study also obtained specific data regarding the most effective model of the three models. The findings show that the OEL model is more effective than the CPS and DI models. That is why the OEL model is more effective than the CPS. Quoting from the findings of (Triwibowo et al., 2017), it was revealed that the application of the Treffinger model with an open-ended learning approach can optimize students' creative thinking skills. Other findings also yield a similar conclusion that the collaborative learning model with an open-ended approach has proven to be effective in maximizing students' problem-solving skills (Nurhayati & Karyati, 2016; Hannula, 2019).

Furthermore, it was found that the CPS model was more effective than the DI model. From each step of the two models, the CPS model has more advantages than the DI model. As stated by Murwaningsih & Fauziah (2020), the CPS model has a greater influence than the DI model. A well-planned CPS model can change the habits of children from thinking convergent to thinking divergently. In line with previous findings, it is evident that the CPS model is superior to the DI model on mathematical connection abilities (Yosopranata et al., 2018), mathematical problem-solving abilities (Nonthamand & Songkhla, 2018), and student learning outcomes (Yuliana et al., 2019).

In general, it can be concluded that the OEL and CPS models are proven to be effective in influencing creative thinking skills. The most superior model is the OEL model while the less effective is the DI model. This is because the OEL and CPS models have the advantage of being more detailed and systematic at each step of the learning process.

Conclusion

The conclusion of this research is that the OEL and CPS learning models are effectively used to teach students' creative thinking skills. In detail, the OEL model is more effective than the CPS model to teach students' creative thinking skills, while the CPS model is more effective than the DI model to teach students' creative thinking skills.

Suggestion

This research has been carried out successfully. The results obtained during the research are that students are more active in participating in learning and students' thinking power is getting sharper in the field of mathematics. Therefore, researchers suggest to teachers that teachers use problem-based learning models, especially in the field of mathematics.

This is because to solve mathematical problems must go through a long process so that teachers need models that are in line (problem-based). The findings of this study can also be a reference for literature studies for future researchers if they want to conduct similar research. The next researcher can also test the OEL and CPS models to teach students' creative

thinking skills. In addition, other research can also test the OEL model to teach students problem solving skills.

Limitation

This finding has limitations that are only applied to elementary schools, so the researcher recommends future researchers to apply this model at a higher level (eg, junior high school or senior high school). Apart from being only conducted in elementary schools, this research was also only conducted in one area or one sub-district. Thus, the expansion of the sample area (one city) would be better if it was carried out by future researchers. This study also only uses the learning model without linking the learning media. So, further researchers can test media-based learning models, such as testing the effectiveness of multimedia-based CPS learning models to teach creative thinking skills.

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Appendix 1

Creative Thinking Ability Test Grid

No.	*Indicator of Creative Thinking Ability*	*Question Indicator*
1.	Thinking Fluency (Fluency) Able to present many ideas, answers or solutions fluently.	Presented a statement about the length of 4 strings, students can explain several ways of converting units of length and rounding them to the nearest unit correctly.
2.	Thinking Flexibility (Flexibility) Able to generate various ideas, answers or solutions.	A statement about the journey from headings I-IV is presented, students can generate several answers in converting units of length and rounding them to units appropriately.
3.	Think Original (Original) Able to come up with new ideas or provide other answers	Presented a statement about batik shops, students can provide new answers in converting units of length and rounding them to tens correctly.
4.	Thinking Elaboration (Elaboration) Able to enrich and develop an idea in detail.	Presented a statement about the weight of the truck load, students can generate several answers in converting the unit of weight and rounding it to units correctly.

Appendix 2

Creative Thinking Ability Test Instrument

Answer the questions below clearly!

1. Lina buys four ropes, the length of the first rope is 2.7 m, the length of the second rope is 145.4 cm. the length of the third rope is 0.7 dam and the length of the fourth rope is 1000 mm. After rounding to the nearest unit, the length of the four lines is…converting to centimeters and meters. Rewrite the reading above. Use your own words! Use several ways to explain your answer.
2. Scout members walk from post I to Post II for a distance of 1 km and over 570.3 m, continued from post II to post III for 7.24 dams then continue from post III to post IV for a distance of 245.6 m. The difference in distance between posts I – II, posts II – III, posts III - IV is ….m
3. A shop has a stock of 24.40 km of batik cloth. Within a week the batik cloth in the shop was sold for 1,560.2 m. This week the shop received shipments of 45, 24 dams of batik cloth. Now the supply of batik cloth in the shop is available….m
4. A truck transports foodstuffs weighing 6200.32 kg in the form of rice, peanuts, and corn. If the weight of rice is 46000.42 hg and peanuts are 120.3 kg, then what is the weight of the corn transported by the truck?

Appendix 3

Criteria for Assessment of Creative Thinking Ability

	Aspects of Creative	*Score*				
No	*Thinking*	*4*	*3*	*2*	*1*	*0*
1.	Fluency	Give more than one relevant answer	Give more than one answer but there is an error	Giving one answer but correct	Giving answer but wrong	No answer
2.	Flexibility	Find more than one way to solve problems and use appropriate mathematical procedures	Find more than one way to solve the problem but the systematic procedure is not suitable	Find a way to solve the problem and use the appropriate mathematical procedure	Finding one way to solve the problem but not using the appropriate mathematical procedure	No answer
3.	Originality	Give answers in different ways and the results are correct.	Give answers in the usual and correct way.	Giving answers in a different but incompre-hensible way	Giving answers in the usual way and the result is wrong	No answer
4.	Elaborati-on	Give the correct answer and the steps given are detailed	Gives the correct answer, but the steps given are less detailed	Giving inaccurate answers and the steps given are less detailed	Giving inaccurate answers without details	No answer