Assessing the Impact of Creative Problem-Solving Educational Models on Students' Ability to Think Creatively

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Abstract. The capacity of students to think creatively is another factor that plays into whether or not they are successful in accomplishing their educational objectives. There will be less opportunity for students to cultivate original thought if they are exposed to fewer learning models. This study aims to answer whether teaching with a Creative Problem-Solving model increases students' propensity for creative problem-solving. The investigation employed a strategy known as a quasi-experimental study. The one-group pretest-posttest design was used for the study, and the sample size was thirty students out of a population of one hundred and twenty. The data analysis method uses descriptive statistical analysis, comprised of data gleaned from student response questionnaires and the outcomes of creative thinking ability tests administered to students. Both descriptive and inferential statistical analyses were used to make sense of the experiment's results. The findings indicated, with a confidence level of 95%, that there was a significant influence on the relevance of the Creative Problem-Solving education model on the student's creative thinking skills.

Keywords: Creative Problem-Solving (CPS) · Learning Model · Creative Thinking Skills · Vocational High School

1 Introduction

The 21st century demands various skills that a person must master. These crucial skills, namely communication, elaboration, critical thinking, and creative thinking, must be developed in learning activities. Creativity for Vocational High School (SMK) graduates is needed to support the competency standards of vocational high school graduates themselves [1–4].

The teacher plays a crucial role in determining the success of students' learning experiences. Teachers need to have a thorough understanding of their student's learning behaviors and possess a mastery of the subject matter being taught. As each student has unique abilities, it is incumbent upon the teacher to create learning environments that promote student engagement and motivation. By providing exciting learning opportunities, teachers can help to unlock their students' potential and facilitate their academic

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success. Teachers must create learning situations and conditions to increase students' activeness in learning activities [5, 6].

The quality of education in Indonesia continues to improve to achieve the expected results. One aspect that continues to be encouraged is the ability to think creatively in students. Creative thinking needs to be developed in the learning process. Creative thinking is a cognitive process employed to generate novel ideas or concepts. The capacity for creative thinking comprises various components, including ease, flexibility, innovation, and elaboration [7–9].

Yuliastuti, Sukajaya, and Mertasari advocate that CPS can help students develop their creative problem-solving skills in a realistic, hands-on way. The CPS framework emphasizes the ability to solve problems using; additionally, the model utilizes systematic techniques to organize students' creative ideas during problem-solving [10, 11]. When students are faced with a question in the form of a problem, students can solve the problem the question with various solutions. Students not only memorize without thinking, but students can also expand their thinking processes.

According to Effendi and Fatimah [12], the CPS learning model emphasizes developing problem-solving skills and enhancing existing abilities. The CPS learning model is included in the learning model with a constructivist approach, where the learning center is the student, so it is considered capable of activating students [9, 13].

Based on the initial observations made at the vocational high school Soppeng, it was found that the learning model used by the teacher was less varied. Learning is still dominated by teachers and less centered on students, affecting student learning activities. Students' success in achieving learning goals is also influenced by the ability to think creatively. Less varied learning models make it difficult for students to develop creative thinking skills.

Based on the results of interviews with teachers supporting the Basic Programming subject, it was found that the conditions at vocational high school Soppeng were that most students were still lacking in working on questions smoothly, flexibly, initially, and elaboratively. In addition, most students are less enthusiastic and prefer not to answer when the teacher gives a question and students have not been able to solve a problem creatively. To overcome this, students need to be accustomed to creative thinking. One way is to change the learning process where previously teacher-centered learning becomes student-centered.

Based on the phenomenon above, the problem of the research problem is whether the Application of Creative Problem-Solving Learning affects increasing the Creative Thinking Skills of Students at the vocational high school Soppeng.

2 Method

This study illustrates an experimental design in quantitative research by employing a group pre-and post-test design. Work on it began at Soppeng Vocational High School in the spring of 2021 and continued through the end of the school year in the fall of that same year.

The population for the study consisted of 120 students from the Department of Computer and Network Engineering vocational high school in Soppeng. The sample

Table 1. Criteria of Creative Thinking

No.	Percentage (%)	Category
1	$80 < K \leq 100$	Very creative
2	$60 < K \leq 80$	Creative
3	$40 < K \leq 60$	Creative Enough
4	$20 < K \leq 40$	Less Creative
5	$0 \leq K \leq 20$	Very Less Creative

size used for the study was 30 individuals. Data were collected through various methods, including questionnaires, tests, and documentation.

Descriptive statistical analysis was the technique used to investigate the data collected from the analysis. The analysis included an assessment of the responses given by students on the questionnaires and an evaluation the data collected from the tests measuring students' creative thinking abilities. The assessment criteria used for each data analysis were established as follows (Table 1).

Hypothesis analysis was done using a paired sample t-test, assuming the research data were typically scattered.

3 Results and Discussion

3.1 Descriptive Analysis

The implementation of the CPS learning model uses Student Worksheets. This Worksheet contains steps for learning Creative Problem Solving: clarifying the problem, expressing opinions, evaluating and selecting, and implementing—the result of the research described below.

3.1.1 Pre-test

Before the learning process started, the students were given pre-test questions. The test aims to determine the extent of students' initial creative thinking abilities in Basic Programming subjects. The result of the pre-test is in Table 2.

Based on Table 2, the descriptive analysis of the pre-test students' creative thinking ability shows that the highest score (max) is 53. The mean value is lower than the median value. It means most score values of the students get lower than the mean score. It also can be seen from the modus value is 18.

3.1.2 Post-test

It was determined whether or not the CPS model successfully stimulated students' creative thinking by giving them a post-test comprised of the same questions used for the initial assessment. The model's influence on the student's imaginative capacities was to

Table 2. Pre-test Descriptive Analysis

No.	Statistics	Statistical Value
1	Number of samples	30.00
2	Maximum	53.00
3	Minimum	10.00
4	Mean	31.63
5	Median	33.00
6	Modus	18.00
7	Standard deviation	11.38

be measured with the post-test. This table provides a descriptive analysis of the post-test results:

According to the data presented in Table 3, the highest score attained by students in terms of their creative thinking abilities is 80, which is also the maximum score possible. Additionally, the mean score is above average, indicating that most students scored higher than the average. The mode value for creative thinking abilities is 60.

The average value of students' creative thinking abilities in the pre-test and post-test can be presented in the following diagram:

Figure 1 shows that the average pre-test score has increased in the post-test by 30.30. This value is obtained from students' average creative thinking ability, calculated based on ease, flexibility, uniqueness, and elaboration indicators. Details of these values are presented in Table 4.

According to Table 4, the pre-test mean score for students' creative thinking ability indicates that the highest score was obtained in the fluency indicator with a score of 44.17, which falls under the Creative Enough category. On the other hand, the lowest average score was found in the elaboration indicator, with a score of 21.67, which was categorized as Less Creative. In the post-test, the highest mean score was achieved in the

Table 3. Post-test Descriptive Analysis

No.	Statistics	Statistical Value
1	Number of samples	30.00
2	Maximum	80.00
3	Minimum	33.00
4	Mean	61.93
5	Median	60.00
6	Modus	60.00
7	Standard deviation	13.711

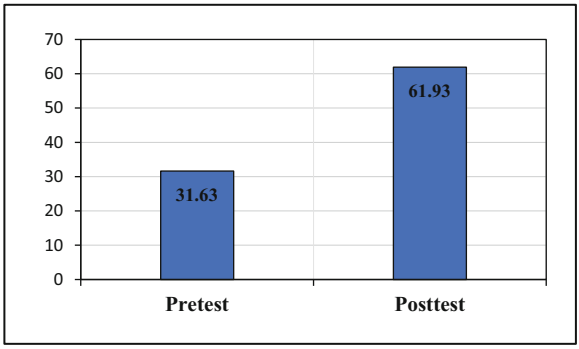

Fig. 1. The mean score of the Creative Thinking Ability

Table 4. Average Value of Creative Thinking Ability

Indicator	Pre-test		Post-test	
	Score	Criteria	Score	Criteria
Fluency	44.17	Creative Enough	80.83	Very Creative
flexibility	23.61	Less Creative	43.06	Simply Creative
Originality	33.75	Less Creative	61.67	Creative
Elaboration	21.67	Less Creative	60.83	Creative

fluency indicator, which was 80.83, classified as Very Creative. The lowest score was found in the flexibility indicator, with a score of 43.06, categorized as Creative Enough.

3.1.3 Inferential Statistical Analysis

In requirements analysis, the normality test is performed before the hypothesis test. Pre-test data have a significance level of 0.99, while post-test data have a significance level of 0.68, according to the Kolmogorov-Smirnov normality test formula. That is a lot bigger than the 0.05 threshold for significance. This usually entails the dissemination of pre-and post-test data from studies.

The subsequent data analysis is paired sample t-test. The test results showed that the t-value was −16.847 in the 2-tailed test and a significance level of 0.000. Referring to the degree of freedom in 29 with the 2-tailed test, the t-table obtained is −2,045. It means the t-value is lower than t-table.

3.2 Discussion

Pre-test results show that students' average value of creative thinking skills is 31.63. It indicates that the students are not particularly creative—post-test averages in the creative range at 61.93, for comparison. There is a significant discrepancy in the mean. The transition from the less creative to the more creative group is accompanied by a

change in each indicator's pre- and post-test mean values. The paired sample t-test results corroborate this; the t-table is 16.847, significantly higher than the t-table of 2.045. The null hypothesis has a significance level of 0.000, which is smaller than the threshold of 0.05. The discovery mentioned above demonstrates how the CPS pedagogical framework affects students' propensity for original thought.

The indicator of the CPS is fluency, flexibility, originality, and elaboration. The highest mean score for both classes is on the fluency indicator, meaning that, on average, students can think fluently or spark many ideas and always think of more than one answer. The elaboration indicator also has significant improvement. The criteria before the implementation of the CPS only had Less Creative, then became Creative criteria after applying the CPS learning model.

The results of this study corroborate those of Rolia et al. [14], who found that teaching students to solve problems using the CPS model improved their creative thinking. The Creative Problem-Solving model's learning activities are well-suited to fostering students' creative thinking skills, and students' motivation rises after using the model.

This study aimed to examine the impact of the CPS learning model on students' ability to think creatively and their performance on Open-Ended Test questions related to physics [15]. This study utilized a pre-experimental design with a Group Pretest-Posttest structure. According to the results, using the CPS learning model significantly improves students' academic performance and capacity for original thought.

They also analyzed the student response questionnaire. The analysis results explained that the average value of the CPS learning model increased students' way of thinking in solving a problem amount 75.5%, trained teamwork in groups by 82.53%, and increased student motivation students by 81.56%. The application of the Creative Problem-Solving learning model received a positive response from the students, as evidenced by the average score of all indicators being 80.29%, which falls under the "Very Good" category. This indicates that the students have positively accepted the model and its implementation in the Basic Programming subject at the vocational high school Soppeng.

In addition, Wati et al., who applied classroom action research, showed that from cycle I to cycle II, teacher activity increased from the good to very good category. Student activity increased from the active category to very active. Students' creative thinking abilities also increased from low to high categories. The students' learning outcomes classically increased from 61.76% to 88.24%, and students responded well to the interactive multimedia-assisted CPS learning model [16].

Puspita et al. [17] conducted a study investigating the impact of the Creative Problem-Solving learning model and the vee diagram technique on the development of student's creative thinking abilities in Bandar Lampung. Employing a quasi-experimental approach with a quantitative methodology, the study utilized experimental and control groups as the research sample. The findings suggest that implementing the CPS learning model and the vee diagram technique favorably enhances students' creative thinking skills.

Agoestanto & Masitoh [9] found similar results to this study, indicating that the CPS learning model can enhance students' mathematical creative thinking abilities. The research revealed a significant difference between the average pre-test and post-test scores, with the average pre-test score being 61.61 and the post-test average score

being 75.27. Moreover, the N-Gain calculation revealed a moderate increase in creative thinking ability, with a value of 0.3716.

The CPS learning model is student-centered. This model brings students more independent in learning. Students are required to be responsible for the success of their group and solve the problems given. Meanwhile, the teacher acts as a facilitator and oversees the developments that occur in students and clarifies the truth of the understanding that students obtain. Hapriani (2012), Hayudiyani et al. (2017), and Risnawati & Saadi (2017) also show that students' responses are classified as positive categories to the implementation of the Creative Problem-Solving learning model [18–20].

4 Conclusion

The above information allows us to conclude, with 95% confidence, that the Creative Problem-Solving learning model profoundly affects the students' ability to think creatively while studying Basic Programming at Soppeng vocational high school. Additionally, the field trip learning model significantly boosted the students' environmental consciousness and waste management expertise.

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