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Application Creative Problem Solving to Improve Junior High School Student Creative Thinking Skills in Environmental Pollution Materials

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Abstract

Education is an effort to improve the quality of life and human resources. One of these educational goals is to increase student creativity in learning at school. This study aimed to determine the increase in students' creative thinking skills, learning implementation, and the responses of class VII E students of SMP Negeri 2 Semen after implementing the learning process by applying the creative problem-solving learning model to environmental pollution material. The research method used is Pre-Experimental Design with the experimental design used is One-Group-Pretest-Posttest. The research subjects in this study were students of class VII E with a total of 34 students at SMP Negeri 2 Semen Kediri. Data collection using tests (pretest-posttest), observation sheets of learning implementation, and student response questionnaires. Based on the results of the study after carrying out learning by applying creative problem solving it was found that students' creative thinking skills increased with an N-Gain value of 0.75 with very high criteria. The application of the creative problem-solving learning model in class VII E of SMP Negeri 2 Semen was carried out well, this can be seen from the mode value of the results of observing the implementation of learning, namely 4. Student responses to the application of creative problem-solving learning models in environmental pollution material received a value of 85, 10% with very high criteria which means students give a positive response. The conclusion from this study is that the creative problem-solving learning model influences the creative thinking skills of class VII E students of SMP Negeri 2 Semen Kediri.

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INTRODUCTION

According to the Republic of Indonesia Law No. 20, Chapter 1, Article 1 of 2003 concerning the National Education System, education is a conscious and planned effort to create a learning atmosphere and learning process in such a way that students can actively develop their potential, society, nation, and state (Latief et al., 2021). The government expects students to achieve various skills by applying HOTs or higher-order thinking skills. These skills include critical thinking, creativity and innovation, communication skills, the ability to cooperate, and self-confidence. The five attributes emphasized by the government, which are the target of student character development, are also known as 21st-century skills or often referred to as the 21st Century Skills (Ariyana et al., 2021).

These skills are needed to educate and prepare students to face competition in the global era. One of the skills that students need to develop in the learning process is creative thinking skills (Choirunnisakh & Fitrihidajati, 2020). Creative thinking skills are included in the graduate competency standards set in the 2013 curriculum. According to (Djayanti Sari,

Sudadi, 2019) creative thinking is closely related to creativity required in Biology subjects, concepts in these subjects that require students to have creative thinking skills. In this study, the basic competence to be achieved is basic competence 3.8 Analyzing the occurrence of environmental pollution and its impact on ecosystems. As well as basic competence 4.8 Writing about the idea of solving pollution problems in the environment based on observations. Basic competence is closely related to solving problems that occur in the surrounding environment (Sabaniah et al., 2019). Carry out investigation and problem-solving activities that can train students to think creatively.

In contrast to the reality, the level of creativity in Indonesia itself is still low. This is shown from the results of the 2015 Global Creativity Index study that Indonesia ranks 86 out of 93 countries with a score of 7.95 in the creative class. One of the causes of low students' creative thinking skills is due to the weak learning process in Indonesia. In the learning process in Indonesia, students are less encouraged to develop creative thinking skills. (Prasetyani et al., 2019). Creative thinking skills refer to the ability to generate innovative ideas, solutions, or approaches to problems. It involves thinking outside the box, exploring new perspectives, and making connections between seemingly unrelated concepts. Creative thinking is characterized by originality, flexibility, and fluency in generating ideas. Curiosity is the driving force behind creativity. Encourage curiosity by asking questions, exploring new topics, and seeking out diverse experiences. Divergent thinking involves generating multiple solutions or ideas for a given problem. Practice brainstorming sessions where quantity is prioritized over quality initially, allowing for a wide range of ideas to be explored.

Creativity often involves taking risks and experimenting with new ideas. Encourage a growth mindset where failures are viewed as opportunities for learning and growth rather than obstacles. Explore ideas and concepts from different fields or disciplines. Drawing connections between seemingly unrelated subjects can spark creative insights and innovative solutions. Foster an environment where different perspectives and viewpoints are valued. Encourage individuals to challenge assumptions, explore alternative viewpoints, and consider unconventional ideas. Practice activities that stimulate creativity, such as brainstorming, mind mapping, visual thinking, and role-playing. Engaging in creative hobbies or pursuits outside of work or school can also foster creativity. Collaboration with diverse individuals can provide fresh perspectives and insights. Encourage teamwork and collaboration to leverage the collective creativity of a group.

The statements from international institutions above are relevant to what happened at SMP Negeri 2 Semen. Based on interviews with teachers at SMP Negeri 2 Semen, it was found that the learning process still predominantly relies on conventional teaching models. Analysis of questionnaire data collected from 34 students revealed the following percentages for creative thinking skill indicators: fluency at 30.76%, flexibility at 23.07%, originality at 23.07%, and elaboration at 19.23%. These findings indicate that students' creative thinking skills are still relatively low..

Based on the conditions previously described, it is necessary to apply an appropriate learning model so that students can master creative thinking skills. The learning model that can be applied is a problem-solving-based learning model so that it can be applied to develop students' creative thinking skills (Van Hooijdonk et al., 2023). One model of problem-based learning *creative problem solving*. This is also in accordance with environmental pollution material, problem-based material is very suitable with the characteristics Creative Problem Solving. Creative problem solving refers to the process of generating innovative solutions to complex or challenging problems. Unlike traditional problem-solving methods that rely on predefined procedures or established protocols, creative problem solving involves thinking outside the box, exploring unconventional approaches, and generating original ideas to

address the issue at hand. The first step is to clearly define the problem or challenge that needs to be addressed. This involves understanding the underlying issues, determining the scope of the problem, and identifying any constraints or limitations (Kartikasari et al., 2022). Once the problem is identified, gather relevant information and data to gain a deeper understanding of the situation. This may involve conducting research, collecting feedback, or consulting with experts in the field. Next, brainstorm potential solutions to the problem. Encourage creative thinking and exploration of different possibilities without judgment. Use techniques such as brainstorming, mind mapping, or lateral thinking to generate a wide range of ideas.

Creative problem solving requires an open-minded and flexible approach, as well as the willingness to explore unconventional ideas and take calculated risks. By fostering a culture of creativity and innovation, individuals and organizations can develop the ability to tackle complex problems effectively and achieve successful outcomes.. This is in accordance with the conclusions of Syamsu's research which states that students' creative thinking skills can increase from cycle I to cycle II after applying the CPS model (Nurrijal et al., 2023). In addition, research from Malisa shows that the application of the CPS learning model can improve all indicators of students' creative thinking skills (Malisa et al., 2018).

METHODS

The experimental research method that will be used is the Pre-Experimental Design (Arikunto, 2019). Researchers used Pre-Experimental Design research with the experimental design used was *One-Group-Pretest-Posttest*. The research data were obtained from the pretest and posttest which were given to one class to find out the increase in the creative thinking skills of the class's students on environmental pollution material. Pretest is a test conducted on a group before being given treatment and aims to determine students' initial achievements. Posttest is a test conducted on the group after being given treatment and aims to determine student achievement after treatment. The pretest and posttest questions totaled 8 essay questions which contained indicators of creative thinking. Each indicator consists of 2 questions. After the researchers consulted with the science teachers of SMP Negeri 2 Semen Kediri, it was decided that the research subjects for this study are students of class VII E, with a total of 34 participants from SMP Negeri 2 Semen Kediri.

The data analysis method uses a quantitative descriptive which describes the results of the research based on the statistical data obtained. Improving creative thinking skills in terms of completeness of learning outcomes with the achievement of indicators of creative thinking. In this study, the aspect that will be assessed is the increase in students' creative thinking skills on environmental pollution material which will be calculated using N-Gain analysis. N-Gain or as symbolized : <g> . N-gain (normalized gain) is used to measure cognitive learning outcomes between before and after learning. The formalization for calculating N-Gain is:

$$< g >= \frac{\% < G >}{\% < G > max} = \frac{(\% < Sf > - \% < Si >}{100 - \% < Si >}$$

Information:
<Si> = initial score (pretest) and <Sf> = final score (posttest)
%<Si> = initial value (pretest) and %<Sf> = final value (posttest) (score that has been converted to grade)

RESULTS AND DISCUSSION

Table 2. Improvement of Creative Thinking Skills Based on Indicators

No.	Creative Thinking Skills Indicator	Pretest	Posttest	N-gain	Criteria
1.	Fluent Thinking (Fluency)	49,63	88,97	0,78	Height
2.	Think Flexible (Flexibility)	39,71	84,19	0,74	Height
3.	Original Thinking (Originality)	43,38	87,87	0,79	Height
4.	Thinking in Detail (Elaboration)	21,32	76,84	0,71	Height
Average		38,51	84,47	0,75	Height

Based on Table 2 it can be said that students' creative thinking skills for each indicator have increased. On the indicator of fluency, it gets an n-gain value of 0.78 with high criteria, flexible thinking gets an n-gain value of 0.74 with high criteria, original thinking (originality) gets an n-gain value of 0.79 with high criteria, and detailed thinking (elaboration) gets an n-gain value of 0.71 with high criteria. Of the 4 indicators, an average n-gain value of 0.75 is high, so it can be concluded that students' creative thinking skills have increased. According to Munandar (2004), creative thinking skills have 4 indicators, namely fluency,flexibility, originality, and elaboration. Flexible thinking is a student's skill in generating ideas or statements and being able to provide more than one answer. Flexible thinking is a student's skill in seeing problems from various perspectives and being able to make variations on ideas or statements. Original thinking is a student's skill in generating new ideas. Detailed thinking is a student's skill in detailing ideas or ideas so that they become more interesting. To find out the increase in creative thinking skills, it is necessary to do a pretest-posttest of creative thinking skills with questions that include the indicators of creative thinking that have been described previously. After that, it was analyzed using the N-Gain score analysis. The pretest is carried out before the learning process while the posttest is after the learning process is complete.

Based on the data provided, the authors categorized the criteria as "height" based on the concept of N-gain or normalized gain. N-gain is a measure used in educational research to assess the effectiveness of an intervention, such as a teaching method or instructional program, in improving students' understanding or skills. It compares the difference between pretest and posttest scores, relative to the maximum possible improvement. In this context, the "height" criterion refers to the extent of improvement achieved in each creative thinking skills indicator from pretest to posttest. A higher N-gain value indicates greater improvement in the respective skill. Therefore, the authors categorized the criteria as "height" because they are assessing the extent to which students were able to enhance their creative thinking skills through the intervention or instructional program. To provide a comprehensive discussion, let's delve into the interpretation of the N-gain values for each creative thinking skills indicator (Kim et al., 2019):

1. Fluent Thinking (Fluency): The N-gain value of 0.78 indicates a significant improvement in fluent thinking skills from the pretest to the posttest. This suggests that the intervention or instructional program effectively helped students enhance their ability to generate a wide range of ideas or solutions.
2. Think Flexible (Flexibility): Similarly, the N-gain value of 0.74 for flexibility indicates substantial growth in students' capacity to think flexibly and consider alternative perspectives or approaches to problem-solving.
3. Original Thinking (Originality): With an N-gain value of 0.79, original thinking skills showed significant improvement as well. Students demonstrated an enhanced ability to produce novel and unique ideas or solutions to problems.

4. Thinking in Detail (Elaboration): The N-gain value of 0.71 suggests notable progress in students' elaboration skills, which involve developing and expanding upon ideas or concepts in depth.

Overall, the average N-gain of 0.75 across all indicators indicates a high level of improvement in students' creative thinking skills as a result of the intervention or instructional program. By categorizing the criteria as "height," the authors emphasize the substantial growth achieved in each skill, reflecting the effectiveness of the educational intervention in fostering creative thinking abilities among students. According to McGregor, students' creative thinking skills can be measured by what students communicate, orally and in writing. What these students communicate can be in the form of student work related to assignments, problem-solving, or student answers to teacher questions (Umar & Abdullah, 2020). To find out the increase in creative thinking skills of class VII E students of SMP Negeri 2 Semen, the researcher applied 4 indicators of creative thinking skills to the pretest and posttest questions.

Improvement of creative thinking skills is analyzed based on each indicator of creative thinking skills that are trained. The first indicator is fluency. In the pretest, the average student can only answer 1 answer correctly. Meanwhile, indicators of creative thinking skills according to (Carmeli et al., 2023) are that students can identify problems and mention them fluently and can provide more than one answer. However, after the learning process the value of students can increase, students can already give at least 2 correct answers to get an n-gain score of 0.78 so you get the high criteria.

The second indicator is flexible thinking. According to (Van Hooijdonk et al., 2022) it can be said to have flexible thinking skills if students can see the impact of these problems from many points of view. In the pretest, the average student can only answer with 1 point of view. However, after the learning process, students can give different views on a problem until they get an n-gain score of 0.74 so that they get high criteria. Having these skills is by the definition of creative thinking skills from (Keleş, 2022), namely, the ability to solve problems from different perspectives.

The third indicator is original thinking (originality) which means being able to provide new ideas. According to (Carmeli et al., 2023) they can provide many ideas/ideas to solve these problems. In the pretest, the average score was only 3.4 out of a maximum score of 8. However, after learning the value increased to obtain an n-gain score of 0.79 so that the criteria were high. The fourth indicator (elaboration) gets an n-gain score of 0.71 so that it gets the high criteria. In the pretest-posttest questions, questions are presented with a situation where students are asked to make a plan to solve the problem in detail. Having these two skills according to the definition of creative thinking skills is a thinking process that is used by individuals to generate new ideas, or develop other people's ideas in solving a problem (Sabaniah et al., 2019).

Based on the data from the four indicators, an average n-gain score of 0.75 is obtained, which means getting high criteria. This proves that there is an increase in students' creative thinking skills after the learning process uses the creative problem-solving learning model. This is supported by Hartati's statement (2021) that the creative problem-solving (CPS) learning model is for students' creative thinking skills. This can be seen by the Manova test with a significant value of 0.000 <0.05, which means that Ho is rejected and Ha is accepted. There is also a statement from Tambunan (2019) that the application of the creative problem-solving (CPS) learning model is more influential than the scientific approach in communication skills, creativity, and problem-solving.

After implementing the creative problem-solving learning model, students' creative thinking skills demonstrated significant improvement. This model, characterized by its emphasis on generating innovative solutions to complex problems, proved highly effective in fostering various aspects of creative thinking among students. By engaging in problem-solving

activities that encouraged exploration, experimentation, and out-of-the-box thinking, students were able to develop their ability to think fluently, flexibly, originally, and in detail. The learning process provided opportunities for students to brainstorm ideas, consider multiple perspectives, and evaluate alternative solutions, thereby expanding their creative capacities (Maker et al., 2023). Through hands-on experience and collaborative learning environments inherent in the creative problem-solving model, students were empowered to tackle challenges with confidence and creativity. As a result, they emerged from the learning process with heightened creative thinking skills, equipped to approach future problems with ingenuity and innovation. Overall, the adoption of the creative problem-solving learning model led to a notable enhancement in students' creative thinking abilities, underscoring its effectiveness as a pedagogical approach in cultivating creativity and problem-solving skills among learners.

CONCLUSION

In conclusion, the implementation of the creative problem-solving learning model led to a significant improvement in students' creative thinking skills. Through this approach, students demonstrated enhanced fluency, flexibility, originality, and elaboration in their problem-solving abilities. The analysis of pretest and posttest scores revealed substantial gains across all indicators, with an average N-gain of 0.75 indicating high criteria for improvement. This underscores the effectiveness of the creative problem-solving model in fostering creativity and innovation among students. Additionally, the findings are supported by previous research and statistical analysis, further confirming the positive impact of this instructional approach on students' creative thinking abilities. Overall, the results suggest that incorporating creative problem-solving strategies into the learning process can contribute significantly to the development of student's critical thinking skills and prepare them for addressing complex challenges in various contexts.

SUGGESTION

Teachers should create a conducive classroom environment during the learning process. This will help students to focus on their learning and minimize disruptions that may lead to ineffective use of study time. For future research, more attention should be paid to students' activities during the learning process by observing improvements in each phase of the creative problem-solving learning model.

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