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Students' Creative Thinking Ability Through Creative Problem Solving based Learning

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Abstract: Creative thinking is identified with the thinking process which includes fluency, flexibility, originality and elaboration. This creative thinking habit can be trained by applying a creative problem-solving model, namely learning creative problem solving, this model is one of constructivist learning. The research focus is applying creative problem solving-based learning to students' creative thinking. Participants are students of SMA Negeri 1 Masbagik for the 2019/2020 academic year class X Science. Quasi-experimental research design with post-test-only control design. Collecting data using a description test. Data analysis by t-test and using SPSS 25.0 program application for its calculations. The results of data analysis: 1) the experimental class obtained a significant average value on the indicators of creative thinking fluency (78.00), flexibility (77.00), originality (54.73), 2) fluency control class (60.18), flexibility (55.48), originality (50.18). The conclusion of this research is that creative problem-solving learning has an impact on students' creative thinking in all indicators with an increasing average value in the experimental class.

Keywords: Constructivist; Creative problem solving; Fluency; Flexibility; Originality

Introduction

The purpose of integrating the four components in the lesson plan, namely character education (PPK), literacy, numeracy, higher order thinking skills (HOTS), and 4C (communication, collaboration, critical thinking, creativity) is none other than to train and equip students in terms of abilities. think, reason, be creative, and communicate students in the face of the development of the 21st century and the era of the industrial revolution 4.0. Supriano (2019) from the Director General of Teachers and Education Personnel of the Ministry of Education and Culture explained the importance of these 4C skills in the learning process so that students will be able to think critically which means not only conveying something, expressing something, but they have a rational and open mind. This is also supported by Arbia. et al, (2020) which states that to produce quality learning, a 4C strategy is needed which emphasizes more on the creative component.

In the world of education, the importance of cultivating creative thinking is recognized as an essential 21st century skill. One way to instill creativity is to give open tasks in solving problems creatively. Kupers. et al, (2019) open tasks provide different opportunities with regard to creativity compared to closed tasks because there are no "right" or "wrong" responses in the answers. Biology as a lesson that emphasizes the development of thinking skills in analyzing, creating and applying concepts to everyday life situations can be used to train students' creative thinking which can help students generate novel ideas in solving problems. According to Zeidan & Jayosi (2015) the purpose of learning science is to teach students to integrate skills, knowledge, and attitudes in developing scientific concepts. Suwarno et al, (2019) argue that teaching science requires creativity as an achievement in the learning process, and requires innovative student-centered learning. But what happens is that generally students do not interpret the concept of science as expected by the teacher because the nature of the concept of science is abstract, teaching strategies are

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less varied, and still teacher-centered. This results in students having difficulty when faced with questions given by the teacher, so that student planning and creativity are less developed (Sinta et al, 2020). Khairini et al, (2021) stated that in the teaching and learning process many obstacles were experienced such as the lack of time allocation, lack of student understanding, and the unavailability of additional teaching materials so that the material was not delivered properly. Initial findings Pursitasari, et. al (2022) that the average creative thinking ability of students is 38.32% in the low category due to the application of less innovative learning. Saptenno et al (2019) in one of the high schools in Ambon that the learning model applied by the teacher in learning has not met the demands of the 2013 curriculum which causes students' creative thinking skills are not good. Gholami et al., (2019) stated that effective teaching and learning is an interaction between the qualities of three components, namely educator knowledge (related to variations in learning strategies), teaching materials and student abilities (higher order thinking skills). These obstacles certainly have an impact on the lack of training / habituation of students' higher-order thinking because the learning methods used are less attractive. Students have not been able to create various types of ideas (flexibility) and create something new (originality). This possibility is because the form of description test questions only measures the level of cognitive level 1 (C1) and level 2 (C2). (Fatmawati et al. 2021).

In learning science, especially biology, is very important to encourage creative problem-solving skills in students in real life. Therefore, teachers must be able to train their students to think at a higher level, of course, by using interesting teaching methods. One model that can be used to train students' HOTS is to use the creative problem solving (CPS) learning model. Guilford (Phaksunchai, et al., 2014; Sophonhiranraka, et al. 2015; Fatmawati, 2020) CPS is one of the constructivists learning models to create creative, imaginative and innovative solutions with the aim of training and teaching individuals to think divergently in solving problems. problem. Cho (Lin, 2017) suggested that creative problem-solving abilities such as organic systems interact dynamically to solve problems. Based on this, the research question is whether using CPS-based learning has an impact on students' creative thinking?

Method

The research used was a quasi-experimental design with a post-test-only control design, involving a control and experimental group to determine the significant effect of creative problem solving-based learning on students' creative thinking skills. The participants were first grade students of SMA Negeri 1 Masbagik for the academic year 2019/2020 which were divided into class X IPA 1 as the control class (N=33), and class X IPA 2 as the experimental class (N=33). The research instrument used was a description test on biodiversity material with CPS indicators consisting of Clarify, Ideate, Develop and Implement (CEF, 2015). Data analysis used t-test to determine the significant difference between the experimental group and the control group on thinking using the SPSS 25.0 program application. In addition to finding differences between the two groups, data analysis was also carried out using descriptive statistics, namely calculating the percentage of results obtained from students' creative thinking both in the control and experimental classes into the categories of Very Not Good, Not good, Fair, Good, and Very Good, as follows interval.

> - 40	Very Not Good
41 – 55	Not good
56 – 70	Adequately
71 – 85	Good
86 – 100	Very Good

Arikunto, 2013

Result and Discussion

Creative thinking is identified with the thinking process which includes fluency, flexibility, originality and elaboration. Suparji et al (2018) used three indicators of creative thinking, namely fluency, flexibility, and originality in their research. Therefore, to find out someone has creative ability, a description test is used which is given a score on each indicator of creative thinking. Listiana & Bahri (2019) integrates creative thinking with learning outcomes in their essay test. The following describes the results of the analysis of the data obtained and before the t-test analysis was carried out, first the normality and homogeneity of the data were tested (table 1 & 2).

Tabel 1. Normality Test Results

Indicator	Sig (Normalitas)		Description
	Ekxsperimen	Control	
Fluency	0.098	0.082	Normal
Flexibility	0.201	0.122	Normal
Originality	0.112	0.062	Normal

Tabel 2. Homogeneity Test Results

Indicator	Sig (Homogenitas)		Description
	Exsperimen	Control	
Fluency	0.195	0.087	Homogen
Flexibility	0.453	0.448	Homogen
Originality	0.119	0.088	Homogen

Based on table 1 & 2, it can be seen that the significant values for all creative thinking indicators in

the experimental and control classes have values greater than the 5% confidence level, so it can be said that the data on all creative thinking indicators are normally distributed. Likewise, to see the homogeneity of the two groups, the experimental and control classes also have a value greater than the 5% confidence level, so it can be said that the creative thinking abilities of the two classes are homogeneous.

Furthermore, to find out whether there are differences in creative thinking skills using the CPS method and conventional learning, it is analyzed using a t-test. Hypothesis testing in this study used the "Independent Sample Test" with a 5% confidence level. The test criteria are "if P value > 0.05 then it is accepted and if P value < 0.05 then it is rejected.

Tabel 2. Average Value of Creative Thinking and Hypothesis Test Results

Indicator	Mean Exsperimen	Mean Control	T	df	Sig. (2 Tailed)
Fluency	60.18	78.00	2.907	64	0.000
Flexibility	55.48	77.00	0.973	64	0.000
Originality	50.18	54.73	7.578	64	0.054

Based on table 2, the experimental class obtained a significant average value on the indicators of creative thinking fluency and flexibility, the results of data analysis using the independent sample test t test obtained a sig value. (2 Tailed) < 5% (0.000) level of confidence means that students' creative thinking skills taught by creative problem solving are better than conventional learning. In contrast to the originality creative thinking indicator, it is not very significant, after data analysis it was found that the sig. (2 Tailed) > 5% (0.054) level of confidence means that students' creative thinking skills taught by creative problem solving do not have a significant effect, this is because the novelty of students' ideas has not been too much in suggesting solutions, it is still general. Munastiwi et al (2021) conducted a t-test when developing the CIPS-based training module, that the experimental group obtained a higher average score than the control group.

Next, the percentage gain for each indicator of students' creative thinking in the experimental and control classes which are grouped into the category "very poor, not good, enough, good, and very good", is presented in graphical form (Figure 1).

When viewed from the graph, in the control class for indicators of fluency, flexibility, and originality, the highest percentage gain is in the "enough" category. The experimental class for the fluency and flexibility indicators has the highest percentage gain in the "good" category, but differs from the originality indicator in the "enough" category. From these results it can be concluded that the creative problem-solving model has an impact on students' creative thinking skills. Some researchers also use CPS which is associated with students' creative thinking abilities, including Lin (2017) concluding that there is an effect on divergent thinking skills, creatively solving problems on students using CPS. Kristanti et al (2018) apply CPS in their learning and find that through the implementation of CPS, students are able to strengthen their creative techniques and adaptive reasoning. Research from Wilany & Rahman (2020) which uses creative problem-solving methods, found that there is a significant effect of this method and by using creative problems, students can find the best solutions for their problems. In addition, research on creative thinking was also proposed by Wahyuni et.al, (2021) when developing ISLE-based worksheets found an increase in students' creative thinking skills on the indicators of flexibility, originality, elaboration, fluency, and evaluation but the highest increase was on the fluency indicator. Suryana et al (2021) creative thinking ability increased on all indicators of creative thinking, namely 16% fluency, 18.80% flexibility, 10.20% originality by using a different model, namely RADEC.

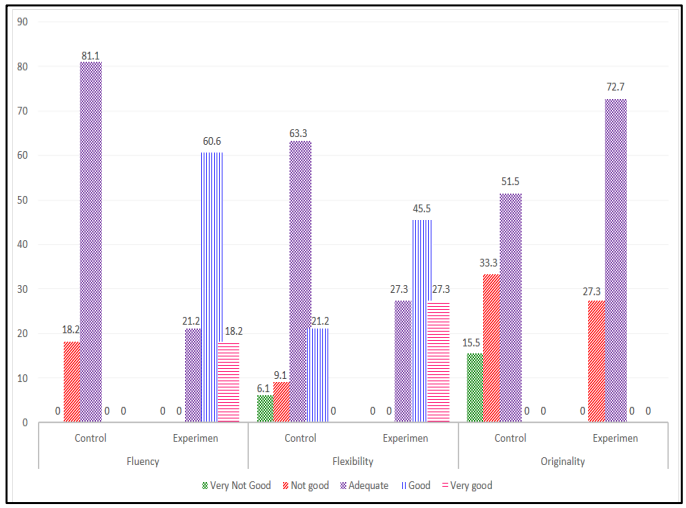

Figure 1. Comparison graph of creative thinking indicators in the control and experimental classes.

Creative thinking skills are important to be trained to students in studying biology, such as in formulating new ideas to help students solve their own problems. Lince (2016) suggests that the thinking process as well as some of the intelligences possessed by students, modalities and learning styles, should be managed as much as possible to become an effective learning strategy. And in its delivery, teachers must also use scientific language in a way that is comfortable in conveying concepts, and motivates students to want to explore information independently (Khaira et al. 2020). Ritter et.al (2020) also suggested that practicing creative thinking in learning can improve students' ideation skills and cognitive flexibility. In addition, teachers must also be proactive in taking the initiative in an effort to develop students' scientific creativity (Sidek et al 2020).

Conclusion

Higher order thinking needs to be applied in the biology learning process, at least at the stage of creative problem-solving skills because biology learning is applicatively oriented and learning to be responsible for society and the natural surroundings. Teachers can use creative problem solving to train these abilities to students because based on the results of research and t-tests, the average value obtained in the experimental class has a significant impact both on the fluency indicator, flexibility but not on the originilaty indicator, because students have not been able to express the novelty of their ideas in solving problems, the ideas given are still general in nature. Creativity has a meaning, namely the ability to give birth to several new ideas and or concepts that have never existed before with reference to fluency, flexibility, originality and elaboration to solve problems, so that a prototype is formed based on the results of previous ideas.

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