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The Influence of Creative Problem-Solving Learning Models on Students' Creative Thinking Skills related Temperature and Heat

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Abstract: One of the skills needed to face the 21st century is creative thinking. The aim of this research is to find out whether there is a significant difference between the creative thinking skills of students who are taught using the creative problem-solving learning model and those taught using the conventional model. This type of research is quasi-experimental, with the research design used being a nonequivalent control group. The subjects in this research are all students in class XI MIA SMAN 14 Maros, with the sample being class XI MIA 2 as the experimental class and class controls, each numbering 34 people. The research instrument used was a creative thinking skills test instrument on temperature and heat materials. The results of this research show a difference in the average score of students' creative thinking abilities between the experimental class and the control class, namely 33.49 in the experimental class and 28.29 in the control class. From the results of the hypothesis test, it can be seen that there are differences in the creative thinking skills of experimental class and control class students using a significance level of $\alpha = 0.05$. Based on the results of this research, it can be concluded that the physics creative thinking ability of students taught using the creative problem solving learning model is higher than the physics creative thinking ability of students taught using the conventional learning model.

Keywords: Creative Problem Solving, Creative Thinking Skills, Temperature and Heat

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INTRODUCTION

Physics is a part of science that studies symptoms, events, or natural phenomena and tries to reveal all the secrets and laws of the universe scientifically (Fakhruddin et al., 2010). One of the objectives of learning physics in senior high schools, as explained by the Ministry of National Education (2006), is so that students have the ability to master the concepts and principles of physics and have the skills to develop knowledge and self-confidence as a provision to continue their education at a higher level and develop science and technology. Physics is basically a science that studies natural phenomena, both visible and invisible. Physics also studies events that occur in nature and their regularity. Physics subjects in high school are one of the subjects in science that can develop inductive and deductive analytical thinking skills in solving problems related to natural events around us, both qualitatively and quantitatively using mathematics, and can develop knowledge, skills, attitudes, and self-confident. Creative thinking skills can improve self-efficacy (Wardani et al., 2023).

According to Abidin (2013), in the 21st century, there are at least four competencies that must be mastered, namely the ability to think creatively, the ability to understand highly, the ability to the ability to communicate, the ability to think critically, and the ability to collaborate. The ability to think creatively is one of the competencies that are very necessary to face global competition (Stevens, 2012). The ability to think creatively is a process that produces new ideas that are broad and varied. This thinking process involves elements of fluency, flexibility, originality, and elaboration (Handayani et al., 2021). National education aims to develop creative thinking skills in students so that they are able to find new ideas for problems and what is planned, new opportunities that can be seen by students, and even new discoveries that use thinking based on originality (Nurdiana, 2019).

Creative thinking ability is an individual's ability in the thinking process to get different ideas, and then these ideas an become new knowledge and answers or solutions to the problems faced (Nurhakiki & Hartini, 2020). Creative thinking is an ability that every student must have, such as when learning physics. Students' creative thinking abilities need to be fostered so they can solve physics problems (Chanthala et al., 2017). If these abilities are developed well, students can solve physics problems well.

Based on the results of interviews with class XI physics teachers at SMAN 14 Maros, it was determined that students' creative thinking skills were still lacking. This can be seen from the ongoing teaching and learning activities; they are less interactive with the teacher, and apart from that, students always have difficulty solving problem-based questions. Aspects of creative thinking skills are also poorly trained by teachers. This was revealed when I interviewed his physics teacher.

Such as fluent thinking (fluency), which stimulates students to ask questions about things they don't understand, flexible thinking (flexibility), which stimulates students to provide the latest opinions or ideas. Therefore, to improve creative thinking abilities, it is necessary to apply an appropriate model that can improve students' creative thinking abilities. The creative problem solving learning model is a learning model that focuses on teaching and problem solving skills, followed by strengthening skills to foster student creativity (Häkkinen & Mäkelä, 1996; Hamid, 2013). So research will be carried out with the aim of finding out whether there is a significant difference between the creative thinking abilities of students who are taught using the creative problem-solving learning model and those taught using the conventional model.

METHOD

This type of research is quasi-experimental research. The research design used in this study was a nonequivalent control group. In this design, the experimental group and control group are not randomly selected (Sugiyono, 2020). The control group was the group that was given learning using a scientific approach, while the experimental group was the group that was given the creative problem solving learning model. Before learning, the control group and experimental group were given the same pretest, and after learning ended, both groups were given a posttest. The research design is depicted in **Table 1**.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

(Sugiyono, 2013)

Information:

O_1 = Pretest score (before being taught using the creative problem solving model)

O_2 = Posttest score (after being taught using the creative problem solving model)

X_1 = Treatment of the experimental class using the creative problem solving model

X_2 = Treatment of the control class using conventional learning models

The population in this study were all students in class XI MIA SMAN 14 Maros, totaling 3 classes with a total of 105 students. The samples used in this research were class XII MIA 2 (experimental class) and Class XII MIA (control class) was taken using a sampling technique, namely using a purposive sampling technique, namely determining the sample with certain considerations (Sugiyono, 2020).

The instrument used in the research is an instrument in the form of a test for creative thinking abilities, which consists of 4 indicators, namely fluent thinking, flexible thinking, original thinking, and elaboration thinking, and consists of 20 essay questions. The instrument is tested for construct validity, so expert opinions (judgment experts) can be used. Data processing in this research was carried out using descriptive and inferential statistical techniques. Descriptive statistics calculate the mean and standard deviation. Inferential statistics are normality tests, homogeneity tests, and hypothesis tests.

FINDING AND DISCUSSION

Finding

Descriptive statistics

Table 2 shows data on the pretest and posttest results of students' creative thinking abilities in the experimental class and control class.

Tabel 2. Pretest and Posttest Results Data on Creative Thinking Ability for Experiment Class and Control Class

Data	Pretest		Posttest	
	Experiment	Control	Experiment	Control
The number of students	34	34	34	34
Highest score	29	29	40	39
Lowest score	13	14	23	22
Maximum ideal score	48	48	48	48
Minimum ideal score	0	0	0	0
Average	21.88	21.85	33.94	28.29
Standard deviation	4.15	3.73	4.21	4.24

Based on **Table 2**, it was found that the average score of students' creative thinking abilities in the experimental class taught through the application of creative problem solving was higher, namely 33.94, than the average score of students' creative thinking abilities in the control class taught through conventional learning, namely 28.29.

Inferential Statistics

Normality test

The normality test aims to find out whether the data population is normally distributed or not. Normality testing was carried out using the Kolmogorov-Smirnov test using the Static Product and Service Solutions (SPSS) version 26 program. The test criteria are:

If P value ≥ α = 0.05, then the distribution is normal.

If P value <α=0.05, then the distribution is not normal.

The Kolmogorov-Smirnov test results can be seen in **Table 3** below:

Table 3. Results of normality testing of average scores for the experimental class and control class

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	class	Statistic	df	Sig.	Statistic	df	Sig.
creative thinking ability	experiment	,100	34	,200*	,966	34	,359
	control	,091	34	,200*	,981	34	,817

Table 3 shows that the normality test results for the average score for the experimental class show that the Pvalue > α, namely 0.2 > 0.05, means that the creative thinking abilities of students in the experimental class are normally distributed. Meanwhile, the average score for the control class shows a P value > α, namely 0.2 > 0.05, meaning that the creative thinking abilities of students in the control class are normally distributed.

Homogenity Test

Based on the results of normality testing, it turns out that the data obtained from the population is normally distributed. Then proceed with the homogeneity test of population variance. Homogeneity testing aims to find out whether the variants of the two samples are homogeneous (the same), meaning that the samples used can represent the entire population. As for the testing criteria, if Fcount < Ftable, then the variance of the two groups is homogeneous, and if Fcount > Ftable, then the variance of the two groups is not homogeneous. From the results of calculating homogeneity of variance tests using SPSS, the Fcount = 0.63 and the Ftable value is 3.29. Because Fcount < Ftable, it can be stated that the variants of the two groups of data are homogeneous.

Hypothesis Testing

After the results of data testing for the two samples for the experimental class and control class prove that the samples are normally distributed and have homogeneous variance, then the data can be used for hypothesis testing. Hypothesis testing is carried out to answer the hypothesis that has been formulated. Testing this hypothesis uses a two-party t test.

The two-tailed t test is a type of statistical test to determine whether there is a difference in the creative thinking abilities in physics of students who are taught using the creative problem solving learning model and those who are not taught using the creative problem solving learning model. The test criteria are that H_0 is rejected and Ha is accepted if $-t(1-1/2\alpha)$

< t < t(1-1/2α). For other t values, H_0 is rejected or Ha is accepted, where t(1-1/2α) is obtained from the t distribution list with a significance level of α = 0.05 and dk = n1 + n2 – 2.

Based on the data processing carried out, it is obtained that the value t = 5.525 is in the H_0 rejection area, thus H0 is rejected and Ha is accepted. This indicates that there are differences in the creative thinking abilities of physics students who are taught using the creative problem solving learning model and those taught using the conventional learning model.

Discussion

Based on the analysis that has been carried out using descriptive and inferential analysis, the results obtained, namely descriptive analysis, show that for the experimental class, the average score obtained was 33.49 and the standard deviation was 4.21, while for the control class, it was seen that the average score was lower than the experimental class, namely 28.29 and a standard deviation of 4.24. So it can be argued that the average score of the experimental class is higher due to the creative problem solving learning model used in the experimental class. This is in accordance with the research results of Aziz & Prasetya (2021), who stated that the use of the creative problem solving learning model obtained higher research results compared to conventional classes because each step in the creative problem solving learning model was able to make students more active. motivated to develop ideas with the creative thinking abilities of each student. This is because students in the experimental class use the creative problem solving model, where during the learning process they receive temperature and heat material that is related to events in everyday life. Then students discuss finding solutions to the problems they face. Meanwhile, in the control class, during the learning process, students only use the physics textbook provided by the school and only do practice questions in the textbook.

The next analysis result is an inferential analysis. First, the normality test shows that the two classes come from a normally distributed population. The second analysis is a homogeneity test, which shows that the class comes from a homogeneous class, and the third analysis is a hypothesis test, which uses a two-party t-test, and results are obtained that show that there are differences in the creative thinking abilities of physics students who are taught using the creative problem learning model and those who are not taught using the creative problem solving learning model.

The results of the research show that the experimental class has a higher physics creative thinking skills score because in the creative problem solving learning model students understand the concepts being taught better because they themselves discovered the concepts,

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are actively involved in finding and solving problems and are demanding students' creative thinking skills are higher, knowledge is embedded based on the schemata that students have so that learning is more meaningful, makes students more independent and mature, able to give aspirations and accept other people's opinions, and instills positive social attitudes among students and conditioning. students in group learning who interact with each other and fellow students.

Aspects of fluency thinking are trained at the meeting stage of the creative problem solving learning model through objective finding, fact finding, and problem finding (Choirunnisakh, 2020). Meanwhile, in the control class, students learn only by using textbooks without any activities that identify problems or explore students' ideas.

Flexibility is trained to be able to think flexibly when learning using the creative problem solving model, where several stages in this learning model train students to interpret things with different views. This is in line with Probowati et al. (2020) research in that the flexibility aspect emphasizes that the expression of different ideas influences students' creative thinking abilities regarding flexibility indicators.

Originality is trained by identifying the main problems presented in the questions at the problem-finding stage. This is in line with research by Meiarti & Ellianawati (2019) that every human being has creativity in expressing ideas that are different from other humans, so that students can find problem-solving solutions from ideas generated through the discussion process, which can be trained in the creative problem solving model stage. Idea-finding and solution-finding. Apart from that, according to Choirunnisakh (2020), students' ability to find original ideas can be trained in the creative problem solving solution-finding model stage. Through questions that contain fluency, originality can also be identified. So the stages of the creative problem solving learning model include idea-finding and solution-finding (Malisa et al., 2018).

Elaboration in the experiment class is able to explain problem-solving solutions accepted (solution finding) by other groups to get the best solution (acceptance finding). In line with research by Probowati et al. (2020), detailed thinking (elaboration) is very necessary because creativity grows and emerges when ideas can be reviewed in detail and in depth. Detailing abilities can be trained at the creative problem solving learning model stage, such as idea finding and solution finding. Apart from that, research conducted by Meiarti & Ellianawati. (2019) also revealed the same thing: the ability to think creatively by detailing the answers or solutions that students get to solve problems can be trained in the creative problem solving learning model stage, namely solution finding and acceptance. finding. The solution-finding and acceptance-finding stages are related to the elaboration aspect, where students are trained in detailing ideas or situations to obtain a solution and make a final conclusion precisely and accurately (Hsm et al., 2021; Liu & Lu, 2002; Musaidah et al., 2022).

CONCLUSION

There are differences in the creative thinking abilities of students who are taught using the creative problem solving learning model and those who are taught using the conventional learning model (lecture). This shows that the physics creative thinking ability of students who are taught using the creative problem solving learning model is higher than the physics creative thinking ability of students who are taught using the conventional learning model.

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