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Study on Collaborative Creativity Learning Models and Gender on Students' Creative Thinking Skills

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Abstract

This study aims to determine the effect of the Collaborative Creativity (CC) learning model on students' creative thinking skills on simple harmonic vibration material. We also examine the different responses by gender. This quantitative study used a quasi-experimental method with a nonequivalent pretest-posttest control group design. The sample used in this study was grade 10th, consisting of 32 students as the experimental class, and 30 as a control class. The research instrument used was a test of creative thinking skills. The results showed the average N-gain in the experimental class was 0.73 with a very high interpretation, and the control class was 0.32 with a moderate. The results of hypothesis testing using the two-way ANOVA test show a sig < 0.05, which means that the learning model influences students' creative thinking skills. In addition, the CC learning model was also comfort to use by gender which statistical analysis prove the sig > 0.05, which means that there is no gender effect on students' creative thinking skills. Thus the Collaborative Creativity (CC) learning model can be used as an alternative to improve students' creative thinking skills on simple harmonic vibration material.

Keywords: collaborative creativity, creative thinking skills, gender, simple harmonic vibration

INTRODUCTION

The 21st century is marked by the presence of technology, information, and communication that continues to grow (Destari et al. 2021). The 21st century is centered on the development of the Industrial Revolution Era 4.0, which puts knowledge as the central spear (Iqbal et al. 2021). However, knowledge alone is not enough to realize the Industrial Revolution Era 4.0. There needs to be a balance between knowledge and skills as the basis of quality human resources to face the times. Creative thinking skills are one of the skills in supporting 21st-century learning (Sutarno et al. 2018). Creative thinking skills are one of the higher-order thinking stages needed in people's lives (Fajaruddin 2022). Humans will always be faced with a problem, so creativity is needed. The habit of creative thinking can be instilled in education (Zubaidah et al. 2017).

Based on the opinion of several experts (Yusuf & Widyaningsih 2019); (Abdjul & Ntobuo 2019); (Ni'mah et al. 2018); (Mukti & Medriati 2018); (Sari et al. 2022) the others definition of creative thinking skills is the ability to reflect fluency, flexibility and originality in thinking and elaborating (developing, enriching, detailing an idea). Creative thinking skills are characterized by four aspects, namely fluency, flexibility, originality and elaboration (Isnaini et al. 2022). Aspects of creative thinking skills can be seen by looking at several indicators including asking questions about problems, being fluent in expressing ideas about solving a problem, giving different views on a problem, having different opinions from friends during discussions, submitting opinions on various issues think of new

ways and solve them, take detailed steps in solving problems, and trying to test the details in seeing the direction to be taken (Qadafi & Hastuti 2022).

Field facts Reality findings about creative thinking skills related to the ability to think creatively researched by Masinta in (Abidin et al. 2018), which was carried out to high school students stated that creative thinking skills were categorized as lacking because they did not meet the indicator requirements that must be mastered. Students are said to have the ability to think creatively if they master predetermined indicators (Hasmarani et al. 2019). This is reinforced by the results of other studies, which show the average score of creative thinking skills obtained by students is 28.53% in the less creative category (Sriatun et al. 2018). Another study conducted by Indiraningrum Pratriwi and colleagues stated that the indicators of original, fluent, and detailed thinking skills have not been achieved by students who have low resilience abilities. Students tend to make mistakes in calculating answers, due to lack of confidence, perseverance and thoroughness in answering questions (Pratiwi et al. 2018) or students are not used to compiling an answer based on the commands given (Paryumi 2022).

Almuharomah et al. (2019) declare that creative thinking skills can be improved through media in the form of Science, Technology, Engineering, and Mathematics (STEM) integrated modules because students' creative thinking skills increase with an N-gain of 0.92 high categories. Meanwhile, Kamilasari et al. (2019) said that students' creative thinking skills experienced a good improvement after the Collaborative Creativity (CC) learning model was applied. Another study conducted by Shabrina and Heru in (Kuswanto 2018) said that students' creative thinking skills increased after the application of physics learning media based on android mobile integrated into Indonesian batik culture.

The level of ability possessed by a person can basically be seen from various angles of the factors that influence it, but the relationship between these factors cannot be explained simply like gender (Cahyani et al. 2022). Every student has a different experience in life. This can be viewed in terms of gender, namely between men and women. These differences must be the main concern of educators because each gender has its own characteristics (Zubaidah et al. 2017). Gender is a psychosocial aspect that determines how a person acts and behaves in order to be accepted in his social environment (Nur & Palobo 2018). Based on research, male and female students were able to solve problems in the excellent category. Gender does not affect students' creative thinking skills (Suprapto et al. 2018).

Wood explained that in men the left brain is more developed so that he is able to think logically, think abstractly, and think analytically, while in women, the right brain is more developed, so he tends to be artistic, holistic, imaginative, intuitive thinking, and some visual abilities (Hodiyanto 2017). The difference between men and women lies in the characteristics of secondaries, emotionality and activity of psychological functions (Davita & Pujiastuti 2020) mention that. In general, women's attention is focused on things that are concrete, practical, emotional and personal, while men are focused on things that are intellectual, abstract, and objective (Susilowati et al. 2021).

Creative thinking skills in learning between male and female students have differences that lie in how male and female students solve problems creatively, resulting in a gap between male and female participation rates. Gender differences not only result in differences in abilities in physics, but also the way to acquire physics knowledge (Nur & Palobo 2018). Some researchers believe that the influence of gender factors in learning is due to biological differences in the brains of boys and girls which are known through observation, that girls, in general, excel in language and writing, while boys excel in the field of writing. mathematics because of its better spatial abilities (Davita & Pujiastuti 2020). Experts generally agree that learning outcomes caused by gender differences are the result of gender bias in the home and school environment. Although men and women have different characteristics, educators must provide students with equal opportunities and encouragement in learning, so that students do not feel different in the learning process (Aini et al. 2018).

Responding to problems that arise in the process of learning physics at school, it is necessary to find a learning model solution that can improve students' connections and representations of physics (Astutik & Maknuniyah 2022). So the model that is suitable for use in this research is Collaborative Creativity (CC) (Gündoğdu & Merç 2022). The success of the Collaborative Creativity model is reinforced by the results of previous research conducted by Fina Puspitasari and friends. The Collaborative Creativity learning model can improve students' problem-solving skills when students conduct discussions and experiments with individual groups and collaborative groups (Puspitasari

2018). Research conducted by Astutik et al. (2020) stated that the Collaborative Creativity learning model can increase energy literacy in good categories. Based on these problems, the purpose of this research is to examine the level of effectiveness of the Collaborative Creativity learning model in improving students' creative thinking skills in terms of gender in the simple harmonic vibration material. We choose these topics because it is feasible to the curriculum in the school that caused student did not realize their in the observed.

METHODS

This study uses a quasi-experimental design in the form of a nonequivalent control group design (Sugiyono 2011) which was carried out in two classes, the experimental class which apply the Collaborative Creativity (CC) learning model and the control class that use the scientific approach. The population of this study was all students of grade X science in one of the senior high schools in the Kuningan area, West Java province, which consisted of three classes with 95 students. The sample was determined by a simple random sampling technique, obtained with class X IPA 2 as the experimental class amounted to 32 people (3 male student and 29 female students), and class X IPA 3 as the control class amounted to 30 people (4 male student and 26 female students). The research design was shown in FIGURE 1.

Class	Pre-Test	Treatment	Post-Test
Experiment	O_1	X	O_3
Control	O_1		O_4

Note: O_1: Initial test given to the experimental class before being given treatment. O2: Initial test given to the control class before being given treatment. O3: Final test given to the experimental class after being given treatment. O4: Final test given to the control class after being given treatment; X: Treatment using the Collaborative Creativity Model

FIGURE 1. Research Design

The data collection method used in this study is a test of creative thinking skills. The data collection of this research was carried out through pretest and posttest tests. The indicator of creative thinking skills applied to the questions is from Guilford, consisting of fluency, flexibility, and elaboration (Guilford 1981). The rubric creative thinking skills test was used assessment rubric with a score range given for each question from 0 to 4. Test the validity of the test tool trial is carried out. The data from the instrument test results were analyzed using Microsoft excel software with tests of validity, reliability, level of difficulty, and discriminating power of questions. Improved creative thinking skills using the Hake formula and criteria (Hake 1999).

Hypothesis testing was carried out using statistical test techniques by the distribution of the data obtained that processed using the SPSS program. Data before testing the two-way ANOVA hypothesis, normality and homogeneity tests are first carried out. The two-way ANOVA hypothesis test was carried out because two influences were reviewed in increasing creative thinking skills, namely the Collaborative Creativity learning model and the influence of gender (Rahmawati & Erina 2020)

RESULTS AND DISCUSSION

Improving Students' Creative Thinking Skills

The results of the creative thinking skills test conducted in the experimental class and control class were obtained after learning three times. Learning outcomes with indicators of creative thinking skills were measured using a test instrument as many as three questions on simple harmonic vibration material. Learning that has been done in both classes can be seen from the values of pretest, posttest, and N-gain which have been processed and analyzed quantitatively through data analysis. The results of the quantitative analysis obtained by the researchers can be seen in TABLE 1.

TABLE 1. Pretest, Posttest, and N-gain Scores for the Experimental and Control Class

Class	Pretest	Posttest	N-gain	Interpretation
Experiment	37.5	82.78	0.73	High
Control	32.17	66.83	0.32	Medium

The average value of the pretest in the experimental class obtained a value of 37.5 which was carried out before the application of the Collaborative Creativity (CC) learning model, and the control class obtained a value of 32.17 carried out before learning with the application of a scientific approach. Meanwhile, the average posttest score of students in the experimental class was 82.78 which was carried out after learning by applying the Collaborative Creativity (CC) model, and the control class obtained a value of 66.83 which was carried out after applying learning using a scientific approach. The pretest and posttest scores were then analyzed to see the improvement in students' creative thinking skills so that N-gain scores were obtained for each class. The normalized N-gain value for the experimental class obtained a value of 0.73 with a high interpretation, while the control class obtained an N-gain value of 0.32 with a moderate interpretation. Based on this, students' creative thinking skills have increased after the Collaborative Creativity (CC) model was applied in the experimental class and the scientific approach in the control class.

This increase can occur because the Collaborative Creativity learning model has advantages including training creative thinking skills in each learning syntax, so that students are trained in exploring and determining creative ideas in a problem. This is in accordance with research conducted by Kamilasari and friends (Fitriyanti et al. 2023; Kamilasari et al. 2019) that SETS-based Collaborative Creativity learning can facilitate students to practice creative thinking skills in physics learning.

While the increase that occurred in the control class after the scientific approach was applied even though it was in the sufficient category could occur because there were skills in asking critically and creatively even though students listened a lot to the lesson. This finding was also found previous research that declare students have difficulty in expressing their ideas (Amalia et al. 2019). Hence, in getting students used to learning by just listening and receiving information from the teacher to learning with a lot of creative thinking in solving problems is something that is difficult.

The improvement of students' creative thinking skills on simple harmonic vibration material can be seen on each indicator namely fluency, flexibility, originality, and elaboration. The average value of the acquisition of the pretest, posttest, and N-gain for each indicator of students' creative thinking skills can be seen in TABLE 2.

TABLE 2. Average Pretest, Posttest, and N-gain for each Indicator of Creative Thinking Skills in the Experiment and Control Class

Indicators of Creative Thinking Skills	Code item	Average							
		Experiment Class				Control Class			
		Pretest	*Posttest*	*N-Gain*	Criteria	*Pretest*	*Posttest*	*N-Gain*	Criteria
Fluency thinking ability (fluency)	A	38	85	0.76	High	31	68	0.54	Medium
Flexible thinking ability (flexibility)	B	44	82	0.68	Medium	37	69	0.51	Medium
Original thinking ability (originality)	C	35	84	0.75	High	32	67	0.51	Medium
Ability to think details (elaboration)	D	33	81	0.72	High	31	63	0.46	Medium
Average		37.5	83	0.73	High	32.75	66.75	0.51	Medium

The experimental class obtained a higher average N-gain value of 0.73 with a high interpretation compared to the control class, which obtained an average N-gain value of 0.51 with a moderate interpretation. The highest N-gain value for each indicator of creative thinking skills in the experimental class is the fluency indicator of 0.76 with a high interpretation, this indicates that students are able to write or provide as many ideas as possible. The fluency indicator obtained the highest percentage of 40% on thermodynamic material (Hasanah et al., 2021). While the N-gain value of each indicator of creative thinking skills is lowest in the experimental class, namely the indicator of flexible thinking skills (flexibility) of 0.68 with a moderate interpretation. The indicator of flexible thinking skills (flexibility) is being able to provide ideas, questions, or answers that vary by 36% in the low category, this is because students find it difficult to formulate a problem through the questions asked (Mustikasari & Ramlah, 2020).

The N-gain value for each indicator of creative thinking skills was highest in the control class, namely the fluency indicator of 0.54 with moderate interpretation because students were able to give correct and varied answers. The increase in the fluency indicator can be seen from the ability of students to write answers with the correct calculation process and accompanied by the correct units (Doyan et al., 2022). While the N-gain value of each indicator of creative thinking skills is lowest in the control class, namely the indicator of elaboration thinking skills of 0.46 with moderate interpretation, this is due to the lack of emphasis on concepts that are not yet clear and not yet understood. The elaboration indicator obtained the lowest percentage of 7.62% because students' initial knowledge was still lacking in phytoplankton cultivation in the laboratory (Jumrodah et al., 2021). The results of increasing students' creative thinking skills in the experimental class and control class in terms of gender can be seen in TABLE 3.

TABLE 3. Average Pretest, Posttest, and N-gain Scores for the Experimental and Control Class Based on Gender

Class	Gender	Pretest	Posttest	N-Gain	Interpretation
Experiment	Male	34.5	74.75	0.61	Medium
	Female	37.93	83.93	0.74	High
Control	Male	34.67	71.33	0.56	Medium
	Female	31.54	65.71	0.5	Medium

The average N-Gain of the experimental class male students was 0.61 with a moderate interpretation, while female students scored 0.74 with a high interpretation. The average N-Gain acquisition of male control class students is 0.56 with a high interpretation, which is greater than the N-Gain acquisition of female students of 0.5 with a moderate interpretation.

The results of increasing students' creative thinking skills in the experimental class and control class based on indicators of creative thinking skills in terms of gender can be seen in TABLE 4.

TABLE 4. Average Pretest, Posttest, and N-gain for each Indicator of Creative Thinking Skills in the Experimental and Control Class by Gender

Indicators of Creative Thinking Skills	Gender	Average							
		Experiment Class				Control Class			
		Pretest	*Posttest*	*N-Gain*	Note:	*Pretest*	*Posttest*	*N-Gain*	Note:
Fluency thinking ability (fluency)	Male	33	76	0.64	Medium	29	70	0.58	Medium
	Female	38	85	0.76	High	31	68	0.54	Medium
Flexible thinking ability (flexibility)	Male	42	80	0.66	Medium	35	68	0.51	Medium
	Female	44	82	0.68	Medium	37	69	0.51	Medium
Original thinking ability (originality)	Male	33	82	0.73	High	37	72	0.56	Medium
	Female	35	84	0.75	High	32	67	0.51	Medium
Ability to think details (elaboration)	Male	30	78	0.69	Medium	27	62	0.48	Medium
	Female	33	81	0.72	High	31	63	0.46	Medium

The experimental class of male students obtained the highest average N-gain value on the originality indicator, which was 0.73 with a high interpretation and the lowest was on the fluency indicator of 0.64 with a moderate interpretation, while female students obtained an average N-gain value. the highest gain on the fluency indicator is 0.76 with a high interpretation and the lowest is 0.68 on the flexibility indicator with a medium interpretation. The control class of male students obtained the highest average N-gain score on the fluency indicator, which was 0.58 with a medium interpretation and the lowest was on the elaboration indicator of 0.48 with a moderate interpretation. Since there is no significant different among male and female student, this learning model was supported our previous research that declare for any learning model, the gender does not really affecting (Malik et al. 2020).

Differences in Students' Creative Thinking Skills based on gender through the Collaborative Creativity (CC) Learning Model and Scientific Approach

This hypothesis test aims to determine the significance of the differences in students' creative thinking skills in the simple harmonic vibration material between the experimental class and the control class through two independent variables, namely the learning model and gender. However, before testing the hypothesis, the normality test and homogeneity test were first carried out on the creative thinking skills instrument data that had been obtained. The following are the results of the normality test which are presented in TABLE 5.

TABLE 5. Recapitulation of Normality Test for Experiment and Control Class

Criteria	Experiment Class		Control Class	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Number of samples	32	32	30	30
Maximum value	54	100	48	94
Average	37.5	82.8	32.2	66.8
Standard deviation	7.246	8.63	5.267	15.16
L_{count}	0.346	0.384	0.137	0.096
L_{table}	0.886	0.886	0.161	0.161
Conclusion	Normal	Normal	Normal	Normal

The normality test data calculated using the Liefors test, in which the pretest data in the experimental class is L_{count} (0.346) < L_{table} (0.886). The pretest data on the simple harmonic vibration material is normally distributed. The posttest data in the experimental class is L_{count} (0.384) < L_{table} (0.886). The posttest data in the experimental class is normally distributed. The pretest data in the control class is L_{count} (0.137) < L_{table} (0.161). The pretest data on the simple harmonic vibration material is normally distributed. The posttest data in the control class has a value of L_{count} (0.096) < L_{table} (0.161). The posttest data in the control class is normally distributed.

While the homogeneity test to determine whether the data is homogeneous or not homogeneous can be presented in TABLE 6.

TABLE 6. Homogeneity Test Recapitulation

Category	***Pretest***	***Posttest***
Total students	62	62
F_{count}	1.65	0.323
F_{table}	1.84	1.84
Conclusion	Homogeneous	Homogeneous

The data from the pretest results show that F_{count} (1.65) < F_{table} (1.84) so it can be concluded that there is no variance in the experimental and control class or the data is homogeneous. Meanwhile, the

posttest data shows that F_{count} (0.323) < F_{table} (1.84) so it can be concluded that the posttest data also does not have variance in the experimental class and control class or the data is homogeneous. Hypothesis testing of research results with two-way analysis of variance (Two Way Anova) can be described in TABLE 7.

TABLE 7. Summary of Two-Way Anova Analysis of Variance

Tests of Between-Subjects Effects					
Dependent Variable: Value					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4384.843a	3	1461.614	9.595	.000
Intercept	177008.158	1	177008.158	1162.036	.000
Class	947.592	1	947.592	6.221	.015
Gender	25.560	1	25.560	.168	.684
Class * Gender	443.572	1	443.572	2.912	.093
Error	8834.899	58	152.326		
Total	362570.000	62			
Corrected Total	13219.742	61			
a. R Squared = .332 (Adjusted R Squared = .297)					

TABLE 7 shows that the value in the corrected model column is to determine the effect of the independent variable (Collaborative Creativity learning model and scientific approach) on the dependent variable (creative thinking skills). The F_{count} value of 9.595 is greater than the F_{table} value at degrees of freedom df = 3, which is 2.69 at sig. 0.000 < 0.05 which means there are significant differences in creative thinking skills between students who are taught through the Collaborative Creativity learning model and the scientific approach.

The value of the intercept in the second line can be known to change the dependent variable without the need for any influence from the independent variable. That is, students' creative thinking skills can change without the influence of gender. Based on TABLE 7 obtained the value of sig. 0.000 < 0.05 which means that the intercept value is significant.

While the value obtained in the class row (learning model) shows the influence of the Collaborative Creativity learning model and the applied scientific approach. In TABLE 7 above, the F_{count} value is 6.221 which is greater than F_{table} at the degrees of freedom df = 1, which is 3.93 with sig. 0.015 < 0.05. This means that there is a significant difference in creative thinking skills between students who learn with the Collaborative Creativity learning model and the scientific approach on simple harmonic vibrations. This shows that the Collaborative Creativity learning model has a positive effect on students' creative thinking skills. This is in accordance with the results of research conducted by Kamilasari et al. (2019).

Furthermore, the value obtained on the gender line shows the effect of gender on students' creative thinking skills. The results in TABLE 7 show that the F_{count} value of 0.168 is less than F_{table} at the degrees of freedom df = 1, which is 3.93 with sig. 0.684 > 0.05. This means that there is no significant difference or effect of creative thinking skills between students in males and females. This is to previous research based on the ANOVA test, which shows that gender does not affect students' creative thinking skills. This indicates that there is no difference in the creative thinking skills and learning outcomes of male and female students (Tendrita 2017).

This class*Gender row shows the interaction between learning models and gender. The results of the analysis in TABLE 7 show that the F_{count} value is 2,912, which is smaller than the F_{table} value at degrees of freedom df = 1, which is 3.93 at sig. 0.093 > 0.05. Thus, it was found that there was no interaction effect between learning models (Collaborative creativity and scientific approach) and gender (male and female) on students' creative thinking skills on simple harmonic vibration material in class X science. This can happen because in addition to the use of the Collaborative Creativity learning model and a scientific approach as well as student gender (Lestari & Sumarti 2018), there are many other factors that affect students' creative thinking skills, both internal and external factors (Dilla et al. 2018). Internal factors that influence creative thinking skills include health, intelligence, attention, motivation, discipline and interest. While external factors that affect learning achievement are learning environment factors, both family, school, and community (Slameto 1995). Besides, factors that affect

creative thinking skills are parenting styles. Parenting patterns are a description of the attitudes of parents and children in interacting, communicating during parenting activities (Pertiwi & Hasan 2021).

CONCLUSION

Based on the results and discussion, an undertaking of the Collaborative Creativity (CC) learning model on simple harmonic vibration material went very well an average percentage of 93%. The results of the calculation of the N-gain show that students' creative thinking skills in class X science have increased after the enactment of the Collaborative Creativity (CC) learning model of 0.73 with a high interpretation and a scientific approach of 0.32 with a medium. Furthermore, based on hypothesis testing using the two-way ANOVA test shows that the Collaborative Creativity learning model and the scientific process have a positive influence or difference on creative thinking skills. Gender has no effect or difference on students' creative thinking skills can happen because of internal and external factors of male or female students. Thus, it is hoped that further research can develop interactive media to improve students' creative thinking skills. This research is still limited to the learning model, while the use of media is still not maximized. Therefore, it is hoped that further research will be able to express the influence of learning media, learning models, and gender on students' creative thinking skills.

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