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The Implementation of Creative Problem Solving Model in Teaching of Biodeviersity at Senior High School

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ABSTRACT

Making students to be creative thinking need exercises in the form of tasks. Creative problem solving is the constructivist learning model to create creative, imaginative, and innovative solutions in the aim of training and teaching individuals to think differently in solving problems.The research focus was to find out students' learning outcome and creative thinking skills using creative problem solving-based learning. The participants were tenth grade of senior high school in the school year 2019/2020 which were divided into science class as the control class (N=33), and X IPA 2 class as the experimental class (N=33). The research instrument used was a description test on biodiversity content with creative problem solving indicators, namely Clarify, Ideate, Develop, and Implement. Quantitative data analysis used was MANOVA test at a significant level of 5%. The results of this study were the average values for each indicator of creative thinking and learning outcomes in the experimental and control classes showing that the control class was lower than the experimental class. It means that learning outcomes and creative thinking skills through creative problem solving had an impact than the classes using creative problem solving. Therefore, there was a significant influence and a relationship among the creative problem-solving model, creative thinking skills, and learning outcomes which was indicated by the value of. 0.000<0.05.

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A. INTRODUCTION

Teachers must take the initiative so that they are accustomed to applying new methods. Their professionalism in teaching (Sidek et al., 2020). Developing creativity is an important educational goal, although teachers see some difficulties in identifying students' abilities related to creative thinking (Pizzingrilli et al., 2015). To overcome such difficulties, teachers must be enabled to apply an easily manageable test that allows them to assess the student's level of creativity. Problem solving and high-level thinking skills (HOTS) are always emphasized in most curricula (Gholami et al., 2019). The preparation of learning devices in the 2013 curriculum currently contains four components, namely strengthening character education, literacy, numeracy, higher order thinking skills (HOTS), and 4C (communication, collaboration, critical thinking, creativity). The purpose of integrating the four components in the lesson plan is none other than to train and equip students in terms of thinking, reasoning, creative, and communicating skills in the face of the development of the 21st century and the

era of the industrial revolution 4.0. 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.

Fatmawati et al. (2021) in learning science, especially biology, it is very important to encourage creative problem solving skills in students in real life. 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 in a collaborative way that can help students generate novel ideas in solving problems. According to Gupta & Sharma, 2019; Zeidan & Jayosi, 2015, the purpose of learning science is to teach students to integrate attitudes, skills, knowledge, imagination, creative insights, and scientific findings for new breakthroughs by developing scientific concepts. Therefore, teachers must be able to train their students to be familiar with how to solve problems creatively, of course using interesting teaching methods. As stated by Kupers et al. (2019); Lee & Shea, (2016) that in teaching science, the strategy can be done by giving structured and open tasks that require different solutions, asking and responding to scientifically oriented questions, formulating and linking explanations, and communicating the results so as to provide opportunities for creativity to students compared to assignments closed tasks. Ritter et al. (2020) also suggested that practicing creativity in learning can improve students' ideation skills and cognitive flexibility.

Some teachers from various institutions have implemented creative problem solving in general education (Laisema & Wannapiroon, 2014). However, we need to pay attention together that something that has just been applied in the learning process, especially related to higher-order thinking, is not as easy as imagined, let alone to familiarize and practice thinking skills such as problem solving, critical, and/or creative. One of the obstacles in training students to think at a higher level is how to integrate it in the learning process even though there are instructions from the government regarding the integration of learning containing KDP, literacy, numeracy, HOTS, and 4C. Some researchers also found obstacles in integrating HOTS in learning including Rajagukguk et al. (2021) the average score of students' completeness in solving problems reached 50% and was classified as poor category. Sandika & Fitrihidajati, (2018) stated that the learning method applied was less effective so that it affected students' low creative thinking skills, motivation and student achievement. The results of observations by Audrey 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 to be poor. Chan & Yuen (2014); Conradty et al. (2020); Martins Gomes & McCauley (2021) state that developing students' creative thinking is important, but teachers are faced with a pedagogical dilemma, namely that they do not have a pedagogic strategy to integrate it because educators lack understanding of concepts and the ability to understand to translate higher-order thinking in its application in the classroom.

If the creative process is the same as problem solving, then scientific inquiry must examine it in such a way by using appropriate methods such as creative problem solving because students' individual cognitive problem solving styles can naturally change from time to time due to their continuous delivery of problem solving styles them Basadur et al. (2014); Phaksunchai et al. (2014); Shieh & Chang (2014); Wimmer (2016) suggest developing creative problem solving to help achieve potential, and maximizing student learning outcomes can be done by providing creative instruction using new methods that are more effective and appropriate for each problem situation.

The development of problem solving for students is a very important issue in teaching today because problem solving capacity helps students to be proactive and creative in independent learning (Tong et al., 2020). Therefore we need a learning design that can provide opportunities for students to explore problems that can improve students' ability to think creatively so that there is a quality interaction between the three components, namely educator knowledge, teaching materials and student abilities. One model that can be used to

train students' creative problem solving skills is to use creative problem solving in learning. The relationship between creative thinking and the problem solving process is known as creative problem solving (Fatmawati, 2020; Kapoor et al. 2020; Sophonhiranrak et al. 2015). Based on these descriptions, learning based on creative problem solving needs to be applied at the high school level because this learning model can help students get used to higher order thinking skill especially creative thinking. The question of this research is whether creative problem solving has an impact on student learning outcomes and creative thinking?.

B. METHODS

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 student learning outcomes and creative thinking skills. The participants were tenth grade of senior high school SMA which were divided into class X IPA 1 as the control class (N=33) using direct instruction, and class X IPA 2 as the experimental class (N=33) using creative problem solving. The research instrument used is a description test on biodiversity material with creative problem solving indicators, namely Clarify its a analyze the problem and make a question, Ideate its Generate ideas to answer questions, Develop its selecting the best solution and developing it and Implement its Formulate plans based on the selected solution such as the tools and materials required according to the solution (CEF, 2015), and scoring refers to creative thinking indicators, namely fluency, flexibility and originality (Fatmawati et al., 2021). This is in accordance with the suggestion of Ndiung et al. (2021); Susyla & Syofiana (2019) that by giving assignments in the form of open questions allows students to find their own concepts and discoveries themselves. Quantitative data analysis using MANOVA test at a significant level of 5%. For analysis of MANOVA data using SPSS 25.0 program application with General Linear Model-Multivariate. The hypothesis testing was done by using MANOVA at a 5% level of the significance level. Hypotheses were tested using MANOVA with the aid of SPSS (Ndiung et al., 2021).

C. RESULT AND DISCUSSION

Lin & Wu (2016); Lince (2016) the meaning of the thinking process is looking for change, taking risks, and exploring smoothly, flexible, unique, elaborative and involving the modalities and learning styles of students. Therefore, in designing/designing the learning process it is based on what students will do in class, because later it will be used in everyday life. As stated by Loc et al. (2020); Tong et al. (2020) that students apply the knowledge they have learned to solve practical problems and situations in a flexible way. Because every individual has the potential to be creative and it does not happen spontaneously in generating new ideas. It takes a process, involving feelings, thoughts, experiences and exercises continuously in the learning process. Based on this, research was conducted on creative problem solving-based learning on student learning outcomes and creative thinking skills, along with the results obtained in experiment class and control class. In control class, it was treated by using direct instruction conducted for meeting and not explained in detail about creative problem solving, worksheet discussion and presentation of the results of the discussion. In experimental class, it was treated by using creative problem solving and explained in detail what to do while working on worksheets based on creative problem solving. Statistical analysis using the MANOVA test, before carrying out the MANOVA test, the data prerequisite test was first carried out, namely the homogeneity test of variance and covariance. However, previously presented the results of

descriptive statistical analysis of research data presented in Table 1 as a basis for conducting homogeneity tests of variance and covariance tests, as shown in Table 1 and Table 2.

Table 1. Descriptive Statistical Analysis Results

Variable	Group	N	Mean	S.D
Fluency	Experiment	33	78.00	9.53
	Control	33	60.18	11.91
Flexibility	Experiment	33	77.00	8.41
	Control	33	55.48	6.76
Originality	Experiment	33	54.73	7.84
	Control	33	50.18	10.7
Learning outcome	Experiment	33	69.64	5.25
	Control	33	55.09	5.89

Table 1 shows that the average value for each indicator of creative thinking and learning outcomes in the experimental and control classes, shows that the control class is lower than the experimental class. This means that creative thinking skills and student learning outcomes through using the creative problem solving m have an impact than classes that are not through the creative problem solving. The homogeneity test of variance can be seen from the results of Levene's Test of Equality of Error Variances using SPSS 25.0, namely the General Linear Model-Multivariate. Levene's Test of Equality of Error Variances is used to determine whether the variance between data groups is the same. If <0.05 then the variance of the data group is different, but on the contrary if.>0.05 then the variance of the data group is the same, as shown in Table 2.

Table 2. Levene's Test of Equality of Error Variance

	F	**df1**	**df2**	**Sig**
Fluency	2.907	1	64	0.093
Flexibility	0.973	1	64	0.087
Originality	7.578	1	64	0.088
Learning outcome	3.041	1	64	0.086

The data in Table 2, it can be seen that the significance of creative thinking skills and student learning outcomes > 0.05 so it can be concluded that the variance of the data groups of the two variables is the same. The covariance homogeneity test can be seen from the results of the Box's M test using the help of SPSS 25.0, namely the General Linear Model-Multivariate, as shown in Table 3.

Table 3. Result of *Box's Test of Equality of Covariance Matrices*

Box's M	**23.278**
F	2.170
df1	10
df2	19582.470
Sig.	0.097

The data in Table 3, it can be seen that the value of Box's M = 23,278 with a significance of 0.097. If the research significance level is 0.05, it can be written as 0.097 > 0.05 which indicates that H_0 is accepted so that it can be concluded that the covariance of the dependent variable is the same. Thus, the test can be continued on the MANOVA test. Because the two prerequisites of the hypothesis above have been met, it can be continued on the MANOVA test. The results of the MANOVA test decisions were taken from the analysis of Pillae Traice, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root. This analysis was carried out with the help of SPSS 25.0, namely the General Linear Model-Multivariate, as shown in Table 4.

Table 4. Result of Multivariate Test

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.993	2290.011[b]	4.000	61.000	.000
	Wilks' Lambda	.007	2290.011[b]	4.000	61.000	.000
	Hotelling's Trace	150.165	2290.011[b]	4.000	61.000	.000
	Roy's Largest Root	150.165	2290.011[b]	4.000	61.000	.000
Learning method	Pillai's Trace	.723	39.796[b]	4.000	61.000	.000
	Wilks' Lambda	.277	39.796[b]	4.000	61.000	.000
	Hotelling's Trace	2.610	39.796[b]	4.000	61.000	.000
	Roy's Largest Root	2.610	39.796[b]	4.000	61.000	.000

a. Design: Intercept + Learning method

b. Exact statistic

c. Computed using alpha = .05

Table 4 shows the results of the Multivariate significance test. The results of the analysis show that the F value of the Learning Method for Pilae Traice, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root has a significance value of 0.000 < 0.05. This shows that the F values for Pilae Traice, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root are all significant. So it can be concluded that there is a significant influence between class variables on creative thinking skills and student learning outcomes. Furthermore, to find out the differences in creative thinking skills and student learning outcomes between the experimental class and the control class, the analysis of Tests of Between-Subjects Effects obtained through calculations using SPSS 25.0 with the General Linear Model-Multivariate can be used, as shown in Table 5.

Table 5. Result of Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Fleuncy	5238.545[a]	1	5238.545	45.021	.000
	Flexibility	7637.879[b]	1	7637.879	131.184	.000
	Originality	340.909[c]	1	340.909	3.838	.054
	Learning outcome	3490.909[d]	1	3490.909	112.137	.000
Intercept	Fleuncy	315054.545	1	315054.545	2707.632	.000
	Flexibility	289611.879	1	289611.879	4974.223	.000
	Originality	181597.636	1	181597.636	2044.207	.000
	Learning outcome	256688.727	1	256688.727	8245.522	.000
Learning method	Fleuncy	5238.545	1	5238.545	45.021	.000
	Flexibility	7637.879	1	7637.879	131.184	.000
	Originality	340.909	1	340.909	3.838	.054
	Learning outcome	3490.909	1	3490.909	112.137	.000
Error	Fleuncy	7446.909	64	116.358		
	Flexibility	3726.242	64	58.223		
	Originality	5685.455	64	88.835		
	Learning outcome	1992.364	64	31.131		
Total	Fleuncy	327740.000	66			
	Flexibility	300976.000	66			
	Originality	187624.000	66			
	Learning outcome	262172.000	66			
Corrected Total	Fleuncy	12685.455	65			
	Flexibility	11364.121	65			
	Originality	6026.364	65			
	Learning outcome	5483.273	65			

a. R Squared = .413 (Adjusted R Squared = .404)
b. R Squared = .672 (Adjusted R Squared = .667)
c. R Squared = .057 (Adjusted R Squared = .042)
d. R Squared = .637 (Adjusted R Squared = .631)
e. Computed using alpha = .05

Table 5 shows the test results of differences in creative thinking skills and student learning outcomes between the experimental class and the control class. The results of the analysis show that there is a relationship between the creative problem solving model and creative thinking skills, and learning outcomes are indicated by the value of 0.000<0.05. Tandirerung et al. (2021) also found an increase in student learning outcomes with a maximum completeness score of 89.65%. Haka et al. (2022) with the results of their research on the application of creative problem solving, namely an increase in post-test scores on essay tests with an average value of 86% and thinking habits questionnaire with an average value of 83% (very good). Heliawati et al. (2021); Khalid et al. (2020); Lobo (2016); Wilany & Rahman (2020); Yaden (2017), that there is a significant difference in students' ability to solve problems creatively and provide the best solutions when students are through g creative problem solving-based learning compared to students who are throughusing direct learning models. In addition, the level of understanding, learning outcomes, and the ability of students' scientific work also experienced a maximum increase. Hooijdonk et al. (2020) in their study found that students were able to identify their most creative ideas in the process of finding solutions. The same thing was stated by Bai et al. (2021) that the increase in originality in the process of expressing ideas depends on the process

carried out by students. The essence of the application of this creative problem solving is the process of one's ability to express new ideas in solving problems creatively.

Golnabi (2016); Resien et al. (2020) argue that identifying and recognizing students' creative thinking skills can be done by developing creative-based tasks, using skills and knowledge to create solutions. Singerin et al. (2020) suggests giving a problem and the process of finding answers in learning can help students to more easily remember and better understand the material being studied. On the other hand, teaching creative problem solving emphasizes creative thinking training that focuses on the creative learning process (Hu et al., 2017). With creative problem solving, one must reach a certain level of divergent thinking (Garcês, 2018; C.-Y. Lin, 2017). Garcês (2018) also highlights that creativity does not occur instantly, there are a series of underlying and interconnected stages in the creative process. To teach creative problem solving depends on the quality of the questions raised, because according to Salmon & Barrera (2021), in learning quality questions encourage students' curiosity, their level of thinking and make questions that are zones of proximal development. With a creative problem-solving model equipped with Higher order thinking skills questions, it can improve students' higher-order thinking skills (Astra et al., 2020). Simarmata (2022) also revealed that creative problem solving can help students develop problem solving skills and creative thinking in realistic mathematics learning.

The experience gained by students is the result of the process of teaching and learning activities, both in terms of students' ability to analyze, reason, compare, communicate, and evaluate. To familiarize students with solving problems creatively in order to improve their learning outcomes and of course creative thinking skills, teachers must take the initiative so that they are accustomed to applying new methods. their professionalism in teaching. Teachers in schools also need to be prepared to teach problem-solving skills based on creative independent problem solving, because they can effectively help develop their professionalism as teachers (Munastiwi et al., 2021). Therefore, in teaching biology material, it is necessary to train students about creative problem solving on suitable materials, because according Aguilar & Turmo (2019) creative thinking is the result of several cognitive processes that explain a series of mental activities in thinking.

In addition, in solving a problem creatively, it can be done collaboratively such as brainstorming in discussions and putting aside each other's ego in order to grow creative thinking. Because according to the opinion Hu et al. (2017); Yokozuka et al. (2021), in doing assignments this method emphasizes cooperation and joint development among students, by putting aside impressions and emotions of each other so that it will help students in their social development. Through the practice and application of creative problem solving that is designed on an ongoing basis on student worksheets, students will be able to strengthen their creative techniques and adaptive reasoning (Kristanti et al., 2018).

D. CONCLUSION AND SUGGESTIONS

Higher order thinking needs to be applied in the biology learning process, at least at the basic stage, namely the ability to solve problems because biology learning is applicative oriented, habituate thinking skills, reasoning skills, raises an attitude of curiosity and learns to be responsible for the community and the natural surroundings. Teachers must be able to apply a variety of strategies, using innovative methods and techniques to make learning more meaningful. Through the practice and application of creative problem solving that is designed in a sustainable manner, students will be able to strengthen their creative techniques and adaptive

reasoning towards creative problem solving. From the research data obtained, it is stated that the implementation of this creative problem solving in the learning process provides significant results on students' learning outcomes and creative thinking with a score of 0.000 < 0.05.

REFERENCES

Aguilar, D., & Turmo, M. P. (2019). Promoting social creativity in science education with digital technology to overcome inequalities: A scoping review. In *Frontiers in Psychology* ,. 10, Issue JULY). https://doi.org/10.3389/fpsyg.2019.01474

Arbia, S. M., Maasawet, E. T., & Masruhim, M. A. (2020). The development of learning tools oriented industrial revolution 4.0 to improve students' creative thinking skills. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, *51*(2), 117–131.

Astra, I. M., Raihanati, R., & Mujayanah, N. (2020). Development of electronic module using creative problem-solving model equipped with HOTS problems on the kinetic theory of gases material. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *6*(2), 181–194.

Audrey, E. S., Tuaputty, H., Rumahlatu, D., & Papilaya, P. M. (2019). The improvement of learning motivation and creative thinking skills of senior high school students through modified problem based learning model. *Journal for the Education of Gifted Young Scientists*, *7*(4), 1175–1194.

Bai, H., Mulder, H., Moerbeek, M., Kroesbergen, E. H., & Leseman, P. P. M. (2021). Divergent thinking in four-year-old children: An analysis of thinking processes in performing the Alternative Uses Task. *Thinking Skills and Creativity*, *40*, 100814. Doi. https://doi.org/10.1016/j.tsc.2021.100814.

Basadur, M., Gelade, G., & Basadur, T. (2014). Creative problem-solving process styles, cognitive work demands, and organizational adaptability. *The Journal of Applied Behavioral Science*, *50*(1), 80–115. Doi: 10.1177/0021886313508433.

Chan, S., & Yuen, M. (2014). Creativity beliefs, creative personality and creativity-fostering practices of gifted education teachers and regular class teachers in Hong Kong. *Thinking Skills and Creativity*, *14*, 109–118. https://doi.org/10.1016/j.tsc.2014.10.003.

Conradty, C., Sotiriou, S. A., & Bogner, F. X. (2020). How creativity in STEAM modules intervenes with self-efficacy and motivation. *Education Sciences*, *10*(3), 70. doi:10.3390/educsci1.

Fatmawati, B. (2020). Creative problem solving; implemented study in biology content. *Journal of Physics: Conference Series*, *1567*(4)issue? Page?, 042079. doi:10.1088/1742-6596/1567/4/042079.

Fatmawati, B., Ariandani, N., & Sasmita, M. (2021). Student's creative thinking ability with the lesson study design in biology content. *Jurnal Penelitian Pendidikan IPA*, *7*(2), 287–292. https://doi.org/10.29303/jppipa.v7i2.708.

Garcês, S. (2018). Creativity in science domains: a reflection. *Atenea*, *517*, 241–253.

Gholami, H., Yunus, A. S., Ayub, A. F. M., & Kamarudin, N. (2019). The impact of lesson study on achievement in mathematical problem solving and higher order thinking skills (HOTS) among foundation level students. *International Journal of Innovation, Creativity and Change*, *10*(2), 289–313.

Golnabi, L. (2016). Creativity and insight in problem solving. *Journal of Mathematics Education at Teachers College*, *7*(2) page?.

Gupta, P., & Sharma, Y. (2019). Nurturing scientific creativity in science classroom. *Resonance*, *24*(5), 561–574. https://doi.org/10.1007/s12045-019-0810-8.

Haka, N. B., Nisa, K., & Masya, H. (n.d.). Improving The Habits of Mind of Senior High School Students toward Biology Learning through Creative Problem Solving Learning Model Based on Mind Mapping: Pre-Experimental Study. *Assimilation: Indonesian Journal of Biology Education*, *5*(1), 34–43. https://doi.org/10.17509/aijbe.v5i1.44010.

Heliawati, L., Afakillah, I. I., & Pursitasari, I. D. (2021). Creative Problem-Solving Learning through Open-Ended Experiment for Students' Understanding and Scientific Work

Using Online Learning. *International Journal of Instruction*, *14*(4), 321–336. https://doi.org/10.29333/iji.2021.14419a.

Hu, R., Xiaohui, S., & Shieh, C.-J. (2017). A study on the application of creative problem solving teaching to statistics teaching. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(7), 3139–3149. DOI 10.12973/eurasia.2017.00708a.

Kapoor, N., Bansal, V. K., & Jain, M. (2020). Development of creative problem solving-based framework for site planning in hill areas. *Frontiers of Architectural Research*, *9*(2), 450–466. https://doi.org/10.1016/j.foar.2019.12.003.

Khalid, M., Saad, S., Hamid, S. R. A., Abdullah, M. R., Ibrahim, H., & Shahrill, M. (2020). Enhancing creativity and problem solving skills through creative problem solving in teaching mathematics. *Creativity Studies*, *13*(2), 270–291. https://doi.org/10.3846/cs.2020.11027.

Kristanti, F., Aini, C., Shoffa, S., Khabibah, S., & Amin, S. M. (2018). Developing creative-problem-solving-based student worksheets for transformation geometry course. *International Journal on Teaching and Learning Mathematics*, *1*(1), 13–23. Doi: 10.18860/ijtlm.v1i1.5581.

Kupers, E., Lehmann-Wermser, A., McPherson, G., & van Geert, P. (2019). Children's creativity: A theoretical framework and systematic review. *Review of Educational Research*, *89*(1), 93–124. . DOI: 10.3102/0034654318815707.

Laisema, S., & Wannapiroon, P. (2014). Design of collaborative learning with creative problem-solving process learning activities in a ubiquitous learning environment to develop creative thinking skills. *Procedia-Social and Behavioral Sciences*, *116*, 3921–3926. https://doi.org/10.1016/j.sbspro.2014.01.867.

Lee, C. K., & Shea, M. (2016). An Analysis of Pre-service Elementary Teachers' Understanding of Inquiry-based Science Teaching. *Science Education International*, *27*(2), 217–237.

Lin, C. S., & Wu, R. Y. W. (2016). Effects of Web-Based creative thinking teaching on students' creativity and learning outcome. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(6)page? . https://doi.org/10.12973/eurasia.2016.1558a

Lin, C.-Y. (2017). Threshold Effects of Creative Problem-Solving Attributes on Creativity in the Math Abilities of Taiwanese Upper Elementary Students. *Education Research International*, *2017*. https://doi.org/10.1155/2017/4571383

Lince, R. (2016). Creative thinking ability to increase student mathematical of junior high school by applying models numbered heads together. *Journal of Education and Practice*, *7*(6), 206–212.

Lobo, L. (2016). The Influence Of Learning Model (Creative Problem Solving Vs. Based Learning) Department of Pancasila Civic Education, Teacher Training and Education Faculty of Nusa Cendana University. *International Conference on Education: Education in The 21st Century: Responding To Current Issues*, 530–541.

Loc, N. P., Uyen, B. P., Tong, D. H., & Ngoi, H. T. (2020). A Teaching Process of Fostering Students' Problem-solving Skills: A case study of teaching the equation of a line. *Universal Journal of Educational Research*, *8*(5) page?. https://doi.org/10.13189/ujer.2020.080510

Martins Gomes, D., & McCauley, V. (2021). Creativity in science: A dilemma for informal and formal education. *Science Education*, *105*(3), 498–520. https://doi.org/10.1002/sce.21614.

Munastiwi, E., Yunos, J. M., Alias, M., & Paimin, A. N. (2021). Effect of Creative Independence Problem Solving (CIPS)-Based Training Module on Professionalism of Rural Indonesian Elementary School Teachers. *Al-Bidayah : Jurnal Pendidikan Dasar Islam*, *13*(1)page?. https://doi.org/10.14421/al-bidayah.v13i1.616

Ndiung, S., Sariyasa, Jehadus, E., & Apsari, R. A. (2021). The effect of treffinger creative learning model with the use rme principles on creative thinking skill and mathematics learning outcome. *International Journal of Instruction*, *14*(2)page?. https://doi.org/10.29333/iji.2021.14249a

Phaksunchai, M., Kaemkate, W., & Wongwanich, S. (2014). Research and development of a training package for developing creative problem solving of undergraduate students. *Procedia-Social and Behavioral Sciences*, *116issue?*, 4824–4828. 10.1016/j.sbspro.2014.01.1032.

Pizzingrilli, P., Valenti, C., Cerioli, L., & Antonietti, A. (2015). Creative thinking skills from 6 to 17 years as assessed through the WCR test. *Procedia-Social and Behavioral Sciences*, *191*, 584–590. https://doi.org/10.1016/j.sbspro.2015.04.498.

Rajagukguk, K. P., Lubis, R. R., Kirana, J., & Rahayu, N. S. (2021). Pelatihan Pengembangan Media Pembelajaran Model 4D Pada Guru Sekolah Dasar. *Jurnal Pengabdian Kepada Masyarakat*, *2*(1)page?.

Resien, C., Sitompul, H., & Situmorang, J. (2020). The effect of blended learning strategy and creative thinking of students on the results of learning information and communication technology by controlling prior knowledge. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, *3*(2), 879–893. https://doi.org/10.33258/birci.v3i2.997.

Ritter, S. M., Gu, X., Crijns, M., & Biekens, P. (2020). Fostering students' creative thinking skills by means of a one-year creativity training program. *PLoS One*, *15*(3), page? e0229773. https://doi.org/10.1371/journal.pone.0229773.

Salmon, A. K., & Barrera, M. X. (2021). Intentional questioning to promote thinking and learning. *Thinking Skills and Creativity*, *40*, 100822. https://doi.org/10.1016/j.tsc.2021.100822.

Sandika, B., & Fitrihidajati, H. (2018). Improving creative thinking skills and scientific attitude through inquiry-based learning in basic biology lecture toward student of biology education. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *4*(1), 23–28. https://doi.org/10.22219/jpbi.v4i1.5326.

Shieh, R.-S., & Chang, W. (2014). Fostering student's creative and problem-solving skills through a hands-on activity. *Journal of Baltic Science Education*, *13*(5), 650.

Sidek, R., Halim, L., Buang, N. A., & Arsad, N. M. (2020). Fostering scientific creativity in teaching and learning science in schools: A systematic review. *Jurnal Penelitian Dan Pembelajaran IPA*, *6*(1), 13–35.

Simarmata, P. (2022). The Effect of Models Creative Problem Solving and Problem Based Learning to Improvability Problem Solving Students. *JMEA: Journal of Mathematics Education and Application*, *1*(1), 31–43. :doi: http://dx.doi.org/10.30596%2Fjmea.v1i1.9167

Singerin, S., Huliselan, E. K., & Latununuwe, A. (2020). Development of Integrated Science Learning Devices Using Problem Based Learning (PBL) Learning Model Through Lesson Study. *Edu Sciences Journal*, *1*(2), 124–132. Doi:https://doi.org/10.30598/edusciencesvol1iss2pp124-132.

Sophonhiranrak, S., Suwannatthachote, P., & Ngudgratoke, S. (2015). Factors affecting creative problem solving in the blended learning environment: A review of the literature. *Procedia-Social and Behavioral Sciences*, *174*,issue? 2130–2136. https://doi.org/10.1016/j.sbspro.2015.02.012.

Susyla, D., & Syofiana, M. (2019). Developing students critical thinking ability through lesson study. *Journal of Physics: Conference Series*, *1320*(1), page?012005.

Tandirerung, W. F., Manuahe, C., & Raturandang, J. O. (2021). Penerapan Model Pembelajaran Creative Problem Solving (CPS) Untuk Meningkatkan Hasil Belajar Siswa. *JSPB Bioedusains*, *2*(2), 144–152. doi: 10.21070/jicte.v5i1.1474.

Tong, D. H., Loc, N. P., Uyen, B. P., & Truc, C. le. (2020). A case study of developing students' problem-solving skills through addressing real-world problems related to fractions in primary schools. *International Journal of Scientific and Technology Research*, *9*(2), 2809–2818.

van Hooijdonk, M., Mainhard, T., Kroesbergen, E. H., & van Tartwijk, J. (2020). Creative problem solving in primary education: Exploring the role of fact finding, problem finding, and solution finding across tasks. *Thinking Skills and Creativity*, *37*,issue? Page? 100665. https://doi.org/10.1016/j.tsc.2020.100665.

Wilany, E., & Rahman, A. (2020). The Effect of Creative Problem Solving Method Towards EFL Students'reading Comprehension. *Anglo-Saxon: Journal of the English Language Education Study Program*, *11*(1), 102–109. https://doi.org/10.33373/as.v11i1.2388.

Wimmer, L. (2016). Problem solving as a sufficient condition of the creative process: A case for closer cooperation of creativity research and problem solving research. In *Frontiers in Psychology* . 7,issue? p. 488). Frontiers Media SA. doi: 10.3389/fpsyg.2016.00488.

Yaden, Z. (2017). A Development of students' worksheet based on contextual teaching and learning. *International Journal of Learning, Teaching and Educational Research*, *16*(6), 64–79.

Yokozuka, T., Miyamoto, H., Kasai, M., Miyake, Y., & Nozawa, T. (2021). The Relationship Between Turn-taking, Vocal Pitch Synchrony, and Rapport in Creative Problem-Solving Communication. *Speech Communication*, *129*, issue? 33–40. https://doi.org/10.1016/j.specom.2021.03.001.

Zeidan, A. H., & Jayosi, M. R. (2015). Science Process Skills and Attitudes toward Science among Palestinian Secondary School Students. *World Journal of Education*, *5*(1), 13–24. doi:10.5430/wje.v5n1p13.