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Improving Creative Thinking Skills Through the PjBL-STEM Model assisted by LKPD Life Cycle Diology

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Abstrak

Penelitian ini dilatarbelakangi oleh rendahnya keterampilan berpikir kreatif siswa di sekolah dasar. Penelitian ini bertujuan untuk menganalisis pengaruh model pembelajaran PjBL-STEM berbantuan LKPD Life Cycle Diology terhadap keterampilan berpikir kreatif siswa. Penelitian ini menggunakan pendekatan kuantitatif dengan desain eksperimen (one group pretest-posttest design). Subjek penelitian ini adalah 30 siswa kelas V yang dipilih menggunakan teknik sampel jenuh. Data dikumpulkan melalui tes esai yang mengukur indikator keterampilan berpikir kreatif, yaitu kelancaran, fleksibilitas, orisinalitas, dan elaborasi. Instrumen penelitian yang digunakan yaitu tes esai. Analisis data dilakukan melalui uji prasyarat (normalitas dan homogenitas) dan uji hipotesis dengan uji-t. Hasil penelitian ini menemukan bahwa penerapan model PjBL-STEM berbantuan LKPD Life Cycle Diology mampu memberikan dampak positif terhadap perkembangan keterampilan berpikir kreatif peserta didik. Model PjBL-STEM memberikan kerangka kerja terstruktur bagi peserta didik untuk menggabungkan pengetahuan dari berbagai disiplin ilmu, memecahkan masalah secara kreatif, dan menghasilkan karya yang orisinil. Sehingga, dapat disimpulkan bahwa, model pembelajaran PjBL-STEM berbantuan LKPD Life Cycle Diology efektif dalam meningkatkan keterampilan berpikir kreatif peserta didik. Implikasi penelitian ini menunjukkan bahwa penerapan model PjBL-STEM berbantuan LKPD Life Cycle Diology efektif dalam mengembangkan keterampilan berpikir kreatif siswa, yang merupakan keterampilan esensial abad ke-21. Penelitian ini memberikan kontribusi penting dalam upaya meningkatkan kualitas pendidikan melalui pendekatan pembelajaran yang inovatif dan efektif.

Kata Kunci: *PjBL-STEM, LKPD Life Cycle Diology, Keterampilan Berpikir Kreatif.*

Abstract

This study was motivated by the low creative thinking skills of students in elementary schools. This study aims to analyze the effect of the PjBL-STEM learning model assisted by Life Cycle Diology LKPD on students' creative thinking skills. This study used a quantitative approach with an experimental design (one group pretest-posttest design). The subjects of this study were 30 fifth-grade students who were selected using the saturated sample technique. Data were collected through essay tests that measured indicators of creative thinking skills, namely fluency, flexibility, originality, and elaboration. The research instrument used was an essay test. Data analysis was conducted through prerequisite tests (normality and homogeneity) and hypothesis testing with a t-test. This study found that applying the PjBL-STEM model assisted by Life Cycle Diology LKPD positively impacted student creative thinking skills development. The PjBL-STEM model provides a structured framework for students to combine knowledge from various disciplines, solve problems creatively, and produce original work. Thus, the PjBL-STEM learning model assisted by Life Cycle Diology LKPD effectively improves students' creative thinking skills. The implications of this study indicate that applying the PjBL-STEM model assisted by Life Cycle Diology LKPD effectively develops students' creative thinking skills, which are essential skills of the 21st century. This research significantly improves education quality through innovative and effective learning approaches.

Keywords: PjBL-STEM, LKPD Life Cycle Diology, Creative Thinking Skills.

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1. INTRODUCTION

Current advances in information and communication technology are the impact of the rapid progress of education. One of the main focuses is improving the 21st-century skills that students need to have, such as higher-order thinking skills or HOTS (Higher Order Thinking Skills). The National Education Association has identified 21st-century skills as "The 4Cs", which include critical thinking, creativity, communication, and collaboration (Fonna & Nufus, 2024; Putri Husma et al., 2023). This skill is important because students must have

marketability, workability, and readiness to become good citizens. One of the government's efforts to implement 21st-century skills is through improving the curriculum. The implementation of the independent curriculum was first carried out at driving schools, which, of course, is a flagship program of the Ministry of Education, Technology and Higher Education. It is hoped that the driving school activities can raise the profile of Pancasila students to improve the quality of education by prioritizing character formation. One of the dimensions of the Pancasila student profile is creativity. Creative thinking skills focus more on the process of producing original works and actions so that students can explore and express their thoughts or feelings according to their interests and preferences in the form of works or actions and appreciate the works and actions produced (AD et al., 2022; Rachmawati et al., 2022; Sumarsih et al., 2022).

In reality, the implementation of these skills still encounters various obstacles in the field, especially in terms of developing student creativity. The results of the Education report card in 2023 for the creative dimension are still less than optimal with an average indicator of a score of 2.1 in yellow in elementary schools in Wonosalam District. For this reason, the school that became the place of this research was SDN Wonosalam, Wonosalam Subdistrict, Demak Regency, which is a driving school in the second generation. Recommendations from the 2022 education report card at Wonosalam Elementary School are expected to increase the creative dimension in strengthening the profile of Pancasila students. The findings through the Education report card found that student activities in the learning process have not supported creative thinking skills. For this reason, the solution offered is through the application of the PjBL-STEM model assisted by LKPD (*learner worksheet*). According to various references, one learning model that can improve creative thinking abilities is PjBL-STEM (Kibtiyah, 2022; Rukamana et al., 2020). Furthermore, revealed several research results supporting the use of PBL and PjBL in actualizing these two competencies. PjBL (Project Based Learning) is a learning model, and STEM is a learning approach. The characteristics of PjBL and PjBL-STEM have similarities and differences in the design process. The design process is a systematic approach to developing solutions to problems with clear outcomes. There are five learning steps PjBL-STEM steps: 1) reflection, investigating to connect what is known and what is learned; 2) research, concretize abstract understanding and focus on relevant conceptual concepts based on the project; 3) discovery, carrying out a discovery process so that students can present solutions to various problems; 4) application, students learn a broader context by connecting between disciplines in STEM fields; 5) communication, creating products by communicating between peers and in the classroom (Lestari & Rahmawati, 2020; Ruci et al., 2023).

LKPD is a tool for measuring students' capacity. LKPD has an important function in seeing teacher achievements in leading learning activities (Ruci et al., 2023). The LKPD component contains assignment sheets as material for students' practice and evaluation of the material previously explained, which is equipped with instructions as a tool to help students form a thinking framework for solving problems. In addition, research results related to PjBL-STEM were revealed by other researchers, who explained that the application of STEM-PjBL learning is useful because students are invited to carry out meaningful learning to understand a concept and explore it through project activities so that students are actively involved in the process. Through PjBL-STEM, students can improve their creative aspects. Learning media is prepared by meeting various standards, including (1) conformity with learning objectives, (2) appearance and content by the learning concept, (3) media packaging must be practical, flexible, and durable, and (4) learning media must be easy to use. used by users. LCD (Life Cycle Diology) media aims to optimize life cycle material during the learning process, making it easier for users to interact with students and creating an active learning environment that can influence and improve student learning outcomes (Faridy et

al., 2019; Kustandi & Darmawan, 2020; Rahardhian, 2019). One of the appropriate media to apply is interactive LCD-based learning media, which utilizes computer software to create animations (Ferlianti et al., 2022; Nofitasari et al., 2021; Widiyono et al., 2023).

The novelty offered in this research is the integration of the PjBL-STEM model with the Life Cycle Diology-based LKPD which has not been studied much before. This research seeks to optimize animal and plant life cycle material during the learning process by using LCD-based interactive media. The advantages of this application include that it has features in the form of animation and can be presented interactively so that it can improve student learning outcomes (Widiyono et al., 2022). This research is expected to make a real contribution to improving the quality of education through an approach that emphasizes character-building and student creativity. This is in line with the recommendations of the existing education report card, which shows the importance of these aspects in the development of the Pancasila learner profile. By integrating the PjBL-STEM learning model assisted by Life Cycle Diology-based LKPD, this research focuses not only on improving academic learning outcomes but also on developing creative thinking skills essential for students in the 21st century. The implementation of this learning strategy is expected to be able to answer current educational challenges, as well as prepare students to become individuals who are ready to face the demands of the world of work and social life with strong character and innovative abilities. (Puspita & Dewi, 2021; Ruci et al., 2023; Widiyono et al., 2023).

2. METHODS

This study used a quantitative approach with an experimental design (one group pretest-posttest design) (Facione, 1994; Kustandi & Darmawan, 2020; Sumarsih et al., 2022). This design was chosen to evaluate changes in students' creative thinking skills before and after the application of the PjBL-STEM model assisted by Life Cycle Diology LKPD. The research subjects used fifth-grade students at SDN Wonosalam, with a total of 30 participants. The sampling technique used was the saturated sampling technique, in which all fifth-grade students at the school were used as research samples. The data collection method used was an essay test prepared based on indicators of creative thinking skills including fluency, flexibility, originality, and elaboration. The validity of the instrument was tested by referring to the grid with the Pearson correlation product moment validity test, while the reliability of the instrument was tested using Cronbach's alpha test. The essay test consisted of five questions, each measuring important aspects of students' creative thinking skills. Data analysis was conducted through a series of prerequisite tests and hypothesis testing using the T-test. The prerequisite tests included normality and homogeneity tests to ensure that the data met the basic statistical assumptions. After that, the analysis continued with a T-test to compare pretest and posttest scores to determine the effectiveness of applying the PjBL-STEM model in improving students' creative thinking skills.

3. RESULTS AND DISCUSSION

Result

The results of this research test show that students' creative thinking skills have increased through the application of the PjBL-STEM learning model assisted by Life Cycle Diology-based LKPD on ecosystem material. Data analysis was carried out on the results of written tests in the form of essays held during the study. The validation results are presented in Table 1. Based on table 1, the five questions asked can be said to be valid because the significance value of each is smaller than 0.05. The Pearson correlation values for the

questions varied from .583 to .796 with significance levels ranging from .001 to .029, indicating that the questions were valid in measuring students' creative thinking ability. In addition, Cronbach's alpha value obtained is 0.679, which indicates that the instrument used can be said to be reliable because the value is above 0.6. This means that the questions are consistent in measuring students' creative thinking skills. The results of the Normality test (One Sample Kolmogorov-Smirnov Test) are presented in Table 2**.**

Table 1. Validation Test Results

Total	Question 1	Question 2	Question 3	Question 4	Question 5
Pearson Correlation	0.634	0.711	0.583	0.796	0.610
signature. (2-tail)	0.015	0.004	0.029	0.001	0.021
N	14	14	14	14	14

Table 2. Normality test (One Sample Kolmogorov-Smirnov Test)

N		12
Parameter Normal	**Means**	0.0000000
	Std. Deviation	0.92472355

Based on the results *of the Kolmogorov-Smirnov test*, It is said that the data is normally distributed because the significance level is less than 0.05. The results of Hypothesis testing (Model Summary) are presented in Table 3. Based on Table 3, the results of the hypothesis test can be said to be valid because the significance value is less than 0.05 through ***ANOVA*** [a], while the R-Square value for these results shows a value of 0.603 or 60.3%. This value means that the influence of the PjBL-STEM model assisted by LKPD Life Cycle Diology (X1) on creative thinking abilities (Y) is 60.3%, and the remaining 39.7% is influenced by other variables outside the model. Results of pretest and posttest creative thinking skills using the PjBL-STEM model assisted by LKPD Life Cycle Diology. The pretest and post-test scores for each indicator, such as fluency, experienced an increase in the overall average for students by 4.25. The increase of 4.25 points indicates that students became more capable of generating many ideas in a short period. An increase of 4.33 points in flexibility indicates students' ability to think more variably and adaptively to various situations. Originality increased by 4.17 points, this result shows an increase in students' ability to generate unique and unusual ideas, which can be developed through activities that encourage imagination and personal discovery. For elaboration, an increase of 4.17 points was obtained, which can be explained that students became more detailed and thorough in developing their ideas. The average student pretest result obtained a score of 63.60, while the post-test increased to 80.42. The results of implementing the PjBL-STEM model assisted by LKPD Life Cycle Diology were able to provide an increase in value of 16.92. For the distribution of the results of students' pretest and posttest scores, you can see the following picture are presented in Figure 1.

Table 3. Hypothesis Testing (Model Summary)

Model	R	R square	Adjusted R Square	Std. Estimation Error
1	0.776	0.603	0.563	0.96986

ANOVA

Model		Sum of Squares	df	Means Square	F	signature.
1	Regression	14.260	1	14.260	15.161	0.003b
	Residue	9.406	10	0.941		
	Total	23.667	11			

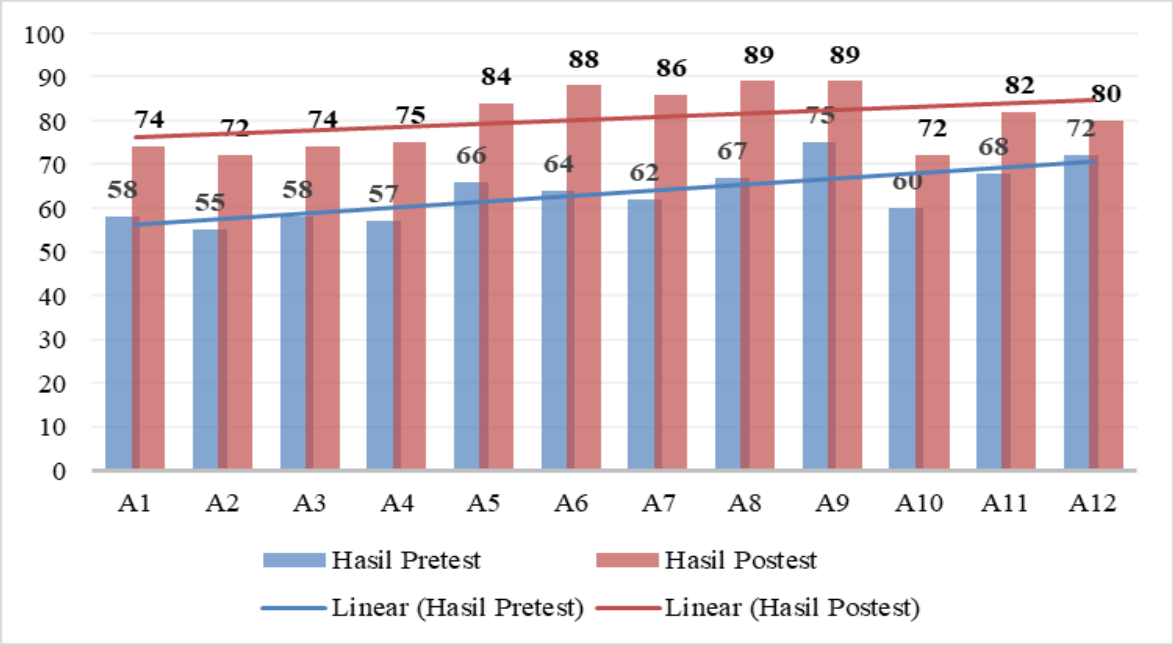

Figure 1. Diagram Of Increasing Pretest And Posttest Results

Based on Figure 1, it can be seen that students' creative thinking skills show that the lowest pretest score was obtained by A2 students with a score of 55, while the highest score was obtained by A9 students with a score of 75. The results of the student creative thinking skills post-test show that the lowest score was obtained by A2 and A10 students, who each obtained a score of 72, while the highest post-test score was obtained by A8 and A9 students, who each obtained a score of 89. The implementation of the PjBL-STEM model assisted by the Life Cycle Diology LKPD has had the highest impact on the flexibility item of 20.42, while the originality item is still lacking at 19.83. These results are in line with research showing that the PjBL-STEM model is effective in improving various aspects of creative thinking skills, especially in terms of flexibility and fluency of thinking.

The significant increase in flexibility indicates that students can adapt and apply various ideas in different situations, which is one of the important aspects of creative thinking. In addition, the improvement in the fluency aspect shows that students can generate many ideas quickly, which is important in the creative process. Based on the average results of the post-test of students' creative thinking skills, the percentage of fluency was 80%, flexibility was 81.67%, originality was 79.33%, and elaboration was 80.67%. The Life Cycle Diology LKPD support also provides structural guidance that helps students understand and apply concepts more effectively. This is by the findings which state that PjBL-STEM-based LKPDs can increase student involvement in learning and facilitate a deeper understanding of the material being studied. In this context, the LKPD acts as a tool that not only directs students in the learning process but also helps them develop creative thinking skills through clear and structured guidance. Overall, the results of this study indicate that the PjBL-STEM learning model assisted by the Life Cycle Diology LKPD is effective in improving students' creative thinking skills. This is important considering that creative thinking skills are one of the 21st-century skills that are urgently needed to prepare students to face future challenges. Thus, this research makes a significant contribution to supporting efforts to improve the quality of education through innovative and effective learning approaches.

Discussions

The result of the ability to think creatively at stage 1) fluency results in the ability to get lots of ideas out of the mind quickly. At this stage, students have skills in the high category in terms of enriching ideas and thoughts in project activities to increase students' self-motivation; 2) flexibility, namely the skill of producing a varied number of ideas, answers or questions. At this stage, students experience a high category where students often find answers that are almost the same, so the development of ideas is still less innovative and needs to be developed; 3) originality, the ability to come up with unique ideas or the ability to come up with original ideas. This student stage is included in the high category because in comprehensive problem-solving, students can answer in different ways and steps so the development of an idea increases in learning activities; 4) elaboration, the ability to develop ideas and add or specify details of an object, idea, or situation so that it becomes more interesting. For students' elaboration abilities, they are in the high category where students can develop ideas in activities that are more interesting and fun in project activities. This condition is in line with research results, which show that every aspect of creative thinking in the respondent's elaboration aspect shows better problem-solving results compared to other aspects of creative thinking. In addition, in improving their understanding of rational thinking, students are very good at project activities in problem-solving (Noviyani et al., 2021; Othman et al., 2022; Rusydiyah et al., 2021; Yunita et al., 2021).

Completion activities LKPD Life Cycle Diology, students focus on the discussion stage through several steps in implementing the PjBL-STEM model, namely analyzing ecosystem material in animals and plants, searching for information on the material independently, determining completion steps, and making conclusions. This is done to apply the syntax of the PjBL-STEM model. The aim of completing assignments given to students is to apply the PjBL-STEM learning model so that students can be involved and more active in the learning process so that students can hone their creative thinking skills to increase (Fitriyah & Ramadani, 2021; Mamahit et al., 2020). Application of group assignments to completion LKPD Life Cycle Diology The result is that students can improve creative thinking skills. This is in line with the research conducted by other researchers which states that in improving students' creative thinking abilities, they can use STEM-based LKPD. Students can search for broader answers through various reading sources such as newspapers or the internet to be more efficient. This is confirmed by research conducted by other researchers, which says that students can explore information and develop and apply existing knowledge independently through practice and carrying out assignments.

Based on observations during the learning process, student's interest and motivation to learn emerged when they were given pictures of ecosystem processes in animals and plants accompanied by ways of analyzing the problems around us. The presentation of images aims to attract students' attention in working on LKPD Life Cycle Biology, which is given. Next, after students are given LKPD Life Cycle Diology yang in the form of problems in ecosystems in animals and plants, students are required to determine and search for material information in groups, analyze and determine steps to solve and draw conclusions on various questions contained in the LKPD. When analyzing and concluding the process of ecosystem formation in the animals and plants found in LKPD Life Cycle Diology. The contribution of these findings to the scientific field highlights the efficacy of the PjBL-STEM model in improving students' creative thinking skills. The model encourages active participation and self-directed learning, which are essential for the development of higher-order thinking skills (Fatimah et al., 2024; Rahim & Ismaya, 2023; Zulkifli Adji Busdayu, Nining Rahmawati, 2023). This study is in line with previous research, reinforcing the idea that STEM-based project activities significantly enhance creative thinking (Faridy et al., 2019; Puspita & Dewi, 2021; Rahardhian, 2019). The advantages of this study include a strong demonstration of how

the PjBL-STEM model can be integrated into the curriculum to foster creativity and problem-solving skills (Fitriyah & Ramadani, 2021; Mamahit et al., 2020; Rahayu & Sutarno, 2021; Triastuti, 2020). However, there are some limitations, such as the potential for varying levels of student engagement and the need for more innovative idea development. Future researchers should focus on strategies to further diversify student responses and explore the long-term impact of such pedagogical models.

Comparing the results of this study with previous research shows a congruence, especially in the enhancement of creative thinking through an active and collaborative learning environment. Previous research corroborates that engaging students with practical, real-world problems can improve creative and critical thinking skills (Andry Budianto, 2024; Aprina et al., 2024; Panjaitan, 2023). The consistency across these studies underscores the reliability and applicability of the findings in a broader educational context. The results showed that learners were very enthusiastic and active in discussing and asking questions because the problems presented were very interesting and comprehensive. Learning activities that involve students making observations, analyzing, and concluding can indirectly trigger the process of developing students' creative thinking skills.

4. CONCLUSION

The results of this study found that the application of the PjBL-STEM model assisted by Life Cycle Diology LKPD was able to have a positive impact on the development of students' creative thinking skills. The PjBL-STEM model provides a structured framework for students to combine knowledge from various disciplines, solve problems creatively, and produce original work. Through the stages of reflection, research, discovery, application, and communication, students can explore the subject matter in a more meaningful and interactive way. The use of LKPD as a learning tool also proved effective in guiding students through a systematic learning process and encouraging their active involvement. Overall, this study shows that the PjBL-STEM model assisted by Life Cycle Diology LKPD can improve various aspects of student's creative thinking, including fluency, flexibility, originality, and elaboration.

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