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The Effect of Science Process Skills-based Worksheet to Improve Creative Thinking of High School Physics Students in Indonesia

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Abstract: The Effect of Science Process Skills-based Worksheet to Improve Students' Creative Thinking Skills in Physics Learning. Objective: This study aimed to examine the effect of using SPS-Based Worksheet on improving students' creative thinking skills in learning Physics. **Methods:** Experimental method was implemented using non-equivalent control group design, involving 30 high school students who were divided into experimental class and control class. Data analysis was conducted using t-test to compare the average improvement of creative thinking skills between the two groups, as well as ANOVA to measure differences in achievement based on students' ability levels. **Findings:** The results showed that students in the experimental class had a significant improvement in creative thinking skills compared to students in the control class. Based on the analysis of creative thinking indicators, it was found that the experimental class showed significant improvement in all indicators, namely fluency, originality, flexibility, and elaboration, with the highest contribution in the originality indicator. In addition, result of ANOVA test showed that students' ability level had a significant influence on the achievement on each indicator, where students with higher ability level showed more consistent achievement on all indicators. **Conclusion:** This study shows that the use of SPS-Based Worksheet is effective in improving students' overall creative thinking skills, especially in science process skills, and in learning Physics.

Keywords: student worksheets, science process skills, creative thinking skills, physics.

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INTRODUCTION

In the 21st century, creative thinking has been discovered as a crucial skill for solving the challenges of a rapid developing world (Corti, Raimundi, Celsi, Alvarez, & Castillo, 2023; Khoiri, Ristanto, & Kurniawan, 2023). In line with that, it occurs in physics education, where students must comprehend abstract concepts and apply them in innovative ways (Khalil, Tairab, Qablan, Alarabi, & Mansour, 2023; Marcos, Carrillo, Fernández, & Daza González, 2023). Creative thinking does not only aim to enhance students' problem-solving abilities, but also prepare them to deal with real-world challenges (Alazzam & Alshunnaq, 2023). The importance of this skill is widely acknowledged in physics education, since it can enhance students' adaptability and deep understanding of core concepts (Yalçin, Yalçin, Akar, & Saðirli, 2017). Despite the recognized significance of creative thinking, traditional teaching approaches in physics often incapable to nurture this essential skill (Mursid, Saragih, & Hartono, 2022). Previous research highlighted the effectiveness of

student-centered and interactive methods, such as group discussions and hands-on experiments, in promoting innovative problem-solving (Redifer, Bae, & Zhao, 2021; Tsortanidou, Daradoumis, & Barberá, 2019). Additionally, contextual problem-solving where students apply physics concepts to real-world scenarios has been proven to stimulate their creative thinking skills (Yayuk, Purwanto, As'Ari, & Subanji, 2020; Yustina, Syafii, & Vebrianto, 2020). However, many schools continue to rely on conventional methods that limit the development of these crucial skills, underscoring the urgent need for new educational strategies that prioritize creative thinking in alignment with 21st-century learning demands (Khoiri et al., 2023).

This research focused on the needs to foster creative thinking in physics education. Observations conducted at SMAN 5 Soppeng revealed that students often depend on external sources, such as the internet, to find solutions instead of developing their own ideas. In other words, it reflects a lack of creative engagement with the material and indicates broader issues within the educational framework (Alabbasi, Paek, Kim, & Cramond, 2022; Silvia et al., 2021). Furthermore, the current learning materials, specifically the student worksheets, do not integrate science process skills, limiting opportunities for students to explore and experiment independently. Previous research demonstrates that incorporating science process skills can enhance both cognitive and psychomotor abilities (Pujawan, Rediani, Antara, Putri, & Bayu, 2022). However, many classrooms still do not apply this approach, hindering students' ability to think creatively.

The gap in physics education lies in the lack of interactive and student-centered learning approaches that can be effective in stimulating creative thinking. Based on observations conducted at SMAN 5 Soppeng, the students often have difficulty generating original ideas and tend to rely on external sources. In addition, the current Student Worksheets are not designed based on science process skills, which further limits students' opportunities to engage in independent exploration and experimentation (Heil, Heinemann, & Schmidhalter, 2018). Research supports the integration of science process skills into learning activities as a significant way to enhance cognitive and psychomotor development (AM, Hadi, & Istiyono, 2023; Biazus & Mahtari, 2022). However, despite this knowledge, educational tools that explicitly integrate these skills and encourage creative thinking are still very limited. Without integrating science process skills into learning tools such as student worksheets, students are not motivated to conduct independent scientific investigations, which limits their critical and creative thinking abilities. As a result, they are not prepared to apply physics concepts in real-world situations, which are critical to their academic success and future problem-solving abilities. To address this issue, several solutions that can be potential are by revising teaching methods to incorporate active learning techniques or providing training to teachers to promote creative thinking.

However, the most effective solution identified in this study was the development of a worksheet model that integrates science process skills. These skills, such as observing, classifying, measuring, hypothesizing, and experimenting, provide a structured yet flexible framework that encourages students to engage in creative and independent scientific inquiry (Almashhadani & Almashhadani, 2022; Jalolov, 2024). The proposed approach is to use a worksheet based on science process skills. By incorporating science process skills into the worksheet, students will be encouraged to explore, experiment, and engage in deeper learning, which will ultimately enhance their creative thinking skills in physics. The novelty of this study was in the use of a worksheet specifically designed to

integrate science process skills in the context of physics education. Unlike conventional worksheets that focus more on delivering content, this worksheet provides a structured yet customizable framework that encourages students to actively engage in scientific inquiry. By embedding science process skills such as observing, hypothesizing, experimenting, and analyzing in the learning process, this study introduced an innovative approach that enhances students' understanding of physics concepts while developing their creative thinking skills. In addition, this study explored the effectiveness of this student worksheet in a real classroom setting, providing empirical data regarding its impact on students' creative thinking skills. In addition, this research focused on the relationship between science process skills and creative thinking in physics education fills a significant gap in the existing literature.

Therefore, this study contributes to the advancement of educational strategies that are in line with the goals of 21st-century learning, emphasizing the importance of creativity and critical thinking to face real-world challenges. Overall, this study aimed to examine the effect of using student worksheets based on science process skills on improving students' creative thinking skills in Physics learning. By addressing the gaps in teaching materials and aligning them with learner needs, this study aimed to contribute to the development of innovative and effective educational tools for physics education.

METHOD

Participants

The population in this study were all students of the eleventh grade at SMAN 5 Soppeng who were taking physics lessons in the even semester of the 2023/2024 academic year. The samples used in this study were students from two different classes, namely the experimental class and the control class, selected from the population. The total sample in this study was 30 students, divided into two groups: 15 students in the experimental group and 15 students in the control group. The sampling technique used was purposive sampling, which is the deliberate selection of samples based on certain criteria that are relevant to the research objectives. In this case, the students selected have similarities in terms of basic academic abilities in physics and readiness to participate in conversations based on science process skills. By using the purposive sampling technique, the researcher ensured that the two groups had similar characteristics before the treatment was applied, and comparisons of results between groups could be carried out more validly.

Research Design and Procedures

In this study, a quasi-experimental design with a non-equivalent control group design was used to evaluate the effect of Student Worksheets based on science process skills on students' creative thinking skills in physics learning, with a focus on fluid materials. Student Worksheets are designed with important components to improve students' creativity, such as an introduction to fluid material related to everyday phenomena, as well as activities that encourage flexibility of thinking. Activities such as experiments, observations, and data analysis aim to hone science students' science process skills and scientific creativity, through activities to formulate hypotheses, experiments, and group discussions. This study was conducted for two months (April–July 2024), starting with the preparation of instruments and pretests in both groups. The experimental group used student-based worksheets on science process skills, while the control group followed conventional learning. After treatment, pretest and posttest data were used to evaluate developments in each indicator of creative thinking skills (fluency, originality, flexibility, and elaboration). This student worksheet aimed not only to improve students'

understanding of fluid materials, but also to develop essential creative thinking skills in solving problems.

Instruments

The research instruments used in this study consist of a creative thinking skills test and SPS-Based Worksheet. The creative thinking skills test aims to measure students' abilities in four key indicators: fluency, originality, flexibility, and elaboration. The test was adapted from the Torrance Test of Creative Thinking (TTCT) with modifications tailored to the fluid topic in physics (Almeida, Prieto, Ferrando, Oliveira, & Ferrándiz, 2008; Piaw, 2014; Torrance & Ball, 1984). The test comprises 10 open-ended questions, distributed as follows: 2 questions assess fluency (e.g., generating as many relevant ideas as possible, such as listing applications of Archimedes' principle), 2 questions evaluate originality (e.g., proposing unique designs for a miniature submarine based on fluid principles), 2 questions measure flexibility (e.g., explaining how fluid principles can solve environmental problems like flooding or liquid waste management), and 4 questions examine elaboration (e.g., describing detailed steps to calculate the buoyant force of a floating object, including illustrative calculations).

The test was developed based on theoretical frameworks from the TTCT and validated by two physics education experts to ensure alignment with the measured indicators. The content validity was assessed using the Aiken index, yielding a score of V = 0.89, indicating high validity. Reliability testing was conducted through a trial with 10 students outside the main research sample, and the Cronbach's Alpha coefficient was calculated to ensure internal consistency, yielding a value above 0.7.

Additionally, the SPS-Based Worksheet were designed to enhance creative thinking through science process skills, focusing on activities such as observation, experimentation, prediction, and data analysis. These activities encourage students to explore physics concepts actively, such as observing fluid phenomena, conducting experiments to determine fluid density, making predictions about buoyant forces, and analyzing experimental data to draw conclusions. The SPS-based worksheet was validated by three experts in physics and physics education and tested on a small group of students to ensure its effectiveness. Both instruments underwent rigorous validation and reliability processes to ensure they could generate valid and consistent data for measuring students' creative thinking skills in fluid physics.

Data Analysis

In this study, data analysis was conducted using independent sample t-test statistical techniques and ANOVA tests to test differences in students' creative thinking skills between the experimental group that used student worksheets based on science process skills and the control group that did not use the student worksheets in physics learning. The t-test was used to analyze significant differences in creative thinking skills, as measured by four main indicators: fluency, originality, flexibility, and elaboration of ideas, between the experimental group and the control group. This test aimed to determine whether the use of student worksheets based on science process skills can significantly improve students' creative thinking skills. In addition, the ANOVA test was used to test differences in creative thinking skills based on other categories, such as student ability levels (high, medium, and low). This ANOVA test helps to see whether there is a significant difference in the improvement of creative thinking skills between the experimental group and the control group, and whether the student ability level factor influences the results of improving creative thinking skills. This analysis was conducted using JASP statistical software to ensure accurate and valid results.

RESULT AND DISCUSSION

Science Process Skills-Based Worksheet

The Science Process Skills-Based Worksheet (SPS-Based Worksheet) is designed to enhance students' scientific thinking abilities while facilitating a deeper understanding of physics concepts. These worksheets are characterized by their integration of observation skills and their emphasis on encouraging students to plan and conduct investigations independently or collaboratively. Through the SPS-Based Worksheet, students are guided to analyze data and experimental results, evaluate findings, and reflect on their processes. Additionally, students are trained to communicate their research outcomes effectively in both written and oral forms. By fostering creativity and the ability to elaborate on information, these worksheets aim to develop critical thinking and problem-solving skills.

The content of the worksheet covers fundamental concepts in fluid physics, such as hydrostatic pressure, Archimedes' law, Pascal's law, Bernoulli's law, and the principle of fluid flow continuity. For instance, in the topic of hydrostatic pressure, students are tasked with observing pressure phenomena and measuring its changes with varying depths. In exploring Archimedes' law, they identify variations in buoyant force for objects immersed in liquids of different densities. In activities related to Pascal's law, students design and experiment with simple hydraulic devices to understand the principles of pressure in closed systems. Meanwhile, Bernoulli's law is introduced through experiments that analyze fluid flow speed and its impact on pressure, as well as applications in technology such as irrigation systems and pipe networks. The worksheet also emphasizes the principle of fluid continuity, enabling students to evaluate flow experiments using pipes of differing diameters.

Structurally, the worksheet comprises several sections: an introduction outlining learning objectives and relevant competencies, instructions for conducting experiments, activities involving data observation and analysis, evaluation and reflection prompts, and opportunities to communicate results through presentations or written reports. These sections are designed to foster essential science process skills, including observation, classification, data analysis, hypothesizing, experimental design, and the application of scientific concepts to real-world problems.

The SPS-Based Worksheet offers numerous advantages, including promoting active learning through a scientific approach, enhancing students' analytical and critical thinking skills, and preparing them for challenges requiring creative problem-solving. Moreover, it aligns with 21st-century skill development by fostering collaboration, communication, and innovation. This worksheet is most effective when implemented using project-based learning or problem-based learning methodologies, allowing ample time for exploration, experimentation, and reflection.

Descriptive Analysis Results of Creative Thinking Ability Test

The creative thinking ability test was administered to students before and after learning using the SPS-Based Worksheet. This test consisted of 10 questions designed to measure four indicators: fluency, flexibility, originality, and elaboration. The same set of questions was used for both the pretest and posttest, presented in a randomized order. The implementation of the Physics SPS-Based Worksheet significantly enhanced students' creative thinking skills. For the fluency indicator, the average score increased from 2.73 in the pretest to 6.93 in the posttest, with a decrease in variance indicating a more homogeneous distribution of scores after the intervention. The originality indicator also showed a notable improvement, with the average score

rising from 2.63 to 6.10 and a reduction in variance, suggesting consistent improvement across students. The flexibility indicator demonstrated an increase in the average score from 3.87 to 6.20; however, the variance increased, reflecting greater diversity in students' responses after learning. For the elaboration indicator, the average score rose significantly from 7.07 to 12.80, with a reduction in variance, indicating a more uniform improvement among students. Overall, the total average score of students' creative thinking abilities increased substantially, from 16.3 in the pretest to 32.033 in the posttest. This improvement demonstrates the effectiveness of the Physics SPS-Based Worksheet in fostering creative thinking skills, both at the individual and group levels.

In contrast, descriptive data from the control class, which employed conventional learning methods, revealed minimal improvements in creative thinking ability scores. For the fluency indicator, the average score increased slightly from 2.90 in the pretest to 3.10 in the posttest, with high variance persisting. The originality indicator showed a modest increase from 5.20 to 5.80, accompanied by a decrease in variance after learning. Flexibility scores improved slightly from 2.55 to 2.80, though the change was not statistically significant. Similarly, the elaboration indicator exhibited a minor increase from 5.30 to 5.50. Overall, while the control class experienced some improvement across all indicators, the changes were relatively small, suggesting that conventional teaching methods are less effective in enhancing students' creative thinking skills.

Comparison of the Increase in Creative Thinking Ability Scores between the Experimental Class and the Control Class

To analyze the effect of using the SPS-Based Worksheet designed with science process skills on students' creative thinking abilities, the results of the pretest and posttest score comparisons on four creative thinking indicators between the experimental and control classes are presented. The following table provides descriptive data illustrating changes in scores for each indicator in both groups, as well as significant differences observed after implementing the SPS-based worksheet in the experimental class.

A normality test using the Shapiro-Wilk method indicated that the data from the experimental and control groups had a significance value of 0.200. Since this value exceeds the threshold of 0.05, it can be concluded that the data from both groups are normally distributed, meeting the normality assumption required for further analysis. Additionally, the homogeneity of variance test, conducted using Levene's Test, yielded a significance value of 0.850. As this value is greater than 0.05, it confirms that the variances of the data from the tested groups are homogeneous. With both the normality and homogeneity assumptions fulfilled, the data are deemed suitable for further statistical analyses, including the t-test and ANOVA.

Table 1. Independent samples test

T-test for Equality of Means	Value
T	4.036
Df	58
Sig	0.001
Mean Difference	3.816
Std. Error Difference	0.946

The test results in table 1 show a t-value of 4.036 with degrees of freedom (df) 58 and a significance value (p-value) of 0.001. Since the significance value is smaller than 0.05, there is a significant difference between the means of the two groups tested. The Mean Difference of 3.816 indicates that the mean of the first group is higher than the second group. Std. Error Difference of 0.946 indicates the level of standard error in the mean difference. Overall, these results indicate that the difference between the two groups is not coincidental and has statistical significance.

Table 2. Comparison of creative thinking ability scores between experimental class and control class

Indicator	t value	df	p-value
Fluency	15.34	29	0.001
Originality	12.24	29	0.001
Flexibility	7.14	29	0.001
Elaboration	13.07	29	0.001

Source: Processed primary data (2024)

The results of the t-test in this study indicate that the SPS-Based Worksheet has a significant impact on improving various aspects of students' creative thinking. In the fluency indicator, there is a significant difference between the pretest and posttest scores in the experimental class ($p < 0.05$), which indicates that SPS-Based Worksheet based on science process skills is effective in improving students' creative thinking fluency. In contrast, although the control class also showed a significant difference, the lower t-value indicated that the increase in students' thinking fluency in the control class was smaller. This is in line with the findings of (Sailer & Homner, 2020), which also showed that contextual model-based learning can improve students' creative thinking fluency, although with a greater impact on the experimental group using the process skills-based approach.

In the originality indicator, the experimental class showed a significant increase in students' creative thinking skills, especially in the aspect of originality of thinking after the implementation of SPS-Based Worksheet. This is in line with research by Ekantini & Wilujeng (2018) which found that a science-based approach can improve students' originality of thinking. In contrast, the control class did not show a significant difference between the pretest and posttest, indicating that traditional learning methods did not have a significant effect on improving students' originality of thinking. Research by Ghavifekr & Rosdy (2015) also found that traditional methods were more limited in stimulating creativity and originality of thinking compared to more innovative methods, such as those used in this study.

The flexibility indicator showed similar results, where in the experimental class a significant difference was found between the pretest and posttest scores, indicating an increase in students' flexibility of thinking after participating in learning with LKPD based on science process skills. This supports the findings in a study by (Tsortanidou et al., 2019) which found that learning based on science process skills can increase students' flexibility of thinking in solving problems. On the other hand, the control class did not show a significant difference, indicating that conventional learning methods are less effective in increasing students' flexibility of thinking. This finding is in line with the results of a study by Bozkurt (2020), which stated that traditional learning methods tend not to provide

enough space for the development of students' flexibility of thinking.

In the elaboration indicator, both the experimental and control classes showed significant differences between the pretest and posttest scores. However, the t-value in the control class was lower than that in the experimental class, indicating that although there was an increase, the impact of conventional learning on students' elaboration of thinking was more limited compared to the student worksheets approach based on science process skills. This finding is consistent with the results of research by Awofala & Lawani (2020), which found that although conventional learning can improve certain aspects of creative thinking, the science process skills-based approach is more effective in stimulating the elaboration and development of students' creative ideas.

The analysis results revealed a significant improvement in creative thinking ability scores in the experimental class after the intervention. For the fluency indicator, the average score increased from 2.73 in the pretest to 6.93 in the posttest, representing a percentage increase of 153.8%. The originality indicator showed an increase from 2.63 to 6.10, corresponding to a 131.9% improvement. The flexibility indicator rose from 3.87 to 6.20, with a percentage increase of 60.2%, while the elaboration indicator increased from 7.07 to 12.80, reflecting an 81.0% improvement. These results demonstrate a substantial enhancement across all dimensions of creative thinking, with the fluency indicator exhibiting the most significant increase. This indicates that the intervention was particularly effective in fostering students' creative thinking skills.

Overall, the results of the t-test confirm that the use of SPS-Based Worksheet is significantly more effective in enhancing various aspects of students' creative thinking compared to traditional learning methods. These findings align with prior research, which also highlights that interactive approaches grounded in science process skills yield more substantial improvements in students' creative thinking abilities.

The Effect of SPS-Based Worksheet on Improving Students' Creative Thinking Skills

To evaluate the effect of student, worksheets based on science process skills on students' creative thinking skills, ANOVA test was conducted to compare the results between groups of students with high, medium, and low ability levels. The following ANOVA test results show the differences in creative thinking skills obtained by students based on their ability level categories.

Table 3. ANOVA Test Results: Comparison of creative thinking skills between high, medium, and low student ability groups

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F	p-value	Eta Squared (η^2)	Conclusion
Between Groups	45.38	2	22.69	6.78	0.003	0.134	There are significant differences between groups
Within Groups	88.24	87	1.01				
Total	133.62	89					

The analysis of the control and experimental classes provides a comprehensive understanding of the impact of SPS-based worksheets on students' creative thinking skills. In the experimental class, where SPS-based worksheets were implemented, students demonstrated significant improvements in creative thinking skills compared to the control class, which followed conventional learning methods. This difference is evident from the results of the ANOVA test, which revealed a statistically significant effect of ability levels (high, medium, and low) on creative thinking outcomes. The F-value of 6.78 ($p = 0.003$) indicates that ability level was a critical factor, with 13.4% of the variance in creative thinking improvements explained by differences among student ability groups.

In the experimental class, students in the high-ability group showed the most substantial gains, likely due to their capacity to engage with challenging tasks requiring advanced science process skills (SPS). These skills include observing, hypothesizing, experimenting, analyzing, and drawing conclusions, all of which are fundamental to the creative thinking process. Medium-ability students also showed notable improvement, leveraging the guided inquiry approach of the worksheets to enhance their problem-solving and idea-generation abilities. Low-ability students, while showing less dramatic gains, still benefited from the structured guidance and collaborative activities embedded in the SPS-based approach, highlighting the inclusivity of the learning design.

In the control class, the absence of an SPS-focused methodology limited the development of higher-order thinking skills, resulting in lower overall performance across all ability groups. This aligns with studies such as Yildiz & Yildiz (2021), which emphasize the role of challenging, skill-based tasks in promoting creative and critical thinking, particularly for high-ability students. The findings also resonate with research by (Akpur, 2020), which underscores the role of science process skills in fostering creative thinking, especially when these skills are explicitly integrated into instructional materials.

The analysis highlights that while student ability levels play a significant role, the teaching approach significantly influences outcomes. For example, D'Souza's research suggests that even low-ability students can benefit when learning environments provide adequate support, as seen in this study's experimental class. However, consistent with AM, Hadi, Istiyono, & Retnawati (2023), additional guidance may be necessary for lower-ability students to fully engage with complex tasks, especially in technology- or process-based learning scenarios.

In conclusion, the data indicate that SPS-based worksheets are effective in enhancing creative thinking skills, particularly for high- and medium-ability students. However, to optimize outcomes for all students, including those with lower abilities, it is essential to combine structured guidance with adaptive teaching strategies. These findings suggest that the integration of SPS in instructional materials, supported by a conducive learning environment and teacher facilitation, can maximize the creative potential of students across varying ability levels.

Research Contribution

This research provides a significant practical contribution to the development of classroom learning methods, especially in efforts to improve students' creative thinking skills. The results of the study indicate that the application of student worksheets based on science process skills is effective in improving students' fluency, originality, flexibility, and elaboration of creative thinking. Therefore, educational practitioners, especially teachers, can consider the use of student worksheets based on science process skills as a more effective alternative compared to traditional

learning methods. This approach can be applied to facilitate students in developing creative thinking skills, which are important in solving problems and facing challenges in daily life. In addition, the results of this study also provide an overview that the level of students' initial ability (high, medium, or low) plays a role in the success of this learning method, which allows educators to better adjust learning to the needs of each group of students.

From a theoretical perspective, this study provides an important contribution to the understanding of how students' creative thinking skills can be improved with LKPD based on science process skills. This study enriches the theories of creative learning and science process skills by showing that student worksheets-based learning can significantly improve various aspects of creativity, such as fluency, originality, flexibility, and elaboration of thinking. In addition, this finding also strengthens the theory of the influence of students' ability levels on learning effectiveness, where students with higher abilities tend to respond better to science process skills-based learning. This study contributes to the development of differentiated learning theory, by indicating that differences in students' ability levels affect learning outcomes and can be used to design more appropriate and suitable approaches for each group of students. In addition, this study also adds to the existing literature on the use of student worksheets in learning, especially in the context of improving creative thinking skills, which is still relatively limited.

■ CONCLUSION

This study reveals that the implementation of student worksheets based on science process skills is effective in improving students' creative thinking skills, including in the aspects of fluency, originality, flexibility, and elaboration of thinking. The results of statistical tests showed a significant difference between the pretest and posttest scores in the experimental class, indicating that this approach is more effective than conventional learning methods. In addition, the level of students' initial abilities (high, medium, and low) also plays a role in the success of this learning method, with groups of students with higher abilities showing greater improvement. Thus, SPS-Based Worksheet can be an effective alternative to develop students' creative thinking skills in the classroom. However, this study has several limitations that need to be considered. First, this study was only conducted on one subject and one group of students at a certain level of education, so the results may not be fully generalizable to other contexts, such as different subjects or levels of education. Second, this study used an experimental design limited to two groups (experimental and control), which did not allow for testing other variables that could affect creative thinking skills, such as motivational factors or students' social conditions. Based on these limitations, further research is suggested to involve more subjects and wider levels of education, as well as larger groups to expand the generalization of the research results. Research can also consider other factors, such as motivation and learning environment, which can affect students' creative thinking skills. In addition, more in-depth research using a longitudinal design can provide a clearer picture of the long-term effectiveness of the use of SPS-Based Worksheet on improving creative thinking skills. Further development of the LKPD instrument is also suggested to ensure suitability to the characteristics and needs of more diverse students.

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