

The Influence of the Causalitik Learning Model Integrated with Local Wisdom Values Assisted by Articulate Storyline on Students' Creative Thinking Ability

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Abstract— This study aims to determine whether there is an effect of the causality-based learning model integrated with local wisdom values and assisted by Articulate Storyline on improving students' creative thinking skills in the topic of sound waves. The research employed a quasi-experimental method with a nonequivalent control group design, involving an experimental group and a control group without random assignment of subjects. The research population consisted of 62 eleventh-grade students of SMAN 2 Narmada in the 2025/2026 academic year. The sample was selected using a cluster random sampling technique, resulting in 21 students from class XI-A as the experimental group and 20 students from class XI-C as the control group. The experimental group received instruction using a causality-based learning model integrated with local wisdom values, while the control group was taught using conventional methods. Data on creative thinking skills were collected through an essay test consisting of five questions. The average creative thinking skills scores obtained were 82.07 for the experimental group and 77.33 for the control group. The data from both groups were homogeneous and normally distributed. The creative thinking skills data were analyzed using a pooled-variance t-test. The results showed that the calculated t-value was 2.19, while the critical t-value at the 5% significance level was 2.023. Since the calculated t-value exceeded the critical value, it can be concluded that the implementation of the causality-based learning model integrated with local wisdom values and assisted by Articulate Storyline has a significant effect on senior high school students' creative thinking skills in the topic of sound waves.

Keywords— Practicality; Causalitik, Local Wisdom, Articulate Storyline, Creative Thinking Ability.

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1. Introduction

Education is a strategic effort to improve the quality of human life. In the context of education in Indonesia, achieving national educational goals in the 21st century requires instructional innovations that are capable of developing students into active and independent learners who possess critical, creative, collaborative, and communicative thinking skills [1] [2]. Physics learning, as a part of science education, plays an important role in fostering these skills because physics develops through scientific processes that emphasize conceptual understanding, reasoning, and practical experience [3] [4].

One of the higher-order thinking skills that is essential in physics learning is creative thinking ability. Creative thinking enables students to generate multiple solutions fluently, flexibly, originally, and in detail when solving physics problems [5]. However, the creative thinking ability of Indonesian students remains relatively low, as indicated by the Global Creativity Index and findings from previous studies. This condition is closely related to physics teaching practices in schools, which are still dominated by conventional approaches and concept memorization, resulting in limited student engagement and difficulties in connecting physics concepts with real-life phenomena [6].

Preliminary observations at SMA Negeri 2 Narmada revealed that students tend to perceive physics as a difficult and monotonous subject, their active participation in learning remains low, and their creative thinking skills have not been optimally developed. In addition, physics instruction has not sufficiently integrated local wisdom, even though the students' surrounding environment contains various local cultural phenomena that are relevant to physics concepts, particularly in the topic of sound waves.

Previous studies have shown that integrating local wisdom into learning can enhance students' learning motivation, conceptual understanding, and awareness of culture and the environment [7] [8] [9]. Meanwhile, the causality-based learning model, which emphasizes the analysis of cause–effect relationships and the construction of scientific arguments, has been proven effective in improving students' creativity, reasoning abilities, and physics problem-solving skills [1] [10] [11] [12]. Furthermore, the use of interactive learning media such as Articulate Storyline can increase student engagement and facilitate the understanding of abstract physics concepts [13] [14].

Based on the conceptual framework, previous research findings, and problems identified through field observations, it is necessary to conduct a study that examines the implementation of a causality-based learning model integrated with local wisdom values and assisted by Articulate Storyline as an effort to enhance students' creative thinking skills in physics learning, particularly on the topic of sound waves at the senior high school level.

2. Method

This study employed a quasi-experimental design as a development of a true experimental design, specifically using a nonequivalent control group design [15]. This design was used to evaluate the effect of implementing a causality-based learning model integrated with local wisdom values as the independent variable on students' creative thinking skills as the dependent variable. The control variables in this study included the sound wave topic, the teacher, and the allocation of instructional time to ensure that the treatments administered to both groups could be compared fairly.

The study was conducted at SMAN 2 Narmada, West Lombok Regency, from August 2024 to June 2025. The research population consisted of all eleventh-grade science students. The sample was determined using a cluster random sampling technique, with class XI-A selected as the experimental group and class XI-C as the control group. The experimental group received instruction using a causality-based learning model integrated with local wisdom values, while the control group was taught using conventional learning methods.

The research instrument was a creative thinking skills test in the form of essay questions. The instrument was validated through expert validity and empirical validity. Expert validation was conducted by academic supervisors to assess the appropriateness of the content, construction, and language of the instrument. Empirical validity and instrument reliability were analyzed using relevant statistical tests prior to its implementation in the study. Data were collected through pre-tests and post-tests administered to both groups. The collected data were analyzed using normality tests, homogeneity tests, and hypothesis testing through a t-test to determine the effect of the treatment on students' creative thinking skills.

The analysis of creative thinking skills was based on four indicators of creative thinking (ICT), namely ICT-1 fluency of thinking, ICT-2 flexibility of thinking, ICT-3 originality of ideas, and ICT-4 elaboration of ideas [16]. The test scores were then converted into percentages to determine the level of students' creative thinking skills using the following formula:

$$\text{Percentage of Creative Thinking Ability} = \frac{\text{accumulated score on each question}}{\text{maximum score}} \times 100$$

The research criteria for students' creative thinking ability obtained on each indicator, interpreted in Table 1.

Table 1. Criteria for Assessing Creative Thinking Ability

Presentage	Interpretation
81% - 100%	Verry good
61% - 80%	good
41% - 6%	sufficient
21% - 40%	deficient
0% - 20%	Severely deficient

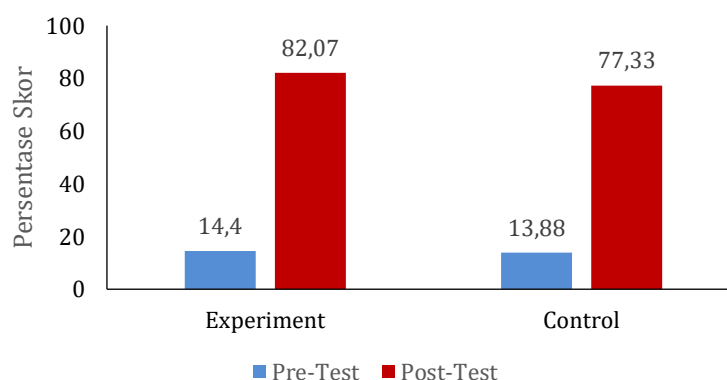
3. Result and Discussion

This study aims to investigate the effect of a causality-based learning model integrated with local wisdom values on senior high school students' creative thinking skills in the topic of sound waves. Employing a quasi-experimental nonequivalent control group design, the experimental class (XI-A, 21 students) implemented the causality-based learning model through four phases: orientation, exploration of causal concepts, argument construction, and evaluation. The control class (XI-C, 20 students) applied a conventional learning model consisting of five phases: stating learning objectives, demonstration, guided practice, checking for understanding, and extended practice. The study was conducted from August 7 to August 28, 2025, over three instructional meetings (80 minutes per meeting). Creative thinking skills were measured using four indicators: fluency, flexibility, originality, and elaboration. The test instrument consisted of five essay questions that had been examined for validity, reliability, discrimination index, and difficulty level, and were deemed adequate for use in both the pre-test and post-test. A summary of the instrument testing results is presented in Table 2.

Table 2. Validity Test, Reliability, Item Discrimination, and Item Difficulty Level

No	Validity		Reliability		Item Discrimination		Item Difficulty Level		Description	
	r_{xy}	r_{tabel}	Description	r_{11}	Description	ID	Description	IDL		Description
1	0,8940	0,374	Validity	0,9423	Reliability	0,68	Good	0,71	Easy	Accepted
2	0,9696		Validity		Reliability	0,58	Good	0,51	Medium	Accepted
3	0,9660		Validity		Reliability	0,55	Good	0,48	Medium	Accepted
4	0,9359		Validity		Reliability	0,53	Good	0,49	Medium	Accepted
5	0,8021		Validity		Reliability	0,43	Good	0,29	Difficult	Accepted

The pre-test was conducted to determine the initial abilities of the students, which showed low results due to the lack of creative thinking skills in answering questions. The average pre-test score for the experimental class was 14.4 (highest score 37.5, lowest score 7.5), while for the control class it was 13.88 (highest score 25, lowest score 5). Based on the homogeneity test, the pre-test data from both classes were homogeneous, indicating equality of initial abilities before treatment. The post-test showed an increase in creative thinking abilities. The average post-test score for the experimental class was 82.07 (highest score 92.5, lowest score 72.5), and for the control class it was 77.33 (highest score 89.5, lowest score 70). Based on the normality test, the post-test data from both classes were normally distributed. The increase in average scores for both classes is shown in the following figure.

**Figure 1.** Increase in the Average Scores of Pre-Test and Post-Test.

The average percentage scores of the post-test on students' creative thinking ability in the experimental class (IBK-1 to IBK-4) were respectively 67%, 59%, 50%, and 43%, while in the control class they were 66%, 58%, 44%, and 41%. The result categories indicate that IBK-1 is categorized as good in both classes, whereas IBK-2, IBK-3, and IBK-4 are categorized as sufficient. Although there was an increase from the pre-test scores, students still experienced difficulties in explaining concepts, principles, theories, and laws of physics. This was caused by the lack of ability to connect concepts and the minimal reading of the provided literature. The improvement in the indicators of creative thinking ability can be seen below.

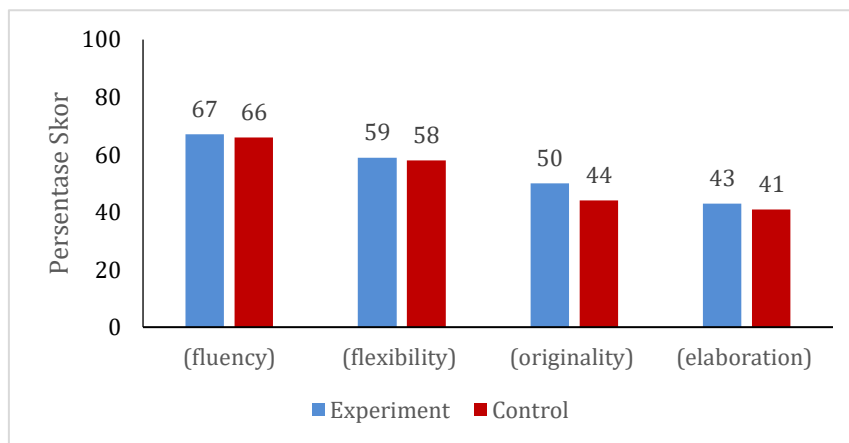


Figure 2 Percentage of Achievement of Creative Thinking Indicators

The research results show that the application of the causalitik learning model integrated with local wisdom values is able to provide a positive influence on students' creative thinking ability. This is evident from the increase in the average post-test scores of the experimental class (82.07), which is higher compared to the control class (77.33). The hypothesis test also strengthens these findings, where the calculated t -value $>$ table t -value, that is $2.19 > 2.023$, thus H_0 is rejected and H_a is accepted. Therefore, it is concluded that the application of the causalitik model integrated with local wisdom values has a positive effect on students' creative thinking ability. The results of the hypothesis test can be seen in Table 3.

Table 3. Results of Hypothesis Testing on Creative Thinking Ability Data

Class	Number of Student	Average	Variance	df	t-calculated	t-table
Experiment	21	82,07	42,23	39	2,19	2,023
Control	20	77,33	52,95			

The findings of this study are consistent with those reported by Anshori et al. (2019), who demonstrated that the causality-based learning model is capable of enhancing students' creativity, as well as by Nurjamilah et al. (2020), who emphasized its role in improving reasoning abilities. In addition, Rohkmat et al. (2024) provided evidence that integrating the causality-based learning model with local wisdom values is effective in enhancing students' physics problem-solving skills. Accordingly, the present study strengthens the evidence that the causality-based learning model contributes to the development of students' creativity and higher-order thinking skills, particularly in improving fluency and flexibility. The higher post-test scores obtained by the experimental group compared to the control group indicate that learning processes emphasizing cause–effect relationships and scientific argumentation provide greater opportunities for students to express ideas and propose alternative solutions.

Nevertheless, the achievement of the originality (ICT-3) and elaboration (ICT-4) indicators remained relatively lower. This limitation can be attributed to students' difficulties in generating genuinely novel ideas and elaborating their ideas in a deep and systematic manner. Students tended to rely on the examples provided and were not yet accustomed to connecting physics concepts with diverse references or prior learning experiences, resulting in underdeveloped abilities to expand and elaborate arguments. The integration of local wisdom values in learning contributed to making the sound wave topic more contextual and meaningful for students. These values assisted students in relating physics concepts to cultural and environmental phenomena in their surroundings, thereby promoting conceptual understanding and thinking fluency. Although the impact was more pronounced on the fluency and flexibility indicators, the integration of local wisdom remains an important foundation for fostering creativity gradually, particularly when implemented consistently and accompanied by strengthened exploratory activities that demand originality of ideas and detailed solution elaboration.

4. Conclusion

Based on the results of the study conducted at SMA Negeri 2 Narmada, through data analysis and hypothesis testing at the 5% significance level, it can be concluded that the implementation of a causality-based learning model integrated with local wisdom values and assisted by *Articulate Storyline* has a significant effect on students' creative thinking skills in the topic of sound waves. This finding is indicated by an increase in the average creative thinking skills scores from the pre-test to the post-test, in which the experimental group achieved a higher mean post-test score than the control group, and is further supported by the results of the t -test showing that the calculated t -value ($t_{\text{calculated}}$) exceeded the critical t -value (t_{table}). Nevertheless, this study has several limitations, including a relatively small sample size, a short treatment duration, and limited generalizability of the findings to other school contexts and subject areas. Practically, the results provide implications for teachers and schools to integrate innovative learning models based on causality, local wisdom values, and digital media in order to create more contextual learning experiences and to promote the development of students' creative thinking skills. Future research is recommended to involve larger samples, longer instructional durations, and to examine the application of this model in other physics topics or different subject areas to obtain more comprehensive findings.

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