

The Effect of Ethnoscience-Based Learning through Kamishibai Media on Creative Thinking Skills of Grade VI Students in Science and Social Studies (IPAS) at Elementary School

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ABSTRACT

Objective: Creative thinking is one of the most essential competencies in 21st-century education, yet its development in elementary school Science and Social Studies (IPAS) remains limited. Conventional instruction in Indonesian elementary schools tends to be text-based and disconnected from students' cultural contexts, resulting in low engagement and underdeveloped higher-order thinking skills. This study examines the effect of ethnoscience-based learning through Kamishibai storytelling media, grounded in Sundanese local culture, on the creative thinking skills of Grade VI elementary school students in West Java. **Method:** A quasi-experimental design with a non-equivalent control group (pretest-posttest) was employed. Participants were 40 Grade VI students ($n = 20$ per group). The experimental group received ethnoscience-based learning integrated with Sundanese Kamishibai media, while the control group received conventional instruction. Creative thinking skills were assessed based on four indicators fluency, flexibility, originality, and elaboration and analyzed using Shapiro-Wilk normality test, independent-sample t-test, N-gain score, and Cohen's d effect size. **Result:** Results showed a significant difference between the experimental group ($M = 59.75$, $SD = 20.16$) and control group ($M = 42.75$, $SD = 20.42$), with $t(38) = 2.649$, $p = 0.012$. The experimental group's N-gain ($g = 0.445$) was significantly higher than the control group ($g = 0.302$, $p = 0.019$), with a large practical effect (Cohen's $d = 0.838$). **Conclusion:** Ethnoscience-based learning through Sundanese Kamishibai media significantly enhances creative thinking skills of Grade VI students in IPAS learning. Teachers are encouraged to adopt this culturally responsive approach as an effective alternative to conventional instruction. **Novelty:** This study is among the first to empirically integrate Sundanese ethnoscience with Kamishibai storytelling media in elementary IPAS learning. The proposed model provides a culturally responsive approach that bridges local wisdom and scientific concepts, enabling students to develop creative thinking through meaningful, context-based learning experiences. This contribution is significant for the implementation of the Merdeka Curriculum because it offers an evidence-based instructional model that operationalizes the Profil Pelajar Pancasila by fostering creativity, critical reasoning, and appreciation of local cultural heritage within IPAS education.

INTRODUCTION

The rapid development of science and technology in the 21st century demands that students possess higher-order thinking skills, particularly creative thinking, as a fundamental competency for solving complex real-world problems (Barus, 2024; Widiastuti & Febriyanto, 2026). Creative thinking, which encompasses fluency, flexibility, originality, and elaboration, is recognized by the World Economic Forum as one of the top skills required for future readiness (WEF, 2020). In the Indonesian educational context, this demand is explicitly embedded in the Merdeka Curriculum (Kurikulum Merdeka) through the Profil Pelajar Pancasila framework, which positions creative reasoning as a core graduate competency for elementary school students in

Phase C (Rahmadayanti & Hartoyo, 2022; Tunas & Pangkey, 2024). Science and Social Studies, known as Ilmu Pengetahuan Alam dan Sosial (IPAS), stands as a newly integrated subject in the Merdeka Curriculum that holds a strategic role in developing students' scientific literacy and creative thinking skills from an early age (Benu & Mbuik, 2024).

Despite this aspiration, field observations in elementary schools in West Java revealed persistent challenges in IPAS learning. Direct classroom observation and teacher interviews indicated that instruction remains heavily text-based and teacher-centered, with limited opportunities for students to engage in exploratory or culturally meaningful activities. Students' IPAS scores were generally low, and initial test results confirmed that creative thinking skills had not been adequately developed. Students tended to be passive, providing conventional answers and showing little capacity for original or flexible thinking. These findings are consistent with broader studies reporting that conventional IPAS instruction in Indonesian elementary schools lacks contextual grounding and fails to connect scientific concepts with students' daily cultural experiences (Marwa et al., 2023; Mazidah & Sartika, 2023). This gap between curriculum aspirations and classroom reality underscores the urgent need for alternative instructional approaches that are both contextually relevant and pedagogically effective.

Ethnoscience-based learning has emerged as a promising approach to address these challenges by integrating local cultural knowledge into science instruction, thereby creating meaningful and contextual learning experiences (Ali et al., 2025; Fahrudin & Saputro, 2023). Ethnoscience positions indigenous knowledge including local practices, wisdom, and traditions as a legitimate bridge between students' everyday experiences and formal scientific concepts (Ardianti & Raida, 2022). In West Java, the rich Sundanese cultural heritage, encompassing traditional food practices, local agriculture, folk wisdom, and environmental stewardship, offers abundant resources for ethnoscience-based IPAS learning. Studies have demonstrated that ethnoscience approaches significantly enhance student engagement, conceptual understanding, and higher-order thinking skills when implemented in elementary science learning (Fitriyah et al., 2025; Ratnasari et al., 2024). Complementing this approach, Kamishibai a Japanese-originated visual storytelling medium using sequential illustrated cards has been recognized as an engaging and participatory instructional media well-suited for elementary learners (Chen & Chen, 2022; Hernawan et al., 2022). Kamishibai stimulates imagination, supports narrative comprehension, and facilitates active meaning-making, making it a suitable vehicle for delivering ethnoscience-based content in culturally resonant ways (Castillo-Rodriguez et al., 2022).

Although previous studies have demonstrated the effectiveness of ethnoscience-based learning in improving students' conceptual understanding and higher-order thinking, several important gaps remain. First, existing studies have primarily investigated ethnoscience and storytelling media separately, leaving limited empirical evidence regarding their integrated implementation in elementary IPAS learning. Second, although Kamishibai has been widely recognized as an engaging storytelling medium, its pedagogical potential as a culturally responsive ethnoscience learning tool has rarely been examined. Third, few studies have investigated how Sundanese local wisdom can function as an epistemological bridge connecting indigenous knowledge with formal science concepts to foster creative thinking within the Merdeka Curriculum. Therefore, this study contributes to the literature by integrating ethnoscience-based

learning with Kamishibai storytelling rooted in Sundanese culture and empirically examining its effectiveness in enhancing Grade VI students' creative thinking skills.

Table 1. Research Gap Analysis of Previous Studies and the Present Study

Authors	Ethnoscience	Kamishibai	Creative Thinking	IPAS	Main Focus
(Rajak et al., 2025a)	✓	✗	✓	✗	Ethnoscience-based STEM learning
(Wanggi et al., 2023)	✓	✗	✓	✓	Ethnoscience integrated with Project-Based Learning
(Nurhayati et al., 2025a)	✗	✓	✗	✗	Kamishibai storytelling media
(Widyana et al., 2024)	✗	✓	✗	✗	Kamishibai for cognitive development
(Yuliyanti et al., 2024)	✓	✓	✓	✓	Integration of ethnoscience and Kamishibai in elementary IPAS learning to improve creative thinking skills

Table 1 demonstrates that previous studies have generally examined ethnoscience and Kamishibai separately. While ethnoscience has been shown to enhance creative thinking and Kamishibai has proven effective as an engaging storytelling medium, empirical studies integrating both approaches within elementary IPAS learning remain limited. Therefore, the present study addresses this gap by integrating Sundanese ethnoscience with Kamishibai storytelling to foster students' creative thinking skills in the context of the Merdeka Curriculum.

This study aims to examine the effect of ethnoscience-based learning through Kamishibai storytelling media on the creative thinking skills of Grade VI students in IPAS learning at an elementary school in West Java, Indonesia. Specifically, it seeks to (1) determine whether creative thinking skills differ significantly between students receiving ethnoscience-based Kamishibai instruction and those receiving conventional instruction, and (2) measure the magnitude of this effect using N-gain scores and effect size analysis. Beyond these objectives, the findings are expected to contribute empirical evidence for developing culturally responsive, contextually grounded instructional strategies in Indonesian elementary IPAS education (Munandar, 2022).

RESEARCH METHOD

This study employed a quasi-experimental design with a non-equivalent control group pretest-posttest structure. The design was selected because the study was conducted in intact elementary school classes, making individual random assignment impractical. It enabled a systematic comparison of students' creative thinking skills before and after different instructional treatments while accounting for baseline performance through pretest measurement. The study involved two intact Grade VI classes at SDN 1 Nagri Kaler, Purwakarta, with 20 students in the experimental group and 20 students in the control group. Participants were selected purposively because the study specifically required Grade VI students with comparable prior academic achievement and access to the Sundanese cultural context. Thus, the inclusion criteria were enrollment in Grade VI at the selected school, membership in one of the two intact classes used for the study, and availability of pretest and posttest data. No individual random assignment was

conducted, and the findings are therefore interpreted within the limits of the quasi-experimental classroom context.

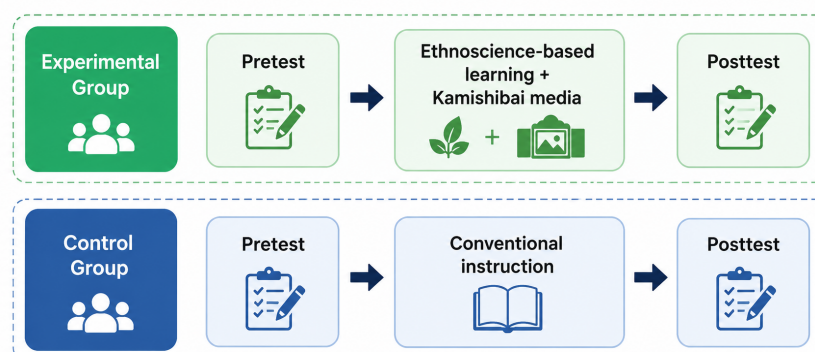


Figure 1. Design Pattern

The participants in this study were 40 Grade VI elementary school students from SDN 1 Nagri Kaler, Purwakarta Regency, West Java, Indonesia, selected through purposive sampling. Purposive sampling was employed because the study required participants at a specific grade level (Grade VI) with comparable prior academic achievement and access to Sundanese cultural context (Sugiyono, 2022). The participants were divided into two intact classes: an experimental group ($n = 20$) and a control group ($n = 20$). The mean age of participants was 11–12 years. Prior to the study, equivalency of the two groups was confirmed through a Mann-Whitney U test on pretest scores, which indicated no statistically significant difference between groups ($p > .05$), supporting the comparability of initial creative thinking skill levels (Field, 2024).

Although the sample size was relatively small, it reflects the natural classroom setting commonly found in Indonesian elementary schools. Since the study employed a quasi-experimental design using intact classrooms, random assignment of students was not feasible. Nevertheless, both classes were comparable in terms of academic background and pretest performance, allowing meaningful comparisons between the experimental and control groups while maintaining ecological validity.

Table 2. Experimental and Control Groups.

Group	n	Treatment	Rade	School
Experimental	20	Ethnoscience-based learning + Kamishibai media	VI-A	SD Negeri 1 Nagri Kaler, Purwakarta
Control	20	Conventional instruction (textbook-based)	VI-B	SD Negeri 1 Nagri Kaler, Purwakarta

This study was conducted in accordance with ethical principles for educational research. Permission to conduct the research was obtained from the principal of SDN 1 Nagri Kaler before data collection. The school informed students and their parents or guardians about the purpose and procedures of the study. Students participated voluntarily after receiving an explanation of the research objectives and procedures. All participant information was anonymized, treated confidentially, and used solely for academic research purposes.

Creative thinking skills were measured using a researcher-developed essay test instrument consisting of 12 items designed to assess four indicators based on Torrance's (1974) model of creative thinking: (1) fluency the ability to generate multiple responses; (2) flexibility the ability to produce varied categories of ideas; (3) originality the capacity

to produce novel and unique ideas; and (4) elaboration the ability to develop and detail ideas. Each indicator was represented by three items with a scoring rubric ranging from 0 to 4 points per item, yielding a maximum total score of 48 points, which was converted to a 0–100 scale

Content validity of the instrument was established through expert judgment by two content specialists in elementary science education and one measurement expert. Construct validity was verified through item analysis using the corrected item-total correlation, with all items yielding $r_{it} \geq .30$ (Azwar, 2021). Instrument reliability was calculated using Cronbach's alpha ($\alpha = .87$), indicating high internal consistency (Tavakol & Dennick, 2011). Prior to the main study, the instrument was piloted with a separate group of 25 Grade VI students from a different class at the same school who were not included in the research sample. The pilot study was conducted to evaluate item clarity, establish the instrument's reliability, and ensure its suitability for measuring students' creative thinking skills before its use in the main data collection.

Table 3. Instrument Characteristics atau Research Instrument Characteristics

Characteristic	Information
Instrument	12-item essay test
Indicators	Fluency, Flexibility, Originality, Elaboration (4 indicators)
Reliability	Cronbach's $\alpha = .87$
Validity	Content and construct validity confirmed

The intervention was implemented over six learning sessions (approximately 3 weeks) within the IPAS subject under Indonesia's Merdeka Curriculum framework at SDN 1 Nagri Kaler (Kemendikbudristek., 2022). The experimental group received ethnosience-based learning delivered through Kamishibai storytelling media rooted in Sundanese local culture. Each session followed a structured four-phase sequence: (1) Cultural exploration (approximately 10 minutes): The teacher began the session by presenting a short narrative or visual prompt based on Sundanese local wisdom, such as traditional rice-terrace farming, indigenous water-management practices, or ecological folklore relevant to the IPAS topic. Students then participated in a guided whole-class discussion to connect these cultural practices with the scientific concepts that would be explored during the lesson; (2) Kamishibai storytelling the teacher presented Kamishibai illustrated card series with students actively predicting, questioning, and elaborating; (3) inquiry-based activity students conducted structured investigations connecting local cultural knowledge to formal scientific concepts; and (4) creative product students produced written responses or visual representations demonstrating creative thinking across the four indicators (Ardianti & Raida, 2022; Hernawan et al., 2022)

The Kamishibai instructional media used in this study consisted of 5 series of illustrated sequential cards under the overarching theme "Bumiku Sayang, Bumiku Malang" (My Beloved Earth, My Suffering Earth), developed by the research team to embed Sundanese ecological and cultural wisdom within the IPAS learning content. The five series were designed to progressively build students' creative thinking from fluency and flexibility in early sessions toward originality and elaboration in later sessions. Each series was validated by two local cultural experts and one IPAS curriculum specialist before use in the classroom (Chen & Chen, 2022).

Table 4. Framework of the Ethnoscience-Based Kamishibai Learning Intervention

Series	Kamishibai Subtheme	Learning Content	Ethnoscience Values
Series 1	Our Earth, Our Home (<i>Fluency</i>)	Earth's layers, environmental components, and the relationship between humans and nature	Philosophy of living in harmony with nature and local wisdom in environmental conservation
Series 2	When the Earth Begins to Suffer (<i>Flexibility</i>)	Water, air, and soil pollution; waste management; environmental changes	Local practices that contribute to or prevent environmental pollution
Series 3	Learning from Nature and Local Culture (<i>Originality</i>)	Environmental conservation and sustainable natural resource management	Local traditions such as <i>gotong royong</i> (mutual cooperation), customary forests, spring preservation, and prohibitions against illegal tree cutting
Series 4	Heroes of Environmental Protection (<i>Elaboration</i>)	Waste management, the 3Rs (Reduce, Reuse, Recycle), and environmentally friendly energy	Utilization of natural materials, recycled crafts, and indigenous simple technologies
Series 5	Taking Action for Earth's Future (<i>Fluency + Elaboration</i>)	Students' roles in protecting the school and home environment	Community-based environmental action projects rooted in local culture

Content validity of the instrument was established through expert judgment by two content specialists in elementary science education and one measurement expert. Construct validity was verified through item analysis using the corrected item-total correlation, with all items yielding $r_{it} \geq .30$ (Azwar, 2021). Instrument reliability was calculated using Cronbach's alpha ($\alpha = .87$), indicating high internal consistency (Tavakol & Dennick, 2011). Prior to the main study, the instrument was piloted with a separate group of 25 Grade VI students from a different class at the same school who were not included in the research sample. The pilot study was conducted to evaluate item clarity, establish the instrument's reliability, and ensure its suitability for measuring students' creative thinking skills before its use in the main data collection. To support scoring consistency, all responses were evaluated using the same predefined 0–4 scoring rubric across the 12 essay items.

The control group received the same IPAS topics through conventional textbook-based instruction and teacher-led lecture without cultural integration or storytelling media. Both groups were taught by the same classroom teachers to minimize instructor bias.

All data were analyzed using IBM SPSS Statistics version 26. Prior to inferential analysis, data normality was verified using the Shapiro-Wilk test, which is recommended for samples of $n \leq 50$ due to its greater statistical power compared to the Kolmogorov-Smirnov test (Field, 2024). Homogeneity of variance was assessed using Levene's test. Since normality assumptions were met ($p > .05$), an independent-sample t-test was conducted to compare posttest scores between the experimental and control groups (Creswell & Creswell, 2017b).

Learning gain was quantified using the normalized gain score (N-gain) formula proposed by Hake (1998): $g = (\text{posttest} - \text{pretest}) / (\text{maximum score} - \text{pretest})$. N-gain values were interpreted as: high ($g \geq 0.70$), medium ($0.30 \leq g < 0.70$), or low ($g < 0.30$) (Hake, 1998; Sundayana, 2022). A further independent-sample t-test was conducted on N-gain scores to determine whether the degree of improvement differed significantly between groups (Fraenkel & Wallen, 1990).

Practical significance was evaluated using Cohen's d effect size, with benchmarks of small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) (Cohen, 1988; Lakens, 2013). The statistical significance threshold was set at $\alpha = .05$ for all inferential tests.



Figure 2. Analysis Pipeline

RESULTS AND DISCUSSION

Results

Descriptive Statistics

Table 1 presents the descriptive statistics of the pretest and posttest scores for both groups, while Figure 3 illustrates the corresponding mean scores with error bars representing ± 1 standard deviation (SD). Prior to the intervention, the experimental group obtained a mean pretest score of 27.50 (SD = 15.09), whereas the control group obtained a mean of 18.00 (SD = 9.23). Following the intervention, the experimental group showed a substantial improvement, achieving a mean posttest score of 59.75 (SD = 20.16), compared with 42.75 (SD = 20.42) for the control group. The mean score gain was 32.25 points for the experimental group and 24.75 points for the control group.

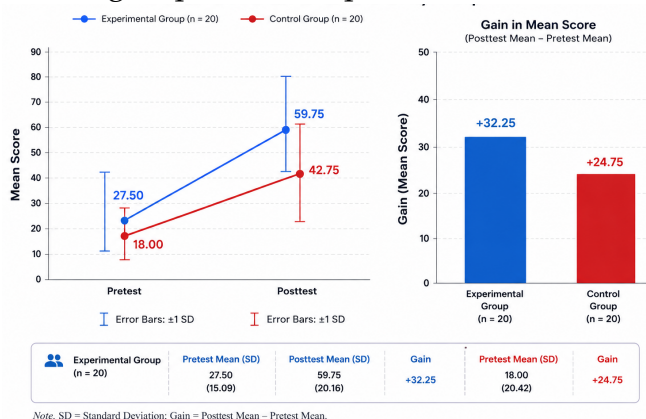


Figure 3. Mean pretest and posttest scores of the experimental and control groups. Error bars represent ± 1 standard deviation (SD)

Figure 3 illustrates the comparison of the pretest and posttest mean scores between the experimental and control groups, together with the average score gains obtained after the learning intervention.

Before the intervention, the experimental group achieved a mean pretest score of 27.50 (SD = 15.09), while the control group obtained a mean pretest score of 18.00 (SD = 9.23). Although the experimental group started with a slightly higher average score, both groups demonstrated relatively low initial levels of creative thinking skills.

Although the experimental group obtained a slightly higher mean pretest score than the control group, both groups demonstrated relatively low initial levels of creative thinking skills prior to the intervention. Therefore, the descriptive results suggest that both groups started from relatively comparable baseline conditions before receiving different instructional treatments.

Following the learning intervention, both groups showed improvements in their posttest performance. The experimental group reached a mean posttest score of 59.75 (SD = 20.16), whereas the control group achieved a mean posttest score of 42.75 (SD = 20.42). This indicates that students who participated in ethnoscience-based learning integrated with Kamishibai media attained higher creative thinking scores than those receiving conventional instruction.

The comparison of score gains further emphasizes the effectiveness of the intervention. The experimental group experienced an average increase of 32.25 points, compared with 24.75 points in the control group. Thus, the experimental group demonstrated an additional improvement of 7.50 points over the control group.

Furthermore, the error bars indicate that the variability of scores in both groups was relatively similar at the posttest stage, suggesting that although students exhibited different levels of achievement, the experimental treatment consistently resulted in higher learning outcomes. Overall, the graphical results provide descriptive evidence that ethnoscience-based learning supported by Kamishibai media was more effective in improving students' creative thinking skills than conventional learning. These descriptive findings are further confirmed by the independent-sample t-test presented in Table 3, which revealed a statistically significant difference between the two groups.

Normality Test

Shapiro-Wilk normality tests were conducted on both pretest and posttest data. Results confirmed that all data were normally distributed. For the pretest, the experimental group yielded $W = .953$, $p = .422$, and the control group $W = .920$, $p = .099$. For the posttest, the experimental group yielded $W = .943$, $p = .276$, and the control group $W = .961$, $p = .569$. Since all significance values exceeded .05, the assumption of normality was satisfied, allowing the use of parametric tests.

Table 5. Shapiro-Wilk Normality Test Results

Data	Group	W	df	p
Pretest	Experimental	.953	20	.422
	Control	.920	20	.099
Posttest	Experimental	.943	20	.276
	Control	.961	20	.569

Table 5 presents the results of the Shapiro-Wilk normality test for the pretest and posttest scores of both the experimental and control groups. The Shapiro-Wilk test was employed

to examine whether the data were normally distributed before conducting the parametric statistical analysis.

The results showed that all significance values (p) exceeded the threshold of .05. Specifically, the pretest scores yielded $p = .422$ for the experimental group and $p = .099$ for the control group. Likewise, the posttest scores produced $p = .276$ for the experimental group and $p = .569$ for the control group. Since all p -values were greater than .05, the null hypothesis of the Shapiro-Wilk test was not rejected, indicating that the score distributions did not significantly deviate from normality.

These findings demonstrate that both the pretest and posttest data for the experimental and control groups were normally distributed. Therefore, the assumption of normality required for parametric statistical analyses was satisfied, allowing the use of the independent-sample t -test to compare students' creative thinking scores between the two groups.

Hypothesis Testing -Posttest

An independent-sample t -test was conducted to compare posttest scores between groups. Results revealed a statistically significant difference, $t(38) = 2.649$, $p = .012$, with a mean difference of 17.00 points (95% CI [4.010, 29.990]). The experimental group significantly outperformed the control group, indicating that ethnoscience-based learning through Kamishibai media had a significant effect on students' creative thinking skills.

Table 6. Independent Sample t -Test Results for Posttest

	<i>T</i>	<i>df</i>	<i>p</i>	Mean Difference	95% CI
Equal variances assumed	2.649	38	.012	17.000	[4.010, 29.990]

Table 6 presents the results of the independent-sample t -test comparing the posttest scores of the experimental and control groups. The assumption of equal variances was met; therefore, the results under the "equal variances assumed" condition were interpreted.

The analysis revealed a statistically significant difference between the two groups, $t(38) = 2.649$, $p = .012$. Since the p -value is less than .05, the null hypothesis was rejected, indicating that students who participated in ethnoscience-based learning using Kamishibai media achieved significantly higher posttest scores than those who received conventional instruction.

The mean difference between the two groups was 17.00 points, suggesting that, on average, the experimental group outperformed the control group by 17 points on the creative thinking posttest. Furthermore, the 95% confidence interval for the mean difference ranged from 4.01 to 29.99. Because this interval does not include zero, it provides additional evidence that the difference between the two groups is statistically significant and unlikely to have occurred by chance.

Overall, these findings demonstrate that the implementation of ethnoscience-based learning integrated with Kamishibai media had a positive effect on students' creative thinking skills, resulting in significantly higher posttest performance than conventional learning.

N-Gain Analysis

Table 4 presents the N-gain distribution for both groups. In the experimental group, 2 students (10%) achieved the high category, 14 students (70%) achieved the medium

category, and 4 students (20%) achieved the low category. In contrast, the control group showed 1 student (5%) in the high category, 10 students (50%) in the medium category, and 9 students (45%) in the low category. The mean N-gain of the experimental group ($g = 0.445$) was higher than that of the control group ($g = 0.302$), with both means falling within the medium category. An independent-sample t-test on N-gain scores confirmed a significant difference between the groups, $t(38) = 2.444$, $p = .019$.

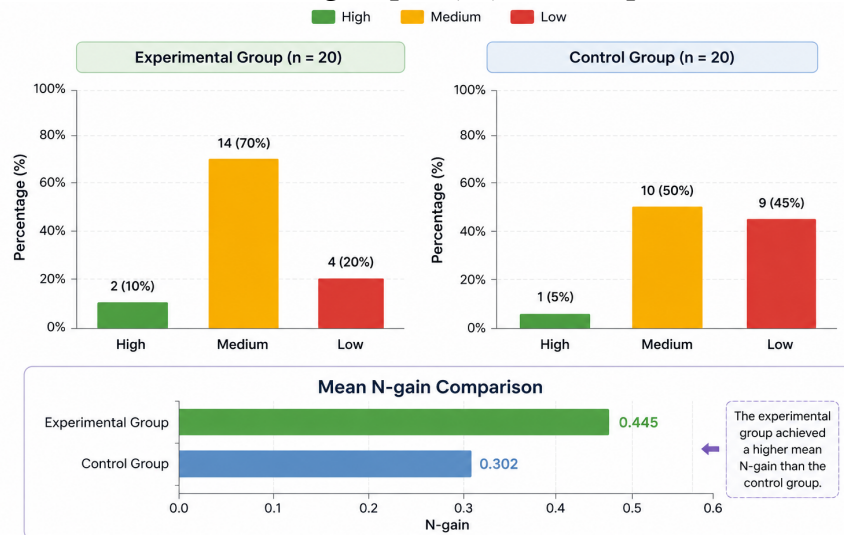


Figure 4. N-Gain Category Distribution and Mean Comparison Between Experimental and Control Group

Figure 4 illustrates the distribution of N-gain categories and the comparison of mean N-gain scores between the experimental and control groups. The results indicate that the experimental group achieved better learning improvement than the control group.

Specifically, 70% of students in the experimental group were classified in the medium N-gain category, compared with 50% of students in the control group. Moreover, the proportion of students achieving the high N-gain category was twice as large in the experimental group (10%) as in the control group (5%). Conversely, the percentage of students in the low N-gain category was considerably lower in the experimental group (20%) than in the control group (45%).

The comparison of the average N-gain scores further supports these findings. The experimental group obtained a mean N-gain of 0.445, whereas the control group achieved a mean N-gain of 0.302. Based on Hake's N-gain classification, both values fall within the medium improvement category; however, the experimental group's score is substantially higher, indicating greater learning gains after the implementation of ethnoscience-based learning integrated with Kamishibai media.

These findings suggest that the intervention not only increased the average learning improvement but also shifted more students from the low category into the medium and high categories. This pattern indicates that the learning approach was effective in promoting students' creative thinking skills more consistently across the class than conventional instruction.

Effect Size

Cohen's d effect size was calculated to determine the practical significance of the treatment. The analysis yielded $d = 0.838$, which falls in the large effect category (Cohen,

1988), indicating that ethnoscience-based learning through Kamishibai media produced not only statistically significant but also practically meaningful improvement in creative thinking skills.

Discussion

The findings of this study demonstrate that ethnoscience-based learning delivered through Kamishibai storytelling media grounded in Sundanese local culture significantly enhances the creative thinking skills of Grade VI elementary school students in IPAS learning. The experimental group outperformed the control group on all measures posttest scores, N-gain, and effect size providing converging evidence for the effectiveness of the intervention.

The significant posttest difference ($t(38) = 2.649$, $p = .012$) indicates that the ethnoscience-based instruction produced higher creative thinking scores than conventional teaching in this study. This finding is consistent with previous research demonstrating that ethnoscience approaches can stimulate higher-order thinking by situating science learning within students' cultural contexts. Studies have shown that ethnoscience-based science learning in STEM contexts can strengthen creative thinking through engagement with local cultural practices, a pattern also evident in the present study, where Sundanese cultural content provided the basis for meaningful inquiry. Rajak et al. (2025b) reported that ethnoscience-integrated instruction significantly improved students' creative thinking skills compared with conventional teaching ($p = .003$), reinforcing the value of culturally grounded learning in stimulating higher-order thinking. Similarly, Wanggi et al. (2023) found that ethnoscience-integrated project-based learning significantly enhanced creative thinking in science at the junior secondary level. These findings suggest that connecting scientific concepts with familiar cultural practices may provide students with meaningful contexts for generating diverse, original, and elaborated ideas.

The role of Kamishibai storytelling media as the instructional vehicle also deserves particular attention. Studies on Kamishibai in elementary education have reported increased student knowledge and engagement, supporting the present finding that the medium can foster active cognitive participation. The sequential illustrated cards require students not only to receive information but also to interpret, predict, and construct meaning from visual narratives. These processes can encourage fluency and flexibility by inviting students to consider multiple possible responses. Kamishibai also provides a structured narrative context in which ethnoscience content can be connected with students' experiences. Nurhayati et al. (2025b) found that Kamishibai storytelling in elementary school settings effectively increased students' cognitive engagement, while Widiana et al. (2024) reported positive effects of Kamishibai-based storytelling on children's cognitive development. In the present study, embedding Sundanese ethnoscience within the narrative sequence further encouraged students to connect cultural knowledge with scientific concepts, potentially supporting originality and elaboration.

The N-gain analysis reinforces these findings. Although both groups fell within the medium N-gain category, the experimental group's mean gain ($g = 0.445$) was significantly higher than that of the control group ($g = 0.302$, $p = .019$). The category distribution also showed a more favorable pattern in the experimental group: 80% of students were in the medium or high categories, compared with 55% in the control group,

while the proportion in the low category was 20% in the experimental group and 45% in the control group. This pattern has practical relevance for classroom teachers because it suggests that the intervention may help reduce the proportion of students showing minimal improvement in creative thinking. The finding is also consistent with research indicating that ethnoscience-integrated instruction can produce practically meaningful gains in creative thinking (Babalola & Keku, 2024).

The large effect size (Cohen's $d = 0.838$) provides further evidence of the practical importance of the observed difference. Following Cohen's (1988) criteria, an effect size above 0.8 is categorized as large, indicating that the difference between the instructional groups was not only statistically significant but also educationally meaningful. In the context of the present study, the result suggests that integrating Sundanese ethnoscience with Kamishibai storytelling can provide a promising classroom strategy for strengthening creative thinking within the Merdeka Curriculum. Nevertheless, the effect size should be interpreted together with the small sample size and single-school setting described in the study limitations.

From a theoretical perspective, these findings align with Vygotsky's (1978) sociocultural theory, which posits that cognitive development, including creative thinking, is facilitated through culturally embedded and socially mediated learning experiences. Ethnoscience-based learning operationalizes this principle by using Sundanese cultural knowledge as a cognitive scaffold, enabling students to build new scientific understanding upon familiar cultural foundations. Supporting this view, Uslan et al. (2024) demonstrated that local wisdom-based science instruction enhanced scientific literacy and creative thinking in elementary students. Kamishibai further strengthens this scaffold by providing a structured narrative sequence that guides students through ethnoscience content in a participatory and visually engaging manner. Thus, the present findings suggest that the combination of culturally relevant content and visual storytelling can create a learning environment that supports active knowledge construction and creative ideation.

Beyond confirming previous findings, this study extends sociocultural learning theory by demonstrating that local cultural knowledge embedded within visual storytelling media can function as a dual cognitive scaffold. Rather than serving merely as contextual examples, ethnoscience and Kamishibai jointly facilitate students' construction of scientific understanding through culturally meaningful interactions. This finding contributes to the growing body of research on culturally responsive science education, particularly within the context of Indonesia's Merdeka Curriculum.

Limitations of this study should be acknowledged. First, the relatively small sample size ($n = 40$) limits the generalizability of the findings beyond the study context. Second, because the study was conducted in a single elementary school in West Java, the findings may be influenced by the local cultural context and should be interpreted with caution when applied to other settings. Third, the study used intact classes and purposive sampling, so the results should not be interpreted as equivalent to those from a randomized controlled trial. Fourth, creative thinking was assessed solely through a written instrument, which may not fully capture students' creative performance in authentic learning situations. Future studies should therefore involve larger and more diverse samples, multiple school settings, and complementary assessment methods, such as performance-based or portfolio assessments, to provide a more comprehensive evaluation of creative thinking.

CONCLUSION

This study demonstrates that ethnoscience-based learning through Kamishibai storytelling media can enhance the creative thinking skills of Grade VI elementary school students in IPAS learning. The experimental group achieved higher posttest scores than the control group ($M = 59.75$ vs. 42.75 ; $t(38) = 2.649$, $p = .012$), while the N-gain was also significantly higher in the experimental group ($g = 0.445$ vs. 0.302 ; $p = .019$). The large effect size (Cohen's $d = 0.838$) further indicates a meaningful difference between the instructional groups. By integrating Sundanese local wisdom with visual storytelling, the learning process provides meaningful cultural contexts that encourage students to generate diverse ideas, explore multiple perspectives, and elaborate scientific explanations.

Beyond the observed improvement in creative thinking, this study contributes to culturally responsive science education by demonstrating how ethnoscience and Kamishibai can function as complementary pedagogical tools within the Merdeka Curriculum. The integration of local cultural knowledge with visual storytelling connects scientific concepts to students' everyday experiences and provides a structured context for active participation. Because the study used a quasi-experimental design in a single school, however, the findings should be understood as evidence from a specific classroom context rather than as a universally generalizable effect.

Practically, elementary school teachers can incorporate relevant local cultural resources and storytelling media into IPAS instruction to create more contextual and meaningful learning experiences. The intervention used in this study suggests several practical considerations: teachers can begin lessons with familiar local practices, use sequential visual narratives to stimulate prediction and questioning, connect cultural knowledge with scientific concepts through inquiry activities, and provide opportunities for students to produce original written or visual responses. These activities can be adapted to the local cultural context and available classroom resources. Curriculum developers and educational policymakers may also consider supporting culturally responsive learning resources that strengthen creative thinking in elementary IPAS education.

Future research should examine the effectiveness of the ethnoscience-based Kamishibai model with larger and more diverse samples, multiple school settings, and longer intervention periods. Further studies may also investigate other twenty-first-century competencies, such as critical thinking, collaboration, and communication, and use complementary assessment methods to capture creative performance more comprehensively.

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