

The Effect of the Brainstorming Method on Creative Thinking Skills in Integrated Natural and Social Sciences (IPAS) Learning Among Grade 6 Students at SDN 1 Weru Lor

¹⁾Defania Sinda Cahyana, ²⁾Fikriyah, ³⁾Fanny Septiany Rahayu, ⁴⁾Norma Bastian

^{1,2,3,4)} Faculty of Teacher Training and Education, Muhammadiyah University of Cirebon

Email : defaniascahya@gmail.com

*Corresponding Author: fikriyah245@gmail.com

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ABSTRACT

Creative thinking skills constitute one of the essential 21st-century competencies that need to be developed from elementary school onward; however, in practice, Integrated Natural and Social Sciences (IPAS) learning remains dominated by the lecture method, which positions students as passive listeners. This study aimed to analyze the effect of the brainstorming method on students' creative thinking skills in IPAS learning among Grade 6 elementary school students. The study employed a quantitative approach with a quasi-experimental nonequivalent control group design. The research participants consisted of 63 Grade 6 students at SDN 1 Weru Lor, divided into a control class of 31 students receiving conventional instruction and an experimental class of 32 students receiving instruction using the brainstorming method. Data were collected using an essay-based creative thinking skills test based on Torrance's four indicators fluency, flexibility, originality, and elaboration administered as a pretest and posttest, as well as teacher and student observation sheets assessing the implementation fidelity of instruction using the brainstorming method. Data analysis included descriptive statistics, the Shapiro-Wilk normality test, Levene's test of homogeneity of variance, the Wilcoxon signed-rank test, N-gain analysis, a normality test for N-gain scores, and the Mann-Whitney U test. The results showed that the mean pretest–posttest score of the control class increased from 59.45 to 65.68, whereas that of the experimental class increased from 63.75 to 83.09. The mean N-gain score of the control class was 16.43% (low category), whereas that of the experimental class was 58.72% (moderate category). The Mann-Whitney U test of N-gain scores yielded a significance value of $0.000 < 0.05$. Thus, there was a significant difference in the improvement of creative thinking skills between students who received instruction using the brainstorming method and those who received conventional instruction. The brainstorming method was shown to be a viable alternative instructional method for improving students' creative thinking skills in IPAS learning at the elementary school level.

Article Information

Kata Kunci:

Brainstorming;
Berpikir kreatif;
IPAS;
Sekolah dasar;
Quasi eksperimen.

ABSTRAK

Keterampilan berpikir kreatif merupakan salah satu kompetensi abad ke-21 yang penting dikembangkan sejak sekolah dasar, namun pembelajaran IPAS di lapangan masih didominasi metode ceramah yang menempatkan siswa sebagai pendengar pasif. Penelitian ini bertujuan menganalisis pengaruh metode brainstorming terhadap keterampilan berpikir kreatif siswa pada pembelajaran IPAS kelas VI sekolah dasar. Penelitian menggunakan pendekatan kuantitatif dengan desain quasi experimental berbentuk nonequivalent control group design. Subjek penelitian terdiri atas 63 siswa kelas VI SDN 1 Weru Lor terbagi menjadi kelas kontrol sebanyak 31 siswa dengan pembelajaran konvensional dan kelas eksperimen sebanyak 32 siswa dengan penerapan metode brainstorming. Pengumpulan data dilakukan melalui tes keterampilan berpikir kreatif berbentuk uraian berdasarkan empat indikator Torrance, yaitu kelancaran, fleksibilitas, orisinalitas, dan elaborasi, yang diberikan dalam bentuk pretest dan posttest, serta didukung lembar observasi guru dan siswa terhadap keterlaksanaan pembelajaran metode brainstorming. Analisis data meliputi statistik deskriptif, uji normalitas Shapiro-Wilk, uji homogenitas Levene, uji Wilcoxon Signed Rank Test, analisis N-gain, uji normalitas terhadap N-gain, dan uji Mann-Whitney U. Hasil penelitian menunjukkan rata-rata skor pretest-posttest kelas kontrol meningkat dari 59,45 menjadi 65,68, sedangkan kelas eksperimen meningkat dari 63,75 menjadi 83,09. Rata-rata N-gain kelas kontrol sebesar 16,43% dengan kategori rendah, sedangkan kelas eksperimen sebesar 58,72 % dengan kategori cukup efektif. Hasil uji Mann-Whitney U terhadap N-Gain memperoleh nilai signifikansi sebesar $0,000 < 0,05$. Dengan demikian, terdapat perbedaan peningkatan keterampilan berpikir kreatif yang signifikan antara siswa yang memperoleh pembelajaran menggunakan metode brainstorming dan siswa yang memperoleh pembelajaran konvensional. Metode brainstorming terbukti dapat menjadi alternatif metode pembelajaran untuk meningkatkan keterampilan berpikir kreatif siswa dalam pembelajaran IPAS di sekolah dasar.

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✉ **Corresponding Author:** (1) Fikriyah, (2) Faculty of Teacher Training and Education, (3) Muhammadiyah University of Cirebon, (4) Jl. Fatahillah No. 40, Watubelah, Sumber District, Cirebon Regency, 45611, Indonesia, (5) Email: fikriyah245@gmail.com

1. Introduction

Creative thinking skills are among the essential abilities that need to be developed in 21st-century education (OECD, 2018). These skills enable students to generate diverse ideas, view problems from multiple perspectives, and identify appropriate solutions to the problems they encounter, as reflected in the four indicators of creative thinking proposed by Torrance (1974): fluency, flexibility, originality, and elaboration. In learning, creative thinking skills involve not only the ability to generate ideas but also the ability to develop, evaluate, and refine those ideas so that they can become meaningful solutions (Wulandari et al., 2019).

In the elementary school context, creative thinking skills need to be developed through instruction that provides students with opportunities to actively explore ideas. This is consistent with the view of Fikriyah et. al. (2025), who identified instructional approaches as an important component in supporting the development of students' critical and creative thinking skills.

Integrated Natural and Social Sciences (IPAS) learning has considerable potential to develop creative thinking skills because the material studied relates to natural and social phenomena encountered in everyday life. IPAS learning not only requires students to understand facts and concepts but also encourages them to connect knowledge with problems in their surrounding environment.

However, Based on initial observations in Grade 6 at SDN 1 Weru Lor and interviews with subject teachers in Class 6C, it was revealed that the teaching methods used still rely heavily on lectures and summarization activities. In fact, project-based assignments had only been conducted once, and even then, only in social studies. The homeroom teacher noted that most students' scores in IPAS were still below the Minimum Proficiency Criteria (MPC), or below a score of 75.

This situation contributed to low student participation. Furthermore, students also appear to lack confidence when expressing their opinions and have not had sufficient opportunities to develop various ideas for solving problems. This condition is consistent with the literature review by Aji et al. (2024), which indicated that many Indonesian student creative thinking skill are not sufficiently trained in classroom learning.

One method that can be used to provide students with opportunities to express ideas is the

brainstorming method. Brainstorming is a teaching technique that allows students to express various ideas freely without fear of being wrong (Roestiyah, 2008). During its implementation, emerging ideas can be collected, classified, verified, and then used to formulate conclusions or solutions to the problems presented.

The use of brainstorming is relevant to the characteristics of creative thinking skills because students are encouraged to generate as many ideas as possible before selecting and developing them. In this study, the implementation of brainstorming was also supported by the use of sticky notes as a medium for recording and organizing students' ideas.

Previous studies have also indicated that brainstorming is associated with improvements in creative thinking skills. For example, the study by Rahmi and Amal (2023) showed that implementing brainstorming with elementary school students resulted in better creative thinking skills outcomes than traditional instruction. Another study of brainstorming in IPAS learning also showed an increase in creative thinking skills scores following implementation of the method, as reported by Oktavia and Anwar (2024).

Based on these issues, this study aims to determine the effect of the brainstorming method on improving students' creative thinking skills in Grade 6 Integrated Natural and Social Sciences (IPAS) learning at SDN 1 Weru Lor.

2. Research Methods

This study used a quantitative approach with a quasi-experimental nonequivalent control group design. This design was selected because the research participants comprised naturally formed classes, making individual randomization infeasible. The control group received conventional instruction, whereas the experimental group received the brainstorming method. Both groups completed identical pretests and posttests to measure changes in creative thinking skills.

Tabel 2.1. Nonequivalent Control Group Design

Class	O1	X	O2
VI-B (Control Class)	Pretest	Treatment (Conventional Instruction)	Posttest
VI-C (Experim ental)	Pretest	Treatment (Brainstormin	Posttest

Class)		g)	
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The participants in this study consisted of 63 sixth-grade students at SDN 1 Weru Lor, including 31 students in Class VI-B as the control group and 32 students in Class VI-C as the experimental group. The sampling technique used was total sampling (saturated sampling), in which all sixth-grade students at the school were included as study participants. Class VI-C was selected as the experimental class because, during the researcher's community service activities at the school, the researcher frequently taught this class and observed that the students generally demonstrated a strong interest in learning, particularly in the subjects of Natural Sciences and Social Studies. However, most students in Class VI-C also reported feeling bored because the learning process was primarily conducted through lectures and summarizing material. Therefore, the brainstorming method was implemented in this class as an alternative learning approach to encourage active participation and foster students' creative thinking skills. The learning material used was Chapter 7 of the Science and Social Studies textbook, "Caring for the Earth," specifically the topic regarding the impact of human activities on the natural environment.

The primary research instrument was a written essay-based test developed based on Torrance's (1974) four indicators of creative thinking: fluency, flexibility, originality, and elaboration. The pilot test involved 30 students at Ciwiru Public Elementary School; the initial instrument consisted of 12 items. The validity test results showed that 11 of the 12 items were valid at a 5% significance level, with calculated r values ranging from 0.424 to 0.773. A reliability test using *Cronbach's alpha* for the 11 items yielded a coefficient of 0.845. The difficulty-level test indicated that all 11 items were in the moderate category, with difficulty indices ranging from 0.433 to 0.567. The discrimination-index test showed categories ranging from poor to good, with the highest value for item 12 at $D = 0.438$.

This study was conducted at SDN 1 Weru Lor on May 16 and 18, 2026. In the first session, both the control class and the experimental class took a pretest to measure the students' initial creative thinking abilities. The experimental class received instruction using the brainstorming method. After the pretest, the experimental group received instruction using the brainstorming method combined with sticky notes during the idea classification stage, while the control group received instruction using lectures and

question-and-answer sessions. The posttest was administered after all learning sessions were completed, using the same procedures and duration as the pretest.

Data analysis began with descriptive statistics to obtain the minimum, maximum, mean, and standard deviation values. Normality was assessed using the Shapiro-Wilk test, with data considered normally distributed when the significance value (Sig.) was greater than 0.05. Homogeneity of variance was assessed using Levene's test across four sets of scores, namely the pretest and posttest scores of the control and experimental classes. Based on the mean, Levene's test yielded a statistic of 2.442 with $df1 = 3$ and $df2 = 122$ and a significance value of 0.067. Since the significance value was greater than 0.05, the variances were considered homogeneous. Because the normality assumption was not met for some datasets, differences between pretest and posttest scores within each group were analyzed using the Wilcoxon signed-rank test. Improvement in students' creative thinking skills was quantified using N-gain analysis, and differences in N-gain scores between the control and experimental classes were analyzed using the Mann-Whitney U test. All statistical analyses were conducted using IBM SPSS Statistics version 25.

The improvement in creative thinking skills was calculated using the normalized gain (N-gain) formula: $g = (\text{posttest score} - \text{pretest score}) / (\text{maximum score} - \text{pretest score})$ (Hake, 1998). N-gain values were categorized as low ($g < 0.30$), moderate ($0.30 \leq g \leq 0.70$), and high ($g > 0.70$) and are reported as percentages. Pretest and posttest scores between the two groups were compared using the Mann-Whitney U test, and N-gain scores were tested for normality using the Shapiro-Wilk test and compared using the Mann-Whitney U test when the normality assumption was not met. The hypotheses were as follows: H_0 , there is no significant difference in the improvement of creative thinking skills between students taught using the brainstorming method and those taught using conventional instruction; H_a , there is a significant difference in the improvement of creative thinking skills between the two groups. H_0 was rejected when the Asymp. Sig. (2-tailed) value was < 0.05 .

3. Results

Descriptive Analysis

The descriptive statistics results indicated score improvements in both groups, with a greater increase in the experimental class. The control class mean

increased from 59.45 on the pretest to 65.68 on the posttest, representing an increase of 6.23 points, while the experimental class mean increased from 63.75 to 83.09, representing an increase of 19.34 points. Based on the score-interpretation criteria, the pretest means of both classes (59.45 and 63.75) fell into the moderately creative category (56–65). The control class posttest mean of 65.68 also remained in the moderately creative category, whereas the experimental class posttest mean of 83.09 fell into the very creative category (80–100). In the control class, the number of students who achieved the minimum mastery criterion (MMC) of 75 increased from 2 students (6.45%) on the pretest to 8 students (25.81%) on the posttest.

Table 3.1. Descriptive Statistics Results

Class	N	Min	Max	Mean	SD
Control Pretest	31	52	72	59.45	4.703
Control Posttest	31	58	82	65.68	6.183
Experimental Pretest	32	50	82	63.75	8.572
Experimental Posttest	32	62	96	83.09	8.924
Valid N	31				

Brainstorming Implementation Observation Results

The observation results indicated that the implementation of the brainstorming method was effective. Student activities received 75%, and were categorized as fairly effective, whereas teacher activities received 80%, and were categorized as effective. The highest level of student achievement was observed during the identification stage, in which students actively expressed their ideas without fear of making mistakes. In contrast, the conclusion stage received the lowest score, indicating that students still experienced difficulties in jointly formulating conclusions. The observation results suggest that the brainstorming method was implemented effectively, although some aspects of student participation, particularly during the conclusion stage, still required improvement.

Table 3.2. Results of Observations of Students and Teacher Activities in the Brainstorming Method

Brainstorming Stage	Student % (Category)	Teacher % (Category)
Providing Information and	72%(Fairly Effective)	80 % (Effective)
Identification	85 % (Effective)	90 % (Very Effective)
Classification	75 (Fairly Effective)	78 % (Fairly Effective)
Verification	73 % (Fairly Effective)	74%(Fairly Effective)
Conclusion	70 % (Fairly Effective)	72 % (Fairly Effective)
Overall	75 % (Fairly Effective)	80% (Effective)

The learning implementation was observed by a peer observer.

Shapiro-Wilk Normality Test

Table 3.3. Shapiro-Wilk Normality Test Results

Data	Shapiro–Wilk			
	W	df	Sig.	Remarks
Control pretest	.903	31	.009	Not normally distributed
Control posttest	.903	31	.008	Not normally distributed
Experimental pretest	.926	32	.030	Not normally distributed
Experimental posttest	.961	32	.291	Normally distributed

Based on the data presented in the table above, three of the four data sets (control pretest, control posttest, and experimental pretest) had significance values < 0.05; therefore, not all data were normally distributed, and differences were tested using a nonparametric statistical approach.

Levene's Test of Homogeneity of Variance

Table 3.4. Results of Levene's Test of Homogeneity of Variance

Test Basis	Levene Statistic	df1	df2	Sig.
Based on mean	2.442	3	122	0.067
Based on median	2.167	3	122	0.095
Median adjusted df	2.167	3	108.645	0.096
Based on trimmed mean	2.424	3	122	0.069

Based on the data presented in the table above, all significance values in Levene's test are greater than 0.05. Levene's test indicates that the variances of the four groups are homogeneous (Levene's statistic = 2.442, df1 = 3, df2 = 122, Sig. = 0.067 > 0.05). Therefore, the assumption of homogeneity is met.

Hypothesis Testing

Because the normality test results indicated that the data were not normally distributed, nonparametric tests, including the Wilcoxon signed-rank test and Mann-Whitney U test, were conducted. The results are presented below:

Table 3.5. Wilcoxon Signed-Rank Test Results

Comparison	Z	Sig. (2-tailed)
Control Posttest–Control Pretest	-4.874	<0.001
Experimental Posttest–Experimental Pretest	-4.942	<0.001

Based on the data in the table above, the significance value for both groups was $0.000 < 0.05$. Thus, there was a significant difference between the pretest and posttest scores in the control and experimental groups. Both groups improved; however, the magnitude of improvement needs to be compared using N-gain analysis.

Tabel 3.6. Mann-Whitney U Test Results

Group	Sig. (2-tailed) Results
Mann-Whitney U Test: Control–Experimental Pretest	0.020
Mann-Whitney U Test: Control–Experimental Posttest	<0.001

Based on the data in the table above, the significance value for the control–experimental

pretest Mann-Whitney U test was 0.020, indicating a significant difference in the pretest scores of the two groups. This finding indicates that the initial abilities of the two groups were not fully equivalent, which is a characteristic that may occur in a nonequivalent control group design.

The significance value for the control–experimental posttest data was $0.000 < 0.05$, indicating a significant difference in posttest scores between the control and experimental groups. The experimental class mean posttest score of 83.09 was higher than that of the control class, which was 65.68.

N-Gain Analysis

Table 3.7. Mean N-Gain Results

Group	Mean N-Gain	Category
Control	16.43%	Low
Experimental	58.72%	Moderate

Based on the results in the table above, the experimental group had a mean N-gain of 58.72%, which was higher than that of the control group (16.43%) according to Hake's (1998) N-gain interpretation criteria. The improvement in the control group was categorized as low, whereas that in the experimental group was categorized as moderate.

Normality Test for N-Gain Scores

Table 3.8. Results of the Normality Test for N-Gain Scores

Group	Shapiro–Wilk			
	W	df	Sig.	Description
Control	.836	31	<0.001	Not normal
Experimental	.935	32	0.365	Normal

Based on the results in the table above, the N-gain scores of the control group were not normally distributed. Because not all groups met the assumption of normality, N-gain scores were compared using the Mann-Whitney U test.

Tabel 3.9 Mann-Whitney U Test Results for N-Gain Scores

Statistic	Value
Mann-Whitney U	50.500
Wilcoxon W	546.500
Z	-6.126
Asymp. Sig. (2-tailed)	<0.001

Based on these results, the significance value was $0.000 < 0.05$; therefore, H_0 was rejected and H_a was accepted. Thus, there was a significant difference in the improvement of creative thinking skills between students who received instruction using the brainstorming method and those who received conventional instruction ($U = 50.500$, $Z = -6.126$, $p < 0.001$).

4. Discussion

Achievement of Creative Thinking Skills Among Students in the Control Class

The results for the control class showed a relatively limited improvement in creative thinking skills, with the mean score increasing from 59.45 on the pretest to 65.68 on the posttest (an increase of 6.23 points). Although the Wilcoxon signed-rank test indicated a statistically significant difference ($\text{Sig.} = 0.000$), the practical magnitude of this improvement was small, as confirmed by the control class's mean N-gain of only 16.43% (low category). The low proportion of students meeting the minimum mastery criterion in this class (only 25.81% of students achieved mastery after instruction) suggests that lecture-based conventional instruction may not have provided sufficient opportunities for students to practice creative thinking indicators such as fluency, flexibility, originality, and elaboration.

This finding is consistent with the results of Oktavia and Anar (2024) at SDN Maleber, who also found that the control class taught using conventional instruction obtained substantially lower scores (mean 68.86) than the experimental class (mean 84.73). Similarly, Rahmi and Amal (2023) at SD Inpres Bontamanai reported that the control class taught using traditional methods reached only the “less active” category (57.12%). This pattern suggests that one-way instruction is less optimal for stimulating higher-order thinking skills among elementary school students, as also emphasized by Fikriyah et al. (2025), who stated that passive learning approaches with minimal student involvement tend to be less effective in fostering critical and creative thinking simultaneously.

Achievement of Creative Thinking Skills Among Students in the Experimental Class

In contrast to the control class, the experimental class that implemented the brainstorming method

showed a substantially greater improvement, with the mean score increasing from 63.75 on the pretest to 83.09 on the posttest (an increase of 19.34 points, or 30.34%); the Wilcoxon test result was also significant ($\text{Sig.} = < 0.001$). This achievement was supported by the effective implementation fidelity of the brainstorming method, in terms of both student activity (75 %, effective category) and teacher (80% very effective category). The highest achievement occurred during the idea-identification stage, when students felt free to express ideas without fear of criticism.

These results are consistent with several previous studies. Oktavia and Anwar (2024) found that experimental posttest scores far exceeded those of the control class after brainstorming was implemented in Integrated Natural and Social Sciences (IPAS) learning. Lerang et al. (2025) SDN 6 Sailus also reported an increase of 19.85 points from the pretest to the posttest, a figure nearly identical to that of the present study (19.34 points), which suggests comparable effects of the brainstorming method in elementary school science and IPAS learning contexts. At the international level, these findings are also consistent with the study by Al-Mutairi (2015) in Kuwait, which demonstrated a significant advantage for the experimental group in creative problem-solving skills, and with Aiamy and Haghani (2012), who showed that the brainstorming method was more efficient than traditional teaching in developing the creative thinking of Grade 3 students. This consistency across educational levels and cultural contexts suggest that brainstorming is a promising method for stimulating students creative thinking.

A distinctive feature of this study compared with previous research is the use of sticky notes during the idea-classification stage, which created a more enjoyable learning environment and supported active student engagement. This element was not reported in the previous brainstorming studies reviewed here, such as those by Rahmi and Amal (2023) and Al-Mutairi (2015).

Effect of the Brainstorming Method on Improvements in Creative Thinking Skills

The comparison of N-gain scores showed a clear difference between the control group (16.43%, low category) and the experimental group (58.72%, moderate category). Because the N-gain data were not entirely normally distributed (Shapiro–Wilk test),

the analysis proceeded with the nonparametric Mann–Whitney U test, which yielded an *Asymp. Sig.* (2-tailed) value of 0.000, less than 0.05, indicating a statistically significant difference in improvement between the two groups.

These findings reinforce the conclusions of various relevant studies described previously, indicating that the brainstorming method has a significant effect on improving students' creative thinking skills in both national (Oktavia & Anwar, 2024; Rahmi & Amal, 2023; Laerang et al., (2025) and international contexts (Al-Mutairi, 2015; Aiamy & Haghani, 2012). They are consistent with the brainstorming method can simultaneously improve students' critical and creative thinking abilities. Thus, it can be concluded that implementing the brainstorming method at SDN 1 Weru Lor is not only statistically effective but also consistent with trends in the broader educational literature: instructional methods that promote active participation and freedom of expression are likely to be more beneficial than conventional instruction in fostering elementary school students' creative thinking skills.

This study has several limitations. First, the two classes were not equivalent at the start of the study, as indicated by the significant pretest difference, so the results should be interpreted with caution. Second, the study was conducted in one school with a single IPAS topic and a short intervention period. Third, the effect of sticky notes could not be separated from the effect of the brainstorming method itself.

5. Conclusion

This study aimed to determine the effect of the brainstorming method on improving the creative thinking skills of Grade 6 students in Integrated Natural and Social Sciences (IPAS) learning at SDN 1 Weru Lor. The results showed that the control class, which received conventional instruction, experienced a relatively limited increase from a mean pretest score of 59.45 to 65.68 on the posttest, with a mean N-gain of 16.43% (low category). In contrast, the experimental class, which received instruction using the brainstorming method, experienced a substantially greater increase from a mean pretest score of 63.75 to 83.09 on the posttest, with a mean N-gain of 58.72% (moderate category).

The Mann–Whitney U test results for the N-gain data showed an Asymp. Sig. (2-tailed) value of 0.000

(< 0.05), indicating a statistically significant difference in the improvement of creative thinking skills between the control class and the experimental class. Thus, it can be concluded that the brainstorming method has a significant effect on improving students' creative thinking skills in Integrated Natural and Social Sciences (IPAS) learning at SDN 1 Weru Lor. These results are consistent with findings from previous studies in both national (Oktavia & Anwar, 2024; Rahmi & Amal, 2023; Laerang et al., 2025) and international contexts (Al-Mutairi, 2015; Aiamy & Haghani, 2012), as well as with the view of Fikriyah et al. (2025) regarding the importance of active learning approaches in fostering students' critical and creative thinking abilities.

Based on these conclusions, the brainstorming method combined with sticky-note media can be recommended as an alternative strategy for Integrated Natural and Social Sciences (IPAS) learning in elementary schools to improve students' creative thinking skills. Future studies are recommended to examine the effectiveness of this method with other IPAS topics, at different grade levels, or in combination with other active learning models, and to analyze each creative thinking indicator separately.

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