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Impact of secret number ice-breaking on elementary students' Mathematics performance

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ABSTRACT
This study explores the effect of the *ice-breaking secret number* technique on mathematics learning outcomes among fifth-grade students at SDN Cilangkap 01 Pagi. The research was conducted in response to students' low motivation and poor performance in mathematics, often caused by monotonous teaching methods. The objective is to examine whether this interactive approach improves learning outcomes. The study used a quasi-experimental design with a pretest-posttest control group. The sample consisted of 60 students divided into experimental and control groups. The experimental class received instruction using the *ice-breaking secret number* technique, while the control class followed conventional teaching. Data were collected through tests and questionnaires, and analyzed using t-tests and effect size calculations. Results showed a significant improvement in the experimental group's post-test scores and enhanced student engagement, as indicated by questionnaire responses. The findings indicate that the *ice-breaking secret number* technique positively influences student performance and motivation in mathematics. This method can serve as an effective alternative for primary school teachers to create a more dynamic and participatory learning environment.

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ABSTRAK
Penelitian ini mengeksplorasi pengaruh teknik ice-breaking secret number terhadap hasil belajar Matematika murid kelas 5 SDN Cilangkap 01 Pagi. Penelitian ini dilakukan sebagai tanggapan atas rendahnya motivasi dan prestasi murid dalam pelajaran Matematika yang sering kali disebabkan oleh metode pengajaran yang monoton. Tujuannya untuk menguji apakah pendekatan interaktif ini dapat meningkatkan hasil belajar. Penelitian ini menggunakan metode kuasi-eksperimen dengan desain kelompok kontrol pretest-posttest. Sampel terdiri dari 60 murid yang dibagi menjadi kelompok eksperimen dan kelompok kontrol. Kelas eksperimen menerima pengajaran dengan menggunakan teknik ice-breaking secret number, sedangkan kelas kontrol mengikuti pengajaran konvensional. Data dikumpulkan melalui tes dan kuesioner, dan dianalisis menggunakan uji-t dan perhitungan effect size. Hasil penelitian menunjukkan adanya peningkatan yang signifikan pada nilai post-test kelompok eksperimen dan peningkatan keterlibatan murid berdasarkan tanggapan kuesioner. Temuan ini menunjukkan bahwa teknik ice-breaking secret number berpengaruh positif terhadap kinerja dan motivasi murid dalam Matematika. Metode ini dapat menjadi alternatif yang efektif bagi guru sekolah dasar untuk menciptakan lingkungan belajar yang lebih dinamis dan partisipatif.
Kata Kunci: *ice-breaking; hasil belajar Matematika; murid sekolah dasar*

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INTRODUCTION

Mathematics learning in elementary schools plays an important role in developing students' logical, analytical thinking, and problem-solving abilities (Abdurohim et al., 2025; Ilindia et al., 2023; Siregar & Siregar, 2025). However, an internal survey at SDN Cilangkap 01 Pagi showed that many fifth-grade students find this subject difficult and boring because teachers still predominantly use lecture methods. As a result, learning motivation is low and daily evaluation results are below the Minimum Competency Criteria (KKM) (Dzattadini et al., 2025). Similar conditions have been reported across various regions, indicating the need for innovative approaches that bridge abstract Mathematical concepts with enjoyable activities (Afroni, 2019; Nindiawati et al., 2021; Pujiarti, 2022; Sudarsih, 2021). Previous research confirms the benefits of interactive learning strategies in improving student learning outcomes.

Research proves that common ice-breaking techniques improve students' Mathematics scores (Pujiarti, 2022). Meanwhile, other studies report a surge in engagement and scores after ice-breaking games in elementary schools (Alfiyatin, 2023). At the Madrasah Ibtidaiyah level, research shows that cooperative models with inserted game activities can significantly increase posttest averages (Sudarsih, 2021). Although studies consistently indicate positive effects, the majority use generic icebreakers that lack embedded numerical content, so the transfer of mathematical concepts has not been specifically measured (Setiawan & Airlanda, 2023). In addition, research that explicitly focuses on secret number games, namely number-guessing based on concept challenges, is still limited, especially on geometry topics in fifth grade. (Solehah, 2024; Subhaktiyasa et al., 2024).

Starting from the research gap on the effect of the secret number ice-breaking technique on the Mathematics learning outcomes of 5th-grade students, this article offers scientific novelty by applying the secret number ice-breaking technique, which directly integrates number puzzles with the topic of area of flat shapes. This technique is designed to stimulate curiosity, collaboration, and conceptual reflection through a series of "secret numbers" that can only be solved if students understand geometric formulas and procedures. This approach is expected not only to lighten the atmosphere but also to serve as a quick diagnostic tool for students' initial understanding (Usoh et al., 2024).

The research problem is formulated as follows: 1) Is there a positive and significant effect of using the ice-breaking secret number on the Mathematics learning outcomes of fifth-grade students at SDN Cilangkap 01 Pagi? Operationally, the proposed hypothesis is H_1: the implementation of the ice-breaking secret number significantly improves Mathematics learning outcomes compared to conventional methods. The purpose of this study is to analyze the effectiveness of the ice-breaking secret number in improving Mathematics learning outcomes in plane geometry for fifth-grade students. The research is expected to enrich the collection of interactive learning strategies based on numerical games in elementary education.

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LITERATURE REVIEW

Learning Outcomes

Learning outcomes are changes in behavior that encompass the cognitive, affective, and psychomotor domains as a result of the learning process (Rostiana & Wahyudin, 2025). Learning outcomes reflect conceptual understanding, critical thinking skills, and the ability to apply knowledge in real situations (Wisman et al., 2021). Evaluation of learning outcomes is generally carried out through test score measurements and observation of student learning activities. Factors that influence learning outcomes include learning motivation, learning methods, environment, and individual learning styles (Rostiana & Wahyudin, 2025). An interactive learning environment that is socially and culturally relevant has been proven to better support students' cognitive development. This is because a conducive and comfortable learning environment can foster students' learning motivation (Sya'ro & Dewi, 2022).

Ice-Breaking Secret Number

Ice-breaking secret number is an opening game technique that combines number-guessing activities with the insertion of lesson materials. Educationally designed ice-breaking can improve students' focus and engagement (Khodijah, 2023; Oktafiami et al., 2025). In the context of Mathematics learning, a secret number is used as a puzzle-based game, in which students must solve clues based on conceptual understanding, such as arithmetic operations or geometry (Umaningsih et al., 2024). In addition to fostering a fun learning atmosphere, this method also serves as an early diagnostic tool to assess students' learning readiness. Ice-breaking techniques have also been shown to increase students' intrinsic motivation in difficult subjects (Nurdin & Mujahidah, 2023).

Several previous studies have shown that the use of ice-breaking techniques in learning can improve students' learning outcomes. The application of ice-breaking techniques in Mathematics learning has a significant effect on learning outcomes (Pujiarti, 2022; Sudarsih, 2021). This is evidenced by the increase in posttest scores after treatment with ice-breaking techniques. Ice-breaking games also encourage enthusiasm for learning, maintain concentration, and improve students' understanding (Alfiyatin, 2023).

Students' learning outcomes should include mastery in the cognitive, affective, and psychomotor domains, so every learning strategy should be designed not only to facilitate understanding of the material but also to stimulate learning motivation. (Wisman et al., 2021). In line with this, other research indicates that the implementation of the ice-breaking secret number can function as a medium for early diagnosis of concept understanding as well as warming up the atmosphere, which has a positive impact on improving posttest scores and students' learning motivation (Habsah & Hamid, 2020; Usoh et al., 2024; Yuda & Hatibe, 2021). These studies reinforce the belief that a learning approach based on enjoyable activities can positively impact students' academic achievement, especially in Mathematics.

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Mathematics in Elementary School

Mathematics learning in elementary school includes introducing number concepts, arithmetic operations, and basic geometry. These concepts must be delivered in a contextually appropriate manner to match children's cognitive development (Alvionita et al., 2025; Nengsih, 2023). Meanwhile, math learning anxiety becomes a factor that must be addressed through a more supportive, non-pressuring approach (Anggoro et al., 2024). An approach that links the material to everyday play activities has been shown to be more effective at increasing student engagement in learning, thereby positively impacting learning outcomes (Wijayanti & Yanto, 2023). The use of visual teaching materials and interactive media also supports learning outcomes, especially for students with learning difficulties or those who have visual-kinesthetic learning styles (Chayumi, 2021). This is because interactive learning media can increase students' interest and motivation in the learning process. (Saputra et al., 2025).

METHODS

This study used a quantitative, quasi-experimental, pretest-posttest control-group design to measure the impact of treatment on certain variables in classroom conditions that do not allow full random assignment. This design involved two groups: an experimental group that received treatment through the ice-breaking secret number technique, and a control group that received conventional learning. The study was conducted at SDN Cilangkap 01 Pagi, East Jakarta, from October to May. The research subjects were 60 fifth-grade students, divided into two groups of 30 each: the experimental group (n=30) and the control group (n=30). The sampling technique used was total sampling because the population was fewer than 100 students. Class V-B was designated as the control group, and V-C as the experimental group, based on equal basic skills as determined by previous scores.

The research procedure consists of three stages. First, the planning stage, which includes preparing learning materials (Syllabus, Lesson Plan), validating test instruments, and obtaining permission from the school. Second, the implementation stage, which involves administering a pretest, conducting learning with and without treatment, and a posttest. The experimental group follows Mathematics instruction on the area of plane figures, with the secret number game inserted at the beginning and end of the session. The game is adjusted to the learning indicators and directly linked to the material (for example, guessing numbers based on the area of certain plane figures). The control group learns through lectures and exercises without the game. Third, the data analysis stage involved processing the results of the pretest, posttest, and student questionnaires. The analysis process included testing the validity and reliability of the instruments, performing prerequisite checks (normality and homogeneity tests), and applying an independent t-test to compare the average learning outcomes between the experimental and control groups. In addition, the level of treatment effectiveness was calculated using Effect Size (Cohen's d) to determine the extent to which the secret number game influenced students' Mathematics learning outcomes.

Quantitative data were collected from pretest and posttest scores and from students' perception questionnaires regarding the learning process. All instruments underwent validity and reliability testing

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using SPSS version 25. Item validity was tested using the Pearson Product-Moment correlation with r count ≥ r table (N = 30, α = 0.05), and reliability was tested using Cronbach's Alpha, with results of α > 0.799 for the posttest and 0.800 for the questionnaire, indicating high internal consistency. Data were analyzed using an independent t-test to compare posttest means between the experimental and control groups, after passing normality (Shapiro-Wilk) and homogeneity (Levene's Test) prerequisite tests. The effectiveness of the treatment was calculated using Effect Size (Cohen's d), with d ≥ 0.8 interpreted as a large effect. Each stage of the analysis is carried out sequentially and systematically to test the hypothesis objectively and to measure the extent of the treatment's impact on students' Mathematics learning outcomes.

RESULTS AND DISCUSSION

Results

Descriptive Analysis

Descriptive analysis is a research activity that aims to analyze previously collected data. Then, the data were processed, and the results were presented, describing the data from the experimental and control classes that had been calculated using SPSS. Meanwhile, in the experimental class, the data before treatment (Pretest) showed a lowest score of 6 and a highest score of 58. From a sample of 30 students, the average (mean) was 27.53 with a standard deviation of 13.584. After treatment (Posttest), the results showed a lowest score of 52 and a highest score of 91. From a sample of 30 students, the average was 70.67 with a standard deviation of 8.612. Meanwhile, for the control class, the data before treatment (Pretest) showed a lowest score of 0 and a highest score of 40. From a sample of 30 students, the average was 18.37 with a standard deviation of 11.793. After treatment (Posttest), the results showed a lowest score of 30 and a highest score of 61. From a sample of 30 students, the average was 49.77 with a standard deviation of 8.398.

Research Instrument Analysis

Pretest-Posttest and Questionnaire Validity Test

Before this research was conducted, a trial of the instruments was carried out, namely the Validity and Reliability Tests on the pretest-posttest and questionnaire instruments. Meanwhile, the Validity Test and Reliability Test for the questionnaire instrument were conducted using the product-moment formula, based on 20 statements, yielding 10 valid and 10 invalid statements.

Pretest-Posttest Reliability Test

Based on the reliability test conducted on the pretest-posttest instrument consisting of 10 items in question, the results show a Cronbach's Alpha value of 0.799, indicating that the instrument is reliable and produces consistent data.

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Questionnaire Reliability Test

Based on the reliability test conducted on the questionnaire instrument consisting of 20 items in question, the results showed a Cronbach's Alpha value of 0.800 for the questionnaire instrument, indicating that the instrument is reliable and produces consistent data.

Pretest-Posttest Normality Test

Based on the pretest-posttest normality test as follows

Table 1. Pretest-posttest normality test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRETEST_EKSPERIMENT	,107	30	,200*	,960	30	,319
POSTEST_EKSPERIMENT	,095	30	,200*	,992	30	,997
PRETEST_KONTROL	,107	30	,200*	,948	30	,146
POSTEST_KONTROL	,117	30	,200*	,969	30	,503

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: Research data processing results, 2025

The results in **Table 1** show that the significance values (Sig. or p-value) in the Shapiro-Wilk test for the four groups are 1) Experimental Pretest with a significance value of 0.319; 2) Experimental Posttest with 0.997; 3) Control Pretest with 0.14; 4) Control Posttest with 0.503. All these significance values are greater than 0.05, so it can be concluded that all the data in the tested variables are normally distributed. Therefore, the assumption of normality in this study is met. Based on the Shapiro-Wilk normality test, the pretest and posttest data in both the experimental and control groups show a normal distribution, as their p-values are greater than 0.05. Therefore, the data in this study are suitable for further analysis using the t-test.

Questionnaire Normality Test

Table 2. Questionnaire Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
angjetkelaskontrol	,116	30	,200*	,971	30	,573
angketkelaseksperiment	,127	30	,200*	,969	30	,522

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: Research data processing results, 2025

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Based on **Table 2**, the results of the normality test on the control class questionnaire were obtained. After testing with the Shapiro-Wilk test, the p-value was 0.573. Since the Sig. value > 0.05, namely 0.573 > 0.05, H_0 is accepted. It can be concluded that the control class questionnaire data are normally distributed.

Pretest-Posttest Homogeneity Test

After determining the data's normality, the next step is to conduct a homogeneity test. The homogeneity test is used to determine the degree of similarity in variance between two groups: the experimental and the control. The interpretation of the homogeneity test is based on the significance value. If the significance value is> 0.05, the data are considered homogeneous.

Table 3. Homogeneity Test

		Levene Statistic	df1	df2	Sig.
score_postest	Based on Mean	,000	1	58	,997
	Based on Median	,001	1	58	,980
	Based on Median and with adjusted df	,001	1	57,935	,980
	Based on trimmed mean	,000	1	58	,995

Source: Research data processing results, 2025

Based on **Table 3**, the posttest homogeneity test results for the experimental and control classes showed a calculated F value (Levene Statistic) based on the means of 0.000 and a significance value (Sig.) of 0.997. Since the p-value of 0.997 is> 0.05, H_0 is accepted, indicating no significant difference in variance between the experimental and control groups, and the data are homogeneous.

Questionnaire Homogeneity Test

After students from the experimental and control classes completed the questionnaires, the next step was to test whether the data from both groups had equal variances. This homogeneity test aims to ensure that differences in the analyzed results are not due to differences in data variability between the groups.

Table 4. Questionnaire Homogeneity Test

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
skorangket	Based on Mean	1,357	1	58	,249
	Based on Median	1,357	1	58	,249
	Based on Median and with adjusted df	1,357	1	55,490	,249
	Based on trimmed mean	1,329	1	58	,254

Source: Research data processing results, 2025

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Based on **Table 4**, the results of the questionnaire data homogeneity test show that the F value (Levene Statistic) based on the mean is 1.357 with a significance value (Sig.) of 0.249. Since the p-value of 0.249 is> 0.05, H_0 is accepted, indicating no significant difference in the variance of the questionnaire scores; thus, the data are homogeneous..

Hypothesis Testing

Pretest-Posttest T Test

The hypothesis test used in this study is a parametric test (paired-samples T-test). This test is used to determine whether there is a difference in the average between two paired (related) sample groups.

Table 5. Summary of Posttest T-Test Results for Experimental and Control Classes

Statistic	Eksperimental Class	Control Class
N (number of samples)	30	30
Lowest Post-test Score	52	30
Highest *Posttest Score*	91	61
Mean (Rata-rata)	70,67	49,77
Standard deviation	8,612	8,398
t-count	-9,517	-
df (degree of freedom)	58	-
Sig. (2-tailed)	0,000	-
Mean Difference	-20,900	-
CI 95% *Lower*	-25,296	-
CI 95% *Upper*	-16,504	-
Conclusion	Significantly different	-

Source: Research data processing results, 2025

In the t-test for Equality of Means section (see **Table 5**), the calculated t-value was -9.517 with df = 58 and a significance (2-tailed) value of 0.000. Since the Sig. value of 0.000 < 0.05, H_0 is rejected, which means there is a significant difference between the posttest results of the experimental class and the control class. In addition, the Mean Difference between the two groups is -20.900, indicating that the average posttest score in the experimental class is higher than in the control class. This is further supported by the 95% Confidence Interval for the Difference, which ranges from -25.296 to -16.504, all of which are negative, indicating a statistically significant difference. Based on the t-test results, it can be concluded that there is a significant difference between the posttest scores of students in the experimental and control classes, with the experimental class receiving the treatment showing significantly better learning outcomes. This indicates that the treatment given to the experimental class has a positive effect on students' learning outcomes.

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Questionnaire T-Test

Table 6. Questionnaire T-Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
skorangket	Equal variances assumed	1,357	,249	-3,640	58	,001	-4,500	1,236	-6,974	-2,026
	Equal variances not assumed			-3,640	55,443	,001	-4,500	1,236	-6,977	-2,023

Source: Research data processing results, 2025

Based on the test results, the significance value (Sig. 2-tailed) was 0.001, which is smaller than 0.05 (0.001 < 0.05). This indicates a significant difference between the questionnaire scores of the experimental and control groups. In addition, the calculated t-value was -3.640 with df = 58, since the variance is assumed equal based on the Sig. value of Levene's Test = 0.249 > 0.05. The mean difference of -4.500 reinforces the conclusion that the treatment given to the experimental group resulted in a significantly different effect compared to the control group.

Discussion

The research results show that implementing the ice-breaking secret number technique significantly improves the Mathematics learning outcomes of fifth-grade students at SDN Cilangkap 01 Pagi. The average posttest score in the experimental class was 20.9 points higher than in the control class, with a p-value of 0.000. These findings confirm that ice-breaking activities that integrate numerical material can stimulate students' interest, focus, and active involvement. This result supports previous research, which found that the use of ice-breaking techniques generally increases learning motivation and Mathematics learning outcomes among elementary school students (Alfiyatin, 2023; Pujiarti, 2022). Furthermore, the study demonstrates that learning through game activities fosters a sense of enjoyment, which significantly increases posttest scores (Sudarsih, 2021).

The implementation of the ice-breaking secret number in this study extends these findings by adopting an approach more focused on numerical puzzles. From the perspective of learning outcome theory, it includes cognitive, affective, and psychomotor aspects (Wisman et al., 2021). The increase in posttest scores aligns with the improvement in learning motivation, as indicated by the questionnaire results. This shows that the ice-breaking secret number not only serves as a mood setter but also facilitates early diagnosis of conceptual understanding (Yuda et al., 2021; Usoh et al., 2024). Furthermore, these findings are consistent with research emphasizing the importance of mastering students' learning styles (Anggoro et al., 2024). In this study, variations in learning styles (visual, kinesthetic, auditory) were facilitated through numerically based puzzles designed cooperatively, allowing students to feel challenged in solving problems together with their groupmates.

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In practice, the results of this study reinforce the notion that learning basic Mathematics is more meaningful when linked to play activities that foster social engagement (Maheswari et al., 2023; Nengsih, 2023). The implementation of the ice-breaking secret number can serve as an alternative for teachers to create a more participatory learning atmosphere, while also enriching interactive learning strategies grounded in local wisdom, as shown (Wijayanti & Yanto, 2023). Based on the previous exposition, it can be concluded that the ice-breaking secret number has proven effective as an innovative learning technique to improve Mathematics learning outcomes, in line with various theories and previous research findings that support the importance of active, interactive, and enjoyable learning.

CONCLUSION

The implementation of the ice-breaking secret number has been proven to have a positive and significant effect on the Mathematics learning outcomes of fifth-grade students at SDN Cilangkap 01 Pagi. All statistical prerequisite tests were met, the t-test showed a posttest mean difference of 20.9 points, and the effect size (d = 2.39) falls into the very large effect category. These findings confirm that integrating numerical games aligned with flat-shape materials not only lightens the atmosphere but also effectively deepens conceptual understanding and increases learning motivation. The research hypothesis that ice-breaking secret number improves Mathematics learning outcomes compared to conventional methods is accepted. Future research can examine the implementation of ice-breaking secret numbers in other Mathematics topics, across different grade levels, or combined with interactive digital media to expand their impact and effectiveness in learning.

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