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# The Effectiveness of the GASING Method in Improving Mathematical Procedural Understanding Ability in Multiplication Among Phase B Elementary School Students

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**Abstract**

This study addresses the persistent challenge of limited procedural understanding in multiplication among elementary school students in Indonesia, particularly those in Phase B. Many students struggle to follow correct steps, select appropriate strategies, and apply multiplication concepts to real-life contexts—issues often exacerbated by traditional teaching methods that prioritize rote memorization over active, tangible learning experiences. The study aims to examine the effectiveness of the GASING method in enhancing procedural understanding of multiplication among fourth-grade students. Employing a pre-experimental one-group pre-test and post-test design, the study involved 24 purposively selected students. Data were collected using pre- and post-test instruments and analyzed through the Wilcoxon test. Results indicate a significant improvement in students' procedural understanding following the intervention, with a p-value of 0.001, demonstrating statistical significance at the 0.05 level. The findings affirm that the GASING method—characterized by its concrete, visual, and interactive learning approach—effectively strengthens students' procedural skills in mathematics. This research contributes to the growing literature on innovative teaching methods in mathematics education and provides practical guidance for educators seeking to implement engaging, structured instructional strategies.

**Keywords**: GASING Method; Procedural Understanding; Multiplication; Elementary Mathematics; Mathematics Education

## INTRODUCTION

Mathematics learning has undergone transformations in line with the needs of the times. This transformation is not only related to content but also highlights the fact that mathematics has become a fundamental discipline for elementary school students (Diah & Siregar, 2023). Mathematics learning is essentially an interactive process that involves various instructional components with the aim of developing students' thinking abilities in problem-solving. The main objective of mathematics education is to encourage initiative and active participation of students in learning activities. In addition, mathematics serves as a tool for reasoning, a medium of communication, and a means of problem-solving (Ultra Gusteti, 2022).

Mathematics learning needs to be introduced to students from an early age. This is because having a good grasp of math is important for dealing with different problems that come up every day (Wapa et al., 2023). A big part of learning math is helping students learn how to understand things like facts, ideas, rules, actions, and how different math parts connect to each other. In addition, students are taught to apply this understanding flexibly, accurately, efficiently, and precisely to solve mathematical problems, covering both conceptual understanding and procedural skills (Kemendikbudristek, 2024). Therefore, mathematics as a school subject aims to provide learning materials that can assist students in mathematical problem solving, one of which is multiplication. However, problems often arise in teaching multiplication at the elementary level due to students' perception that mathematics can be a tough subject, and that often causes people to feel bored and lose interest (Lina Silvia et al., 2023).

Multiplication is a math process where you use one number to make another number bigger or smaller. It is one of the four main math actions, along with adding, taking away, and sharing. Multiplication has particular characteristics, one of which is its abstract nature, meaning that students need to understand that multiplication does not only involve numbers but can also be used to represent concepts such as grouping or repeated addition in everyday life (Maulana et al., 2020). The abstract nature of multiplication is one of the main reasons

why elementary school students often struggle with it (Faujiah & Nurafni, 2022). Therefore, effective instruction requires an approach that goes beyond rote memorization and instead supports students' procedural understanding through interactive learning media.

Procedural mathematical understanding refers to the ability to comprehend procedures, to know when and how to apply the correct procedure, and to demonstrate accuracy and efficiency in solving problems (Armanza & Asyhar, 2020). However, several common difficulties are often encountered by students when applying procedural principles, including: (1) students are unable to engage in exploration or discovery and lack accuracy in calculations; (2) students struggle to identify key factors, making it difficult for them to abstract patterns; or (3) students can state a principle but fail to grasp its meaning and encounter difficulties in applying it (Pratidiana & Muhayatun, 2021). Good procedural understanding is considered the ability of students to use the most effective methods to produce accurate results, strengthen their comprehension of concepts, and apply the correct steps in problem-solving. Thus, students who don't have a good grasp of the steps involved in math will struggle to understand more complex ideas and will have trouble solving different types of math problems (Susanti & Sudiansyah, 2024).

Observations at an elementary school in Bandung Regency revealed that although some fourth-grade students had memorized basic multiplication tables, many still struggled to apply sequential procedures in problem solving. Common errors included misunderstanding the order of steps, writing final answers without following the process, misinterpreting word problems, and skipping essential stages in converting sentences into mathematical operations. These difficulties became more evident in complex word problems, as students were rarely guided to analyze situations or relate them to real-life contexts. Consequently, they often experienced confusion and loss of motivation, especially when learning resources were limited to textbooks. This condition highlights the need for innovative teaching approaches that are contextual, interactive, and tailored to students' characteristics to better develop their procedural skills (Mufliva & Iriawan, 2022).

There are various multiplication methods, including jarimatika (finger counting), the number line method, multiplication tables, and contextual story methods. The GASING method (Simple, Fun, and Enjoyable) is one approach that can help overcome difficulties in learning mathematics. This method was created by Prof. Yohanes Surya, Ph.D., with the aim of facilitating students in building procedural understanding by simplifying mathematical

concepts so that the process of carrying out solution steps becomes more structured and easier to grasp. GASING emphasizes a more intuitive and enjoyable approach, focusing on deep understanding rather than merely memorizing formulas or procedures (Lestari & Tyas, 2022).

In addition, this method also emphasizes systematic and repetitive practice, giving students the opportunity to gradually sharpen their mathematical skills. These exercises are designed not merely to memorize steps, but to build a deeper understanding of mathematical processes. A fun and engaging learning atmosphere can increase students' motivation, making it easier for them to overcome various obstacles in understanding mathematical concepts. This condition indirectly supports the development of procedural understanding, as students become more open and active in learning and practicing systematic steps in solving mathematical problems (Ni Kadek Lespita Devi, 2024). Through this visual and interactive approach, students are taught not only to know the final result of a mathematical operation, such as the result of multiplication, but also to understand the underlying process. The GASING method encourages students to view mathematics as something enjoyable and comprehensible through direct experience, so they do not merely memorize formulas but truly understand the concepts behind each step (Mutiara et al., 2024).

Based on the aforementioned discussion, this study aims to implement the GASING method (Simple, Fun, and Enjoyable) as an effort to improve students' procedural understanding of mathematics, particularly in multiplication for Phase B elementary school students. Through a gradual approach ranging from concrete, semi-abstract, to mental calculation the method is expected to facilitate students in systematically and meaningfully comprehending procedural steps. Furthermore, this study is expected to help improve and enrichment of innovative mathematics teaching strategies, providing valuable references for teachers in creating more interactive, engaging, and effective learning environments to achieve optimal learning outcomes.

## METHODS

This study used a pre-experimental design with a one-group pre-test and post-test approach to assess how much students procedural understanding improved after they received instruction using the GASING method. The independent variable in this study was the GASING teaching method, and the dependent variable was the students' level of

procedural understanding in multiplication. The research was conducted at one public elementary school in Bandung Regency, involving 24 fourth-grade students who were selected purposively based on teacher assessments indicating low procedural fluency despite having learned basic multiplication. The primary instrument used was a procedural understanding test on multiplication, consisting of 8 essay items covering multi-digit multiplication, application of the distributive property, and word problems requiring sequential solutions. The instrument was developed and validated by two mathematics education experts to ensure content validity. Data gathering was done in three stages, namely the pre-test to measure initial ability, an intervention phase consisting of four GASING learning sessions following the concrete, abstract, and mental calculation stages, and the post-test to measure learning gains. The data obtained were analyzed quantitatively using descriptive statistics (mean, standard deviation, and gain score) and inferential statistics through the Wilcoxon Signed-Rank Test to determine the significance of improvement. All analyses were conducted using SPSS version 27 software.

## RESULTS

Based on the research conducted on May 23 and 24, 2025, with fourth-grade students from a public elementary school located in Batujajar, Bandung Regency, pre-test scores were collected to provide an initial overview of students' procedural mathematical understanding before the application of the GASING method, as well as post-test scores after the learning intervention. These results are presented in Figure 1.

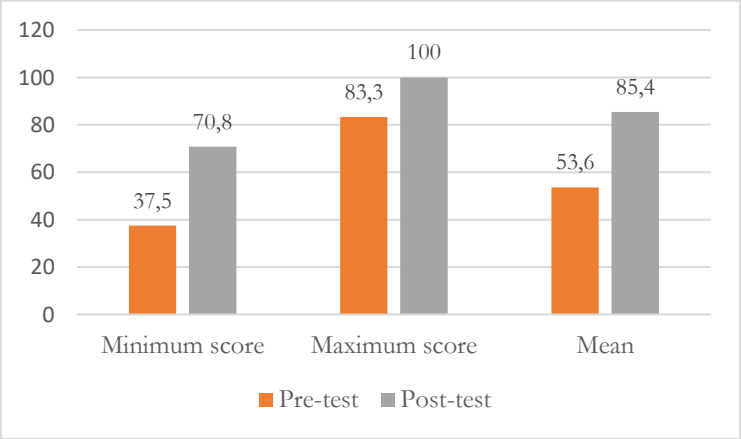


Figure 1. Pre-test and Post-test Score Chart

According to Figure 1, in the pre-test, the lowest score recorded was 37.5, and the highest was 83.3, with an average of 53.6. In the post-test, the lowest score was 70.8, the highest was 100, and the average score increased to 85.4. The results of the pre-test and post-test scores can be grouped according to the criteria for achieving learning objectives (KKTP), as presented in Table 1.

**Table 1.** Categorization of Pre-test and Post-test Results

| | Result | Category | Frequency | Percentage |
|---|---|---|---|---|
| **Mastery Criteria KKTP (≥75)** | Pre-test | Did not achieved | 22 | 92% |
| | | Achieved KKTP | 2 | 8% |
| | Post-test | Did not achieved | 1 | 4% |
| | | Achieved KKTP | 23 | 96% |

Table 1 shows that during the pre-test, 92% of students were unable to achieve the KKTP, while during the post-test, 96% of students successfully achieved the specified KKTP. In addition, an analysis was conducted on the average of the three indicators of mathematical procedural understanding used in this study, including:

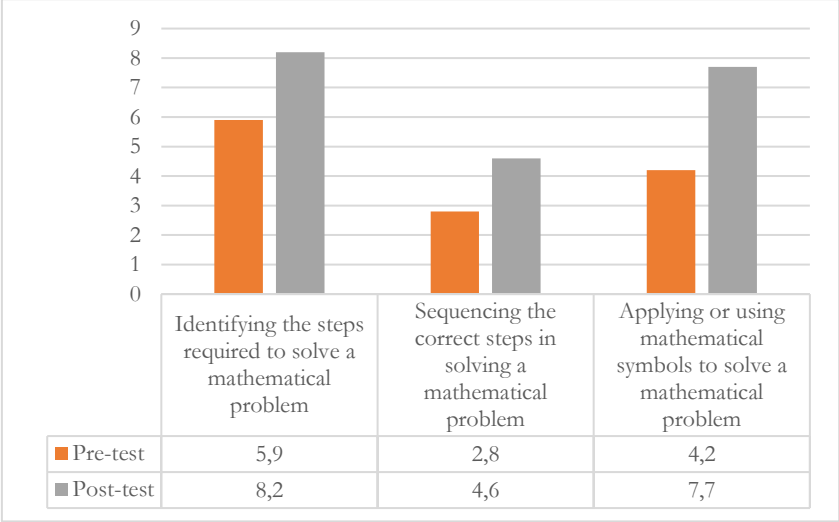


**Figure 2.** Diagram of average pre-test and post-test scores

Based on the analysis of the average pre-test and post-test scores on the three indicators of mathematical procedural understanding, there was an increase in students' abilities after the implementation of the GASING method. In the first indicator, which is identifying the steps needed to solve mathematical problems, the average student score increased from 5.9 in the pre-test to 8.2 in the post-test, with an increase of 2.3 points. Next, in the second indicator, which is sequencing the steps correctly, there was an increase from an average score of 2.8 to 4.6, or an increase of 1.8 points. Meanwhile, in the third indicator, which is applying or using mathematical symbols, the average student score increased from

4.2 in the pre-test to 7.7 in the post-test, with an increase of 3.5 points. This increase indicates that students are becoming more proficient in using notation or symbols in the context of multiplication operations.

Additionally, the scores from the pre-test and post-test were checked to see if the data followed a normal distribution. This was carried out with a normality assessment in IBM SPSS Statistics 27 software, namely the Shapiro-Wilk test. A significance value above 0.05 suggested that the data followed a normal distribution. The outcomes of this examination are presented in the table below.

**Table 2.** Normality test results

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Pretest | .151 | 24 | .162 | .920 | 24 | .059 |
| Posttest | .215 | 24 | .005 | .865 | 24 | .004 |

a. Lilliefors Significance Correction

Examining the findings displayed in Table 2, the significance figure for the pre-test was 0. 059, exceeding 0. 05. This indicates that the pre-test information adheres to a standard distribution. However, the significance value for the post-test was 0.004, which is lower than 0.005, showing that the post-test data does not follow a normal distribution. Because one of the data groups fails to satisfy the requirements of a normal distribution, we are unable to apply the paired sample t-test for examining the hypothesis regarding the GASING method's impact on enhancing students procedural math comprehension. Therefore, we will utilize the non-parametric Wilcoxon Signed-Rank test, as presented in the table below.

**Table 3.** Results of Wilcoxon test

**Test Statistics[a]**

| | Post-test - Pre-test |
|---|---|
| Z | -4.294[b] |
| Asymp. Sig. (2-tailed) | <,001 |

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Based on Table 3, the analysis using the Wilcoxon Signed Ranks Test shows a Z value of -4.294 and a significance level of Asymp. Sig. (2-tailed) less than 0.001. This significance level is much lower than 0.05, which means there is a statistically significant difference between the scores obtained in the pre-test and the post-test. Thus, the null

hypothesis ($H_0$) is rejected and the alternative hypothesis ($H_1$) is accepted, meaning that there is effectiveness related to the application of the GASING method in improving the procedural mathematical understanding of Phase B elementary school students, particularly in multiplication operations. These results match earlier quantitative data that shows an increase in the average score from the pre-test to the post-test. To help understand how effective the learning intervention was, the results of the N-Gain score calculation are shown in the table below. This table gives a clear picture of the improvements that happened.

**Table 4.** N-Gain score test results

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| NGain | 24 | .41 | 1.00 | .6951 | .19497 |
| Valid N (listwise) | 24 | | | | |

Based on the descriptive analysis of the N-Gain scores from 24 students, the minimum score obtained was 0.41, the maximum score was 1.00, and the mean score was 0.6951 or 69.51%, with a standard deviation of 0.19497. The average N-Gain score is in the medium range, which shows that overall, using the GASING method resulted in a moderately effective improvement in students' procedural mathematical understanding. The minimum value of 0.41 shows that while some students experienced lower improvement, there were also students who achieved the maximum score of 1.00, reflecting optimal learning gains.

## DISCUSSION

The results of this study demonstrate a consequential advance in students' procedural mathematical understanding following the application of the GASING method. The average score increased from 53.6 in the pre-test to 85.4 in the post-test, with 96% of students meeting the KKTP. The highest improvement was found in the indicator of applying mathematical symbols, reflecting students' enhanced skills in accurately using mathematical notation in multiplication operations. These findings affirm that the concrete, abstract, mental calculation approach can gradually and systematically build procedural skills (Utami, 2025).

Compared to previous studies, these findings are consistent with those reported by (Munawaroh & Nurtamam, 2024), (Aulia et al., 2025) which indicated that the GASING

method effectively improves computational skills, student engagement, and conceptual mathematical understanding. However, this study makes a specific contribution by focusing on procedural understanding in multiplication, an aspect that has rarely been the primary focus in earlier research. Thus, it extends the empirical evidence of the GASING method's effectiveness into a more targeted domain (Siahaan et al., 2023).

The practical implication of these findings is that the GASING method can serve as an alternative instructional strategy for mathematics in primary schools, particularly for strengthening students' procedural skills. It also offers a theoretical contribution by reinforcing the premise that learning which integrates concrete, abstract, mental stages can comprehensively enhance mathematical skills. Teachers are encouraged to adopt this method to foster active student engagement, clarify conceptual understanding, and gradually train computational automatization (Sari et al., 2022).

However, this study has a limitation because the sample size is not very large, only 24 students, and it was done at one primary school in the Bandung Regency area, so generalization of the results should be approached with caution. Additionally, external factors such as learning motivation, student focus during lessons, and environmental support were not fully controlled. Future research could involve larger samples and more diverse settings to strengthen the validity of these findings (Maulidin et al., 2025).

## CONCLUSION

Based on the results, it can be stated that before applying the GASING method, students had a fairly limited understanding of procedural mathematics, as shown by the average scores on the pre-test being lower than the KKTP, with most students struggling to identify steps, sequence multiplication procedures, and apply mathematical symbols. After applying the GASING method, there was a significant improvement in the post-test scores, indicating that students were able to accurately identify steps, sequence procedures, and apply symbols systematically through the concrete, abstract, mental. These results strengthen the contribution of the GASING method as an innovative instructional alternative that effectively enhances elementary students' procedural skills in a structured and meaningful way. Future studies are recommended to involve larger samples, explore its effectiveness in other mathematical topics such as fractions or geometry, and integrate the method with digital technology to foster more interactive and sustainable learning.

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