

Unlocking Rapid Calculation: An Analytical Investigation into Vedic Mathematics for Enhancing the Speed of Mathematical Calculations

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Abstract:

Vedic Mathematics, a system rediscovered by renowned Indian mathematicians between 1911 and 1918 from ancient Vedic texts, comprises 16 sutras and 13 sub-sutras that facilitate modern calculations. This study aims to evaluate the effectiveness of Vedic Mathematics in enhancing mathematical calculation related to multiplication and square of numbers. The sample consisted of 40 students preparing for competitive exams following the state syllabus of Kerala. A purposive sampling method was employed, creating an experimental group that received instructions in Vedic Mathematics techniques and focused group discussion on Vedic Mathematics. The objectives of the study were to know the effectiveness of Vedic Mathematics strategies for different multiplication and square of a number. The results revealed a statistically significant t-value at the 0.01 level, indicating that teaching strategies based on Vedic Mathematics significantly improved students' mathematics learning. The findings suggest that integrating Vedic Mathematics techniques into the curriculum could enhance students' mathematical proficiency and engagement.

Keywords: Vedic Mathematics, Multiplication, Square, Competitive examination, Mental calculation

INTRODUCTION

In a world where speed and efficiency are paramount, the ancient wisdom of Vedic Mathematics offers a timeless solution to modern mathematical challenges (Kasliwal et al., 2011; Mandal & Dasgupta, 2019). Rooted in the rich traditions of ancient India, this system showcases the remarkable wisdom of our early scholars. It's a collection of different sutras which provides quick and straightforward techniques used for solving mathematical calculations with easier and more intuitive (Ramteke & Vaishnav, 2019; Shruti, 2015). Whether learners are dealing with arithmetic, algebra, geometry, or trigonometry, Vedic Mathematics provides simple rules that turn complex calculations into something much more manageable, known for its speed, accuracy and ease, this approach not only boosts learners' problem-solving skills but also helps to grasp mathematical concepts more deeply (Shastri et al., 2017). By connecting ancient knowledge with modern learning, Vedic Mathematics continues to be a valuable



resource for students, teachers, and math enthusiasts around the world. The system of Vedic Mathematics is built on 16 Vedic sutras and 13 Vedic sub-sutras, which are essentially word-formulae that outline the steps or logic needed to solve a wide range of mathematical problems (Maharaja, 1965). These sutras act as mental shortcuts, making it possible to tackle complex problems with ease and speed. Traditionally, many of these mathematical challenges are considered difficult or cumbersome, requiring lengthy calculations. However, through the application of these sutras, Vedic Mathematics simplifies the process, allowing for quick and efficient solutions (Katgeri, 2017; Kumari, 2014).

The roots of Vedic Mathematics stretch back to ancient Indian scriptures, where these techniques were first conceived. Between 1911 and 1918, they were rediscovered, and in 1957, Jagadguru Sri Bharathi Krishna Thirthaji Maharaja, a renowned scholar of Sanskrit, Mathematics, and philosophy, fully developed and codified the system (Maharaja, 1965). His work not only revived this ancient wisdom but also demonstrated its practical applicability in modern Mathematics. Now-a-days, Vedic Mathematics is celebrated for its ability to enhance mental agility and problem-solving skills, making it a valuable tool in both academic and real-world contexts (Kumari, 2014). Vedic Mathematics is highly valuable for multiplication due to its efficient and simplified methods. It breaks down complex calculations into smaller, manageable steps using sutras, allowing for faster mental computation. This approach not only enhances speed and accuracy but also strengthens students' understanding of numbers and patterns. It makes multiplication less intimidating, improving confidence and problem-solving skills, and making the process both engaging and intuitive.

In the context of school education, many students who face competitive examinations such as Mathematics Olympiad, NTSC, KVPY, IIT, AIPMT, NEET, CLAT, NIFT, NDA, and University entrance examinations in India often struggle with solving aptitude or reasoning problem questions under time constraints (Kumari, 2014; Shruti, 2015). A key challenge is the speed required to solve complex mathematical operations. Vedic Mathematics, an ancient Indian system, offers different techniques or strategies that can simplify these operations significantly (Karani & Prasad, 2016). These include techniques for multiplying large numbers, squaring, finding square roots and cube roots, solving calendar problems, subtraction, and division (Karani & Prasad, 2016; Parajuli, 2019). These methods serve as highly efficient shortcuts, dramatically reducing the time and effort needed to solve mathematical problems in their upcoming competitive exams and even in formative and summative evaluation in academics examinations (Kasliwal et al., 2011). In school education, introducing Vedic Mathematics can help students develop these skills early on, preparing them for future challenges. By mastering these techniques, students can solve more problems within a shorter timeframe, enhancing both their speed and accuracy.

The presents empirical study aimed at determining whether Vedic Mathematics techniques can improve the speed of basic mathematical operations, especially for multiplications and square of a number. A set of mathematical questions, covering topics such as square and multiplication of different numbers, multiplication of numbers close to a base, using the "all from nine and last from ten" rule, were given to students preparing for competitive and school exams. The time taken by students before and after learning Vedic techniques was recorded and analyzed in terms of minutes. A hypothesis was constructed and evaluated using a paired t-test to assess whether the improvements were statistically significant. The findings show that adopting Vedic methods significantly increases the speed of performing basic mathematical operations, providing students with a valuable edge in time-sensitive examinations.

Incorporating Vedic Mathematics into the school curriculum can thus offer students a distinct advantage, not only improving their problem-solving skills but also building confidence for future competitive exams where time management is critical.

Review of Related Literature

Vedic Mathematics has a major influence in accelerating basic calculation of arithmetic operations at the secondary school level has received limited attention in the current body of research. However, Vedic Mathematics has gained recognition and popularity beyond India (Williams, 2021). In 1981, British mathematicians such as Kenneth Williams, Andrew Nicholas, and Jeremy Pickles showed interest in the subject, delivering lectures across London and expanding on Bharathi Krishna Thirthaji's foundational book on the topic (Vaghela & Vasoya, 2021). Vedic Mathematics techniques are known for facilitating fast and efficient calculations in specific situations, improving not only calculation speed but also concentration and logical thinking both of which are essential skills for students preparing for exams either academic or competitive (Kumari, 2014).

In addition to Vedic Mathematics, other techniques such as Trachtenberg Speed Arithmetic and Lester Meyers' methods also contribute to increasing proficiency in rapid arithmetic and reasoning (Karani & Prasad, 2016). These alternative systems of mental arithmetic offer students a range of tools to enhance their problem-solving abilities, particularly when faced with time-sensitive tasks in competitive examinations. The combination of Vedic Mathematics and other speed arithmetic systems equips students with a solid foundation for tackling complex problems quickly and accurately (Joshi, 2017). As these techniques become more widespread in educational systems, especially in preparation for competitive exams, they can play a vital role in improving students' mathematical efficiency and performance (Kasliwal et al., 2011).

In recent years, the resurgence of interest in ancient mathematical techniques such as Vedic Mathematics has been particularly notable in the context of modern education. With the increasing demand for quick mental calculations, particularly in competitive exams, these techniques offer a refreshing alternative to conventional methods of problem-solving (Singh et al., 2017). Vedic Mathematics not only enhances computational speed but also promotes an intuitive understanding of numbers, which is often lacking in traditional approaches. By simplifying complex calculations into smaller, manageable steps, students are able to approach mathematical problems with greater confidence and reduced anxiety (Shastri et al., 2017). The simplicity and effectiveness of Vedic Mathematics methods can transform the way students learn, especially in environments where speed and accuracy are crucial. As educational curricula evolve to meet the demands of the digital age, incorporating Vedic Mathematics into the mainstream could bridge the gap between traditional learning and modern needs.

Moreover, Vedic Mathematics is not just about speed; it also strengthens mental faculties like logical reasoning, problem-solving, and concentration (Raikhola et al., 2020; Sevak & Vyas, 2019). These skills are particularly vital for students preparing for competitive exams, where the ability to think quickly and accurately can determine success. Studies have shown that students trained in Vedic techniques tend to develop a more profound grasp of mathematical concepts, making it easier for them to apply these principles to real-world scenarios. Integration of such techniques into the curriculum would offer students a comprehensive toolkit, enabling them to tackle both academic challenges and practical problems with efficiency. The growing interest in Vedic Mathematics and similar methods reflects a

broader trend in education, where there is an increasing emphasis on innovative, adaptable, and holistic learning approaches.

OBJECTIVES

O₁: To compare the achievements scores of Vedic Mathematics strategies to enhance performance in multiplication and square of any number.

O₂: To determine whether Vedic Mathematics techniques enhance the speed of performing multiplications and square of any numbers.

HYPOTHESIS

H₁: There is no significant difference between pretest and posttest achievement score for the performance in multiplication and square of any number.

RQ₁: Does Vedic Mathematics enhance the speed of performing multiplications and square of any numbers?

RQ₂: Does the Vedic Mathematics enhance mental calculation speed?

METHODOLOGY

This study adopted a mixed-methods approach by integrating qualitative and quantitative data. Primary data were collected from 40 students enrolled in a competitive examination training center in Kasaragod district, Kerala, India, who were preparing for competitive examinations such as the Mathematics Olympiad, NTSE, KVPY, JEE, NEET, CLAT, NIFT, NDA, and university entrance examinations. Secondary data were obtained from journals, research articles, books, magazines, newspapers, and relevant online sources to support the study. Focus group discussions were conducted to gain qualitative insights into students' experiences with Vedic Mathematics and to complement the quantitative findings. The participants completed a mathematical achievement test comprising basic multiplication, multiplication of three- and four-digit numbers, multiplication of numbers close to a base, and calculation of squares. The study hypothesis was tested using a paired t-test to examine the effectiveness of Vedic Mathematics in enhancing the speed of multiplication and square calculations, thereby providing a comprehensive understanding of its potential contribution to competitive and academic examination performance.

DATA ANALYSIS AND INTERPRETATIONS

The statistical techniques employed for data analysis included both descriptive statistics related to performance for the calculations related to multiplications and square of a number along with the time taken to solve the achievement test for the total sample. The table below presents the central tendency measures such as mean, median, and mode along with variability measures such as the standard deviation, which provide insights into the overall performance of the sample in this area. These statistics are crucial for understanding the distribution and spread of the data, enabling a clearer interpretation of how students performed on tasks involving multiplications and squares of any numbers. Additionally, these measures help in identifying patterns and trends within the dataset.

Table 1- Descriptive statistical analysis of gender-wise group performance

Group Statistics					
Group	Gender	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Female	20	5.74	1.52	.34002
	Male	20	5.25	1.34	.30022
Posttest	Female	20	19.75	6.70	1.4985
	Male	20	18.67	3.10	.6942

Table 2- Descriptive statistical analysis of time (in minutes) taken for gender-wise sample.

Group Statistics					
Group	Gender	N	Mean	Std. Deviation	Std. Error Mean
Pre-test time(min)	Female	20	26.3480	2.49152	.55712
	Male	20	26.0165	2.46064	.55022
Post-test time(min)	Female	20	16.6085	2.21282	.49480
	Male	20	18.4705	2.63609	.58945

Hypothesis testing **H₁**: There is no significant difference between pre-test and post-test performance in the calculations before and after adopting Vedic Mathematics strategies. The hypothesis was tested using the t-test statistical technique using SPSS software. The table below illustrates the significance of the difference in students' performance in solving problems between the pre-test and post-test results.

Table 3 - Comparison between pre-test and post-test performance of the sample

Group	N	Mean	Standard Deviation	't' Value	Level of Significance
Pre-test	40	5.49	1.44	19.55	Significant
Post-test	40	19.21	5.18		

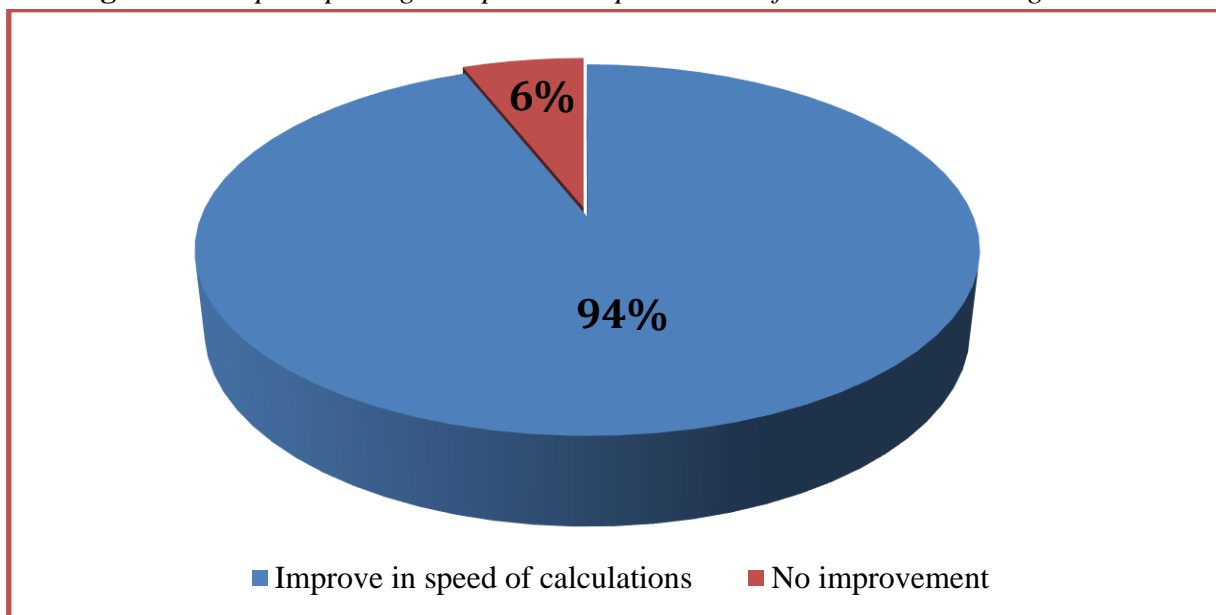
Note: The significant value is taken at 0.01

Table 3 shows that calculated 't' value 19.55 exceeds the critical value, the null hypothesis is rejected. This indicates a significant difference between the pre-test and post-test scores in terms of students' performance in the achievement test after the implementation of the Vedic Mathematics technique. The results suggest that the intervention had a positive impact on student performance. Before the intervention, students were familiar with square and multiplication of 2 by 2 digits, but for larger multiplication and square, they relied on the table and factorization method. This method was lengthy, and many students struggled to apply it effectively. The introduction of Vedic Mathematics techniques provided them with more efficient strategies to solve these problems. With ample practice, students became more proficient in solving square and multiplication problems, as reflected in their improved post-test performance.

RQ1: Does Vedic Mathematics enhance the speed of performing multiplications and square of any numbers?

Approximately 94% of the 40 respondents agreed that Vedic Mathematics enhances calculation speed, highlighting a strong consensus on its effectiveness. In contrast, only 6% indicated no noticeable improvement in their speed. This overwhelming majority suggests that the techniques in Vedic Mathematics are widely perceived as beneficial for quick problem-solving. Furthermore, respondents noted that these methods not only increase speed but also boost confidence in handling complex calculations. The minority who saw no improvement may require additional practice or alternative strategies to fully benefit from the approach.

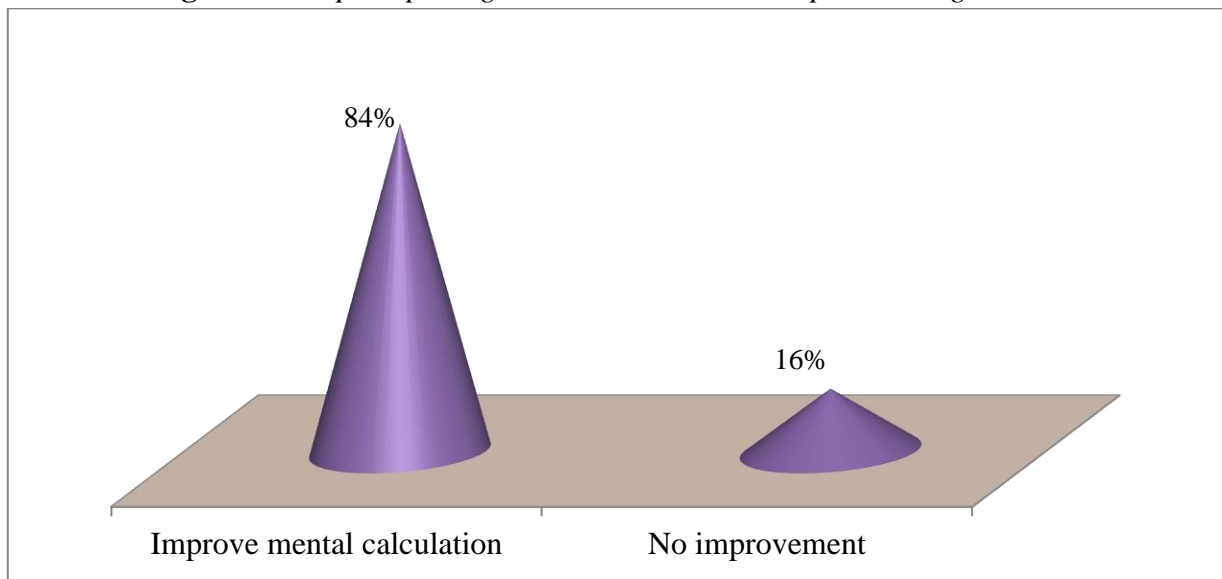
Figure 1- Graph depicting the speed in improvement of calculations among students



RQ2: Does the Vedic Mathematics enhance mental calculation speed?

About 84% of the respondents affirmed that Vedic Mathematics improves mental calculation speed, reflecting a strong agreement on its effectiveness. Conversely, only 16% noted that they did not observe any significant enhancement in their mental calculation speed. Vedic Mathematics significantly enhances mental calculation speed. Its unique set of techniques and sutras (formulas) simplifies complex arithmetic operations, allowing calculations to be performed mentally with greater efficiency. By using these methods, individuals can quickly solve problems in addition, subtraction, multiplication, division, squares, and square roots without relying on lengthy traditional approaches (Ganesh et al., 2021; S. R. Singh et al., 2021). The ability to break down problems into simpler steps enables faster computation, boosting both accuracy and speed (Chauhan & Ali, 2021), making it especially useful in competitive exams and everyday mathematical tasks.

Figure 2- Graph depicting the mental calculation speed among students



DISCUSSION

The findings reveal a significant improvement in students' performance between the pre-test and post-test following the implementation of Vedic Mathematics techniques. Students demonstrated greater accuracy in calculating squares and performing different types of multiplication, committing fewer errors than when using conventional factorization methods. These findings suggest that Vedic Mathematics enhances students' conceptual understanding and computational proficiency (Katgeri, 2017; Kumar & Joshith, 2023; Raikholia et al., 2020). A significant reduction was also observed in the time required to solve mathematical problems after the intervention, indicating that students completed calculations more efficiently using Vedic Mathematics. This finding is consistent with previous studies reporting that Vedic Mathematics improves computational speed and efficiency (Joshi, 2017; Prasad, 2016). Thus, Vedic Mathematics contributes to both the accuracy and speed of mathematical problem-solving.

The perception data further support these findings. Approximately 94% of the respondents reported that Vedic Mathematics improved their calculation speed, while only 6% perceived no noticeable improvement. Similarly, 84% indicated that the techniques enhanced their mental calculation ability, whereas 16% did not observe significant changes. Respondents also reported increased confidence in solving complex arithmetic problems, attributing these improvements to the simplified techniques and sutras of Vedic Mathematics. These methods facilitate faster and more accurate mental computation in operations such as addition, subtraction, multiplication, division, squares, and square roots, making them particularly beneficial for competitive examinations and everyday mathematical problem-solving.

CONCLUSION

Vedic Mathematics can be introduced to learners from a young age, and having a basic understanding of multiplication tables significantly aids in grasping the subject. This engagement enhances memory and concentration, making mathematical concepts easier to internalize. Since Vedic Mathematics emphasizes mental calculations over using pen and paper, it encourages deeper concentration, which ultimately strengthens one's focus and cognitive abilities. This unique approach is based on straightforward

principles and rules, allowing learners to solve various mathematical problems mentally. By practicing Vedic Math, students can discover new ways to approach problems that might have once seemed insurmountable, thereby boosting their confidence in their abilities. As students engage more frequently with Vedic Math, they are likely to develop a greater interest in mathematics as an area that many students often find daunting. By fostering a positive attitude toward math through these engaging techniques, Vedic Mathematics can transform a challenging subject into an enjoyable and rewarding experience. Moreover, the skills developed through Vedic Mathematics extend beyond the classroom; they equip students with valuable problem-solving skills and enhance their ability to think critically and creatively in various situations.

In conclusion, the findings of this study demonstrate that Vedic Mathematics is an effective pedagogical approach for enhancing students' calculation speed, accuracy, and mental computation skills. Its emphasis on mental calculations strengthens concentration, memory, logical reasoning, and problem-solving abilities while fostering confidence and positive attitudes toward mathematics. Beyond improving computational proficiency, Vedic Mathematics encourages critical thinking, creativity, and sustained engagement with mathematical learning, making it particularly beneficial for both academic and competitive examinations. Therefore, integrating Vedic Mathematics into mathematics education has the potential to strengthen foundational mathematical competencies, improve learners' cognitive abilities, and promote lifelong interest and achievement in mathematics.

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