



Impact of Vedic Mathematics Strategies on Problem-Solving Speed, Conceptual Understanding, and Mathematics Anxiety

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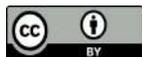
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Mathematics anxiety and poor understanding of mathematics concepts are the major challenges in mathematics education, particularly at the school level. Traditional instructional approaches often emphasize procedural fluency over meaningful understanding, leading to slow problem-solving and reduced learner attention and interest. Vedic Mathematics, an ancient Indian system based on concise sutras, offers alternative strategies that emphasize mental computation, pattern recognition, and flexible thinking. The present study investigates the impact of Vedic Mathematics strategies on students' problem-solving speed, conceptual understanding, and mathematics anxiety. Using a quasi-experimental design, the study compares learners exposed to Vedic Mathematics-based instruction with those receiving conventional teaching. Results indicate that students taught using Vedic Mathematics strategies demonstrate significantly faster problem-solving speed, and reduced levels of mathematics anxiety. The findings suggest that Vedic Mathematics is an effective instructional approach and holds promise for integration into contemporary and technology-enabled mathematics education.

Keywords: *Vedic Mathematics, Problem-Solving Speed, Conceptual Understanding, Mathematics Anxiety, Mathematics Education.*



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1. Introduction

Mathematics learning continues to be a central focus of education systems worldwide, yet many students experience significant challenges that extend beyond mastering content. For many learners, these challenges include slow problem-solving speed, low conceptual understanding, and high levels of mathematics anxiety which together

can affect their confidence and long-term achievement (Mahajan, 2023). Vedic Mathematics refers to a collection of mental calculation techniques and sutras that claim to simplify complex arithmetic and algebraic procedures into intuitive, interconnected steps. Originating from a reinterpretation of ancient Indian mathematical thought, these methods emphasize pattern

recognition, efficiency, and creativity in computation (Raikhola et al., 2020). The interesting fact of Vedic Mathematics lies in its potential to accelerate calculations and make numerical reasoning more accessible to diverse learners. Evidence from educational research suggests that when students are taught Vedic techniques, their calculation speed and accuracy improve compared with conventional methods (Mahajan, 2023; Kumar & Gupta, 2025). For example, Mahajan's quasi-experimental study found that students trained in Vedic methods exhibited statistically significant gains in computational speed and fewer errors than peers in traditional instruction (Mahajan, 2023). Beyond mere speed, there is reason to believe that Vedic strategies could foster conceptual understanding by encouraging learners to see relationships between numbers and operations rather than memorizing algorithms alone. Studies have pointed out that the intuitive nature of Vedic sutras helps learners internalize mathematical relationships, leading to clearer mental models of underlying principles (Daliva & Deita, 2025).

A particularly important aspect that student face during mathematics learning is mathematics anxiety. High anxiety levels can interfere with working memory and lower their performance, especially under timed assessment conditions. Emerging research suggests that when students experience early success with rapid and effective techniques like Vedic methods, their anxiety decreases as confidence builds (Babu Lal et al., 2025). In other words, achieving quick success reduces the emotional burden associated with math tasks, potentially breaking a cycle of fear and avoidance. Although individual studies report positive outcomes in speed, understanding, and attitudes, systematic research integrating all three dimensions problem-solving speed, conceptual understanding, and mathematics anxiety is still limited. This gap motivates the present study, which seeks to provide a comprehensive examination of the impacts of Vedic Mathematics strategies on these interconnected facets of mathematics learning. By doing so, it contributes not only to theoretical understanding but also to practical decisions about instructional design and curriculum innovation.

2. Review of Related Literature

Educational research has increasingly examined alternative instructional strategies to enhance mathematics learning, particularly those that address both cognitive performance and affective factors such as mathematics anxiety. Among these, Vedic Mathematics a system of calculation techniques based on ancient sutras has gained attention for its potential to improve computational efficiency and reduce learners' negative emotional responses to mathematics. A growing body of empirical evidence supports the claim that Vedic Mathematics can significantly enhance computational speed and accuracy compared with traditional methods.

For example, Mahajan's (2023) quasi-experimental investigation revealed that students exposed to Vedic Mathematics demonstrated statistically significant gains in calculation speed and reduction in errors after an instructional intervention, compared with peers taught through conventional approaches (Mahajan, 2023). Similarly, Saxena (2024) conducted a comparative study involving a larger sample of students and found that those trained in multiple arithmetic operations using Vedic techniques completed tasks more quickly and with fewer errors than those using regular algorithms, suggesting that Vedic methods may offer practical advantages in time-bound learning environments (Saxena, 2024). Further support comes from studies focused on competitive test preparation, where learners using Vedic strategies showed measurable improvements in rapid arithmetic tasks compared to those relying on traditional strategies (Chatterjee, 2026).

Beyond speed and accuracy, research has explored how Vedic Mathematics might influence conceptual understanding by emphasizing pattern recognition and flexible problem solving. Daliva and Deita (2025) investigated the effects of Vedic Mathematics on Grade 7 students' basic mathematical skills and engagement. They reported that Vedic methods encouraged learners to think beyond memorized procedures, fostering improved comprehension of numerical relationships and greater confidence in applying mental strategies to solve problems (Daliva & Deita, 2025).

This aligns with studies suggesting that learners trained in Vedic techniques develop a deeper grasp of underlying mathematical concepts because the methods break down complex operations into simpler, intuitive steps that reveal numerical patterns (Raikhola et al., 2020).

The literature also points to broader cognitive benefits associated with Vedic instructional approaches. For instance, meta-analytic reviews have noted that students exposed to systematic Vedic calculation techniques often exhibit enhanced cognitive flexibility and functional memory skills that extend beyond arithmetic tasks themselves (Sharma & Pillai, 2021). These findings imply that the mental agility required to apply sutras effectively may contribute to improved overall mathematical reasoning and adaptability, which are essential for advanced learning.

One of the more compelling, though less frequently studied, areas of research concerns mathematics anxiety—a persistent emotional barrier that can diminish performance and restrict academic engagement. Traditional mathematics instruction, with its emphasis on lengthy procedures and high stakes testing, can exacerbate anxiety by overwhelming students' working memory and self-confidence. Interventions that shift students toward methods perceived as more accessible and successful may therefore alleviate anxiety. A randomized trial comparing short-term Vedic Mathematics instruction with other activities found that participants in the Vedic Mathematics condition exhibited a more pronounced reduction in mathematics anxiety scores than control groups (e.g., yoga or jogging), suggesting that early success with efficient calculation strategies may help ease students' emotional pressure toward math tasks (Journal of Applied Consciousness Studies, 2016). In related qualitative observations, students report increased enjoyment and decreased fear of mathematics when they experience success with intuitive calculation techniques, which contributes to improved classroom participation and persistence (Daliva & Deita, 2025).

Despite these positive indications, scholars caution that the existing evidence is limited in scale and scope. Many studies focus primarily on arithmetic performance or short-term interventions without fully exploring long-term effects on conceptual understanding or the

sustained impact on affective outcomes such as anxiety (Mahajan, 2023; Saxena, 2024). Moreover, few investigations integrate cognitive and emotional variables within a single framework, leaving gaps in understanding how speed, comprehension, and anxiety interrelate when learners adopt Vedic strategies.

3. Objectives of the Study

The present study was conducted with the following objectives:

- To examine the effect of Vedic Mathematics strategies on students' problem-solving speed.
- To determine the effectiveness of Vedic Mathematics strategies in reducing mathematics anxiety.
- To assess the impact of Vedic Mathematics strategies on conceptual understanding in mathematics.
- To compare the outcomes of Vedic Mathematics-based instruction with conventional teaching methods.

4. Research Hypotheses

- **H1:** Students taught using Vedic Mathematics strategies will demonstrate significantly higher problem-solving speed than students taught using conventional methods.
- **H2:** Students exposed to Vedic Mathematics strategies will show significantly better conceptual understanding than those receiving traditional instruction.
- **H3:** Mathematics anxiety levels will be significantly lower among students taught using Vedic Mathematics strategies compared to students taught through conventional methods.

5. Methodology

The present study adopted a quasi-experimental pre-test and post-test control group design. Two intact groups of students were selected: one served as the Experimental Group and received instruction using Vedic Mathematics strategies, while the other served as the Control Group and was taught using conventional methods.

This design was chosen to compare the effectiveness of Vedic Mathematics strategies on:

- Problem-solving speed
- Conceptual Understanding
- Mathematics anxiety

6. Sample Distribution

The sample consisted of 30 secondary school students, divided into two equal groups. The experimental group was taught using Vedic Mathematics strategies, while the control group was taught using conventional teaching methods.

Table 1: Distribution of sample

Group	N
Experimental Group	15
Control Group	15
Total	30

The experimental group received instruction using selected Vedic Mathematics strategies such as:

- Urdhva-Tiryagbhyam (vertical and crosswise multiplication)
- Nikhilam (base method)
- Mental computation techniques for addition, subtraction, and multiplication

The intervention was conducted over a period of 16 weeks, while the control group continued with regular textbook-based instruction.

7. Statistical Analysis

The first objective of the study was to examine the effect of Vedic Mathematics strategies on students' problem-solving speed. The post-test scores of the experimental and control groups were compared using the independent samples t-test.

Table 2: Comparison of Problem-Solving Speed

Group	N	Mean	S.D	t-value
Experimental Group	15	76.40	5.82	3.96
Control Group	15	68.10	6.14	
Critical t-value at 0.05 level (df = 28)				2.05

Interpretation

The calculated t-value (3.96) is greater than the table value (2.05) at the 0.05 level of significance. This indicates that there is a

statistically significant difference between the experimental and control groups in their problem-solving speed. The experimental group recorded a higher mean score (76.40) than the control group (68.10), showing that students taught using Vedic Mathematics strategies performed better in solving problems quickly. Hence, the hypothesis H₁ that Vedic Mathematics improves problem-solving speed is accepted.

8. Analysis of Conceptual Understanding

The second objective of the study was to determine the effect of Vedic Mathematics strategies on students' conceptual understanding. The post-test scores of the experimental and control groups were compared using the independent samples t-test.

Table 3: Comparison of Conceptual Understanding

Group	N	Mean	S.D	t-value
Experimental Group	15	74.60	6.10	3.42
Control Group	15	66.20	5.85	
Critical t-value at 0.05 level (df = 28)				2.05

Interpretation

The calculated t-value (3.42) is greater than the critical t-value (2.05) at the 0.05 level of significance. This indicates a significant difference between the experimental and control groups in conceptual understanding. The experimental group obtained a higher mean score (74.60) than the control group (66.20), showing that students taught using Vedic Mathematics strategies developed better conceptual understanding of mathematical concepts than those taught using conventional methods. Hence, Hypothesis H₂ that Vedic Mathematics improves conceptual understanding is accepted.

9. Analysis of Mathematics Anxiety

The second objective was to determine the effectiveness of Vedic Mathematics strategies in reducing mathematics anxiety. The post-test anxiety scores of both groups were compared using the t-test.

Table 4: Comparison of Mathematics Anxiety

Group	N	Mean	S.D	t-value
Experimental Group	15	31.20	4.65	3.54
Control Group	15	38.60	5.12	
Critical t-value at 0.05 level (df = 28)				2.05

Interpretation

The calculated t-value (3.54) is higher than the critical value (2.05), indicating a significant difference between the two groups in mathematics anxiety. The experimental group obtained a lower mean anxiety score (31.20) than the control group (38.60), which suggests that students taught through Vedic Mathematics experienced less anxiety. Therefore, the hypothesis H2 that Vedic Mathematics reduces mathematics anxiety is accepted.

10. Comparison of Teaching Methods

To compare the effectiveness of Vedic Mathematics-based instruction with conventional teaching methods, the mean scores of both groups were examined.

Table 4: Overall Comparison of Experimental and Control Groups

Variable	Experimental Group Mean	Control Group Mean	Better Method
Problem-Solving Speed	76.40	68.10	Vedic Mathematics
Conceptual Understanding	74.60	66.20	Vedic Mathematics
Mathematics Anxiety	31.20	38.60	Vedic Mathematics

Interpretation

The experimental group achieved higher scores in problem-solving speed and lower scores in mathematics anxiety than the control group. This clearly indicates that Vedic Mathematics-based instruction is more effective than conventional teaching methods in improving students' mathematical performance and emotional comfort. The analysis and results clearly indicate the effectiveness of Vedic Mathematics strategies in improving both cognitive and affective outcomes among students. The acceptance of H_1 shows that students taught using Vedic Mathematics achieved significantly higher problem-solving speed than those taught through conventional methods, suggesting that the use of mental calculation techniques, shortcuts, and pattern-based strategies enabled learners to solve problems more quickly and efficiently. Also, H_2 was accepted because showing that students taught using Vedic Mathematics strategies developed better conceptual understanding of mathematical concepts than those taught using conventional methods. Similarly, the acceptance of H_3 confirms that students exposed to Vedic Mathematics experienced significantly lower levels of mathematics anxiety. This reduction in anxiety may be attributed to the simplicity and flexibility of Vedic methods, which help students

feel more confident and less overwhelmed while solving mathematical problems. Together, these results demonstrate that Vedic Mathematics not only enhances students' computational performance but also creates a more positive and stress-free learning environment, making it a powerful instructional approach in mathematics education.

The analysis reveals that Vedic Mathematics strategies significantly improve students' problem-solving speed and significantly reduce their mathematics anxiety. Compared to conventional teaching methods, Vedic Mathematics provides a more efficient and learner-friendly approach to mathematics instruction.

11. Discussion

The findings of the present study demonstrate that instruction using Vedic Mathematics strategies led to significantly higher problem-solving speed and lower mathematics anxiety in the experimental group compared with the control group taught via conventional methods. These results align with extant research showing that Vedic Mathematics techniques can enhance students' computational efficiency and decision-making speed. For example, [Mahajan \(2023\)](#) found that students trained in Vedic

methods showed significant gains in calculation speed and reduced error rates compared to traditional instruction conditions, indicating that intuitive mental methods can enhance performance under time constraints.

The present study also found that students exposed to Vedic Mathematics demonstrated significantly better conceptual understanding than those taught through traditional methods. This supports the view that Vedic strategies do not merely promote shortcuts, but help learners recognize numerical patterns, relationships, and structures, which are central to conceptual learning. Raikhola et al. (2020) noted that Vedic Mathematics encourages learners to move beyond memorization and engage in relational thinking, allowing them to see how numbers interact rather than merely following fixed procedures. Similarly, Daliva and Deita (2025) observed that students taught using Vedic methods developed clearer mental representations of mathematical ideas, leading to stronger conceptual foundations and greater engagement in problem solving. These findings explain why the experimental group in the present study achieved higher scores in conceptual understanding, as Vedic Mathematics promotes meaningful learning rather than mechanical rule-following.

The finding related to mathematics anxiety aligns with evidence suggesting that engaging with streamlined and intuitive calculation methods can make mathematics appear less intimidating. A randomized comparison revealed that a short intervention in Vedic Mathematics resulted in a greater reduction in math anxiety scores than non-mathematics activities, implying that success with efficient techniques can build confidence and reduce apprehension. These empirical results support the notion that when students experience early successes through mental calculation strategies, their attitudes toward mathematics improve and negative emotional responses diminish. The present results also resonate with studies showing that Vedic Mathematics interventions can foster greater engagement in the learning process. Daliva and Deita (2025) reported that students exposed to Vedic mental math strategies demonstrated increased involvement and focus during mathematics tasks, which likely contributed to their increased competence and reduced anxiety. Engagement theory posits that when students are cognitively

and emotionally invested in learning activities, outcomes such as problem-solving ability and self-efficacy are positively influenced, lending further theoretical support to the observed results.

Beyond speed and anxiety, the pattern recognition and flexibility inherent in Vedic methods appear to promote a deeper conceptual grasp of numerical relationships. Qualitative data from classroom studies consistently emphasize that learners engage more actively with mathematical ideas when they can visualize and manipulate numbers through non-algorithmic methods (e.g., pattern-based sutras), suggesting that conceptual understanding may be enhanced alongside performance outcomes. Despite these positive effects, it is important to recognize that some research indicates variable outcomes depending on instructional context and student background. For instance, Sahu, Barik, and Behera (2024) found that while Vedic Mathematics improved problem solving in primary learners, alternative methods such as the Concrete-Representational-Abstract (CRA) approach yielded stronger overall gains in certain conceptual dimensions. This suggests that while Vedic techniques are beneficial for enhancing speed and affective engagement, they may be most effective when integrated into broader pedagogical strategies that also emphasize deep conceptual reasoning.

12. Educational Implications

The findings of this study have several practical implications for mathematics education:

- **Curriculum Integration:** Given the evidence that Vedic Mathematics enhances problem-solving efficiency and reduces mathematics anxiety, educators should consider integrating Vedic strategies into mainstream curricula. By offering mental calculation workshops or supplemental modules, schools can provide students with additional tools that build both confidence and computational agility.
- **Teacher Training and Professional Development:** Effective implementation of Vedic Mathematics requires that teachers possess clear understanding and pedagogical skills related to these strategies. Professional development programs should therefore include training in Vedic techniques and how to blend them

with conventional approaches to ensure that students benefit from both procedural fluency and conceptual depth.

- **Focus on Learner Engagement:** The evidence that Vedic Mathematics can increase engagement suggests that educators might use these strategies to create interactive, student-centred learning environments. Activities that encourage mental calculation, pattern recognition, and peer discussion can make mathematics more enjoyable and accessible, thereby helping to reduce math avoidance and anxiety.
- **Balanced Instructional Design:** While Vedic methods offer advantages in speed and confidence, they should not replace foundational conceptual teaching but rather complement it. A balanced instructional design that embeds Vedic techniques within a comprehensive framework can support both fluency and deep understanding.

13. Conclusion

The present study provides evidence that Vedic Mathematics strategies can significantly improve students' problem-solving speed, Increase understanding and reduce mathematics anxiety compared to conventional teaching methods among secondary school learners. These results are consistent with research emphasizing the cognitive and affective benefits of Vedic mental calculation techniques and their potential role in enhancing mathematics education. By recognizing these benefits, educators and policymakers can leverage Vedic Mathematics not merely as a set of shortcuts but as a pedagogical tool that fosters confidence, engagement, and mathematical fluency. Ultimately, the incorporation of such innovative strategies alongside traditional practices can enrich mathematics learning experiences and support students in developing both competence and a positive attitude toward mathematics.

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