

## Effect of Using the Vedic Multiplication Technique Urdhva Tiryagbhyam Sutra (Vertical and Crosswise Method) in Enhancing Calculation Speed and Accuracy of Class V Students of Titabar Town School, Titabar, Jorhat

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### Abstract

*This research investigates the effectiveness of the Urdhva Tiryagbhyam Sutra, a Vedic mathematics technique, in enhancing multiplication skills among primary school students. Conducted over eight weeks at Titabar Town School in Jorhat District, Assam, the study involved 23 Class V students aged 10–11 years. A mixed-methods approach was adopted, utilising pre- and post-tests, weekly assessments, classroom observations, and semi-structured interviews with teachers and students to assess changes in speed, accuracy, and engagement.*

*Findings revealed statistically significant improvements in students' multiplication performance ( $t(22) = -4.42, p < .001; d = 0.92$ ) and efficiency, with average problem-solving time decreasing by nearly 5 minutes post-intervention. Additionally, qualitative results highlighted increased student motivation, greater mathematical confidence, and active classroom participation. However, initial challenges were noted in student adaptation, particularly for those with weak foundational skills.*

*The study underscores the pedagogical value of integrating culturally rooted computational strategies like Vedic mathematics into elementary curricula. To ensure successful implementation, the research recommends structured teacher training, incorporation of age-appropriate visual aids, and sustained practice through curriculum-based activities. Future investigations should include a larger and more diverse student population across longer intervention periods to validate the scalability of these outcomes.*

**Keywords-***Vedic Mathematics, Urdhva Tiryagbhyam Sutra, Speed, Accuracy, Pedagogical Innovation, Primary Education.*

### Introduction

Mathematics is a core discipline within the educational curriculum, playing a vital role in developing students' cognitive skills, logical reasoning, and problem-solving abilities. Among the basic arithmetic operations introduced in early education, multiplication is fundamental to achieving numerical fluency and building a foundation for higher-level mathematical concepts. Despite its importance, many primary school students find multiplication challenging, leading to decreased academic performance, reduced self-confidence, and negative attitudes toward mathematics (Brown & Quinn, 2006).

In response to these learning difficulties, educators are increasingly turning to alternative pedagogical strategies that enhance engagement and simplify complex concepts. One such approach is Vedic Mathematics, an ancient Indian system of mental computation that was reintroduced by Bharati Krishna Tirthaji in the early 20th century (Tirthaji, 1965). The system comprises sixteen Sutras, or mathematical formulae, each designed to provide simplified and intuitive methods for solving arithmetic problems. Among these, the Urdhva Tiryagbhyam Sutra, meaning "Vertically and Crosswise," offers a visual, pattern-based method for multiplication that allows for faster and more accurate computation (Sharma & Mehta, 2019). Its intuitive structure is particularly appealing for young learners and may improve both performance and confidence in mathematics.

The current action research explores the instructional value of the Urdhva Tiryagbhyam Sutra in the context of primary education. Specifically, the study investigates its effect on improving multiplication speed and accuracy among Class V students at Titabar Town School. It also examines students' perceptions of mathematics following instruction using this technique, along with the challenges teachers face during its implementation.

## Objectives

1. To compare students' performance in multiplication accuracy before and after instruction using the Urdhva Tiryagbhyam Sutra.
2. To assess the impact of the technique on students' multiplication speed.
3. To identify challenges faced by teachers in implementing the method.

## Hypotheses

- **H<sub>01</sub> (Accuracy):** There is no significant difference in the mean multiplication accuracy scores of students before and after instruction using the Urdhva Tiryagbhyam Sutra.
- **H<sub>02</sub> (Speed):** There is no significant difference in the mean multiplication problem-solving time of students before and after instruction.

## Literature review

The Urdhva Tiryagbhyam Sutra, one of the most prominent techniques in Vedic mathematics, has garnered increasing attention in both educational and computational research for its effectiveness in simplifying multiplication and enhancing computational speed. Originating from the ancient system rediscovered by Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaj (Tirtha & Agrawala, 1992), the method introduces a vertical and crosswise approach that enables faster and more intuitive multiplication. Scholars such as Prasad (2016) and Patel (2015) have shown that integrating Vedic techniques into classroom instruction significantly improves students' arithmetic performance, particularly in terms of speed and accuracy. Akhtar (2023) further emphasises the method's suitability for early education, citing its alignment with the New Education Policy's push toward incorporating Indian Knowledge Systems

into mainstream curricula. Supporting these findings, Prasad (2016) conducted an empirical study involving competitive examination aspirants and demonstrated that the application of Vedic methods—including multiplication techniques—led to statistically significant improvements in the speed of performing basic mathematical operations, as measured through paired t-tests. From a computational standpoint, researchers like Kanhe et al. (2012) and Ramalatha et al. (2009) have validated the algorithmic efficiency of Vedic multipliers in digital hardware, demonstrating their superiority over conventional techniques in terms of processing time and energy consumption. These studies collectively highlight the versatility of the Urdhva Tiryagbhyam Sutra, which not only simplifies mental calculation for students but also serves as a high-performance algorithm for hardware implementation. However, despite this growing interest, limited research has been conducted on the practical application of Vedic multiplication in northeastern India, particularly within government schools. This gap highlights the need for localised investigations to explore how such traditional techniques can be integrated effectively into diverse classroom settings. The current study contributes to this effort by examining the impact of the Urdhva Tiryagbhyam Sutra on the multiplication skills of Class V students in Assam, thereby extending the discourse on culturally rooted, high-speed arithmetic strategies.

## **Methodology**

### **Research Design**

This study adopted an action research framework within a pre-experimental, single-group pre- test–post-test design. Action research is a reflective and iterative process in which practitioners investigate their own educational practices to bring about improvement (Kemmis & McTaggart, 1988). This approach was chosen as the researcher, also an educator, was directly involved in implementing an intervention (the Vedic multiplication technique) within a real classroom setting to solve a practical problem—students' difficulties with multiplication—while simultaneously contributing to pedagogical knowledge. The cyclical process of planning (designing the intervention), acting (teaching the sutra), observing (collecting data), and reflecting (analysing results) aligns with the action research paradigm.

This study evaluates the effectiveness of the Urdhva Tiryagbhyam Sutra—a Vedic multiplication technique—in enhancing multiplication skills among primary school students. The intervention was conducted over eight weeks at Titabar Town School in Jorhat District, Assam.

### **Participants**

A total of 23 students from Class V, aged 10–11 years, participated in the study. Participants were selected using purposive sampling, based on teacher-identified challenges in mastering traditional multiplication methods. This ensured the intervention addressed the needs of learners who stood to benefit most from alternative instructional approaches. In addition to the student participants, the two mathematics teachers responsible for instructing Class V at Titabar Town School were included as

key informants for the qualitative component of the study. Their direct involvement in the classroom provided invaluable insights into the practical implementation and reception of the intervention. Semi-structured interviews were conducted with them to gather data on perceived benefits, student engagement, and instructional challenges.

### **Procedure**

A mixed-methods approach was adopted to capture both quantitative and qualitative data on the intervention's effectiveness. Prior to data collection, the study received approval in accordance with institutional ethical standards. Informed consent was obtained from the students' parents or guardians, and assent was secured from all student participants. Participation was entirely voluntary, and all responses were handled with strict confidentiality.

Quantitative data were collected through structured pre-tests and post-tests that measured changes in multiplication accuracy and calculation speed. Weekly assessments were administered to reinforce the technique and track ongoing progress. Data were analysed using a paired sample t- test to evaluate statistically significant differences between pre- and post-test scores.

Qualitative data were gathered through classroom observations, which documented engagement levels, problem-solving behaviour, and instructional interaction. Additionally, semi-structured interviews with mathematics teachers provided insight into their experiences with the technique, including perceived benefits and instructional challenges.

By integrating both cognitive and affective measures, this triangulated approach offered a comprehensive evaluation of the Urdhva Tiryagbhyam Sutra's pedagogical value, while also acknowledging limitations related to sample size and study duration.

### **Results and Analysis**

This study evaluated the impact of an educational intervention on both test performance and test-taking efficiency using pre-test and post-test data from 23 students.

#### **1. Test Performance Improvement**

A paired-samples t-test was conducted to evaluate the impact of an educational intervention on student performance by comparing pre-test and post-test scores. The mean pre-test score was 5.91 (SD = 4.15), and the mean post-test score was 8.17 (SD = 5.10), yielding an average improvement of 2.26 points.

Normality of the difference scores was verified using the Shapiro–Wilk test,  $W = 0.94$ ,  $p = 0.17$ , confirming the appropriateness of parametric testing.

The paired t-test revealed that the increase in scores was statistically significant,  $t(22) = -4.42$ ,  $p < .001$ . The effect size was large,  $d = 0.92$  (Cohen, 1988), and the Pearson correlation between pre- and post-test scores was strong,  $r = 0.88$ , indicating consistency in performance improvement.

This suggests that the intervention had a strong positive impact on student learning outcomes.

## 2. Test-Taking Time Efficiency

To assess changes in test-taking efficiency, a Wilcoxon signed-rank test was applied due to non-normality in the difference scores ( $W = 0.90$ ,  $p = .024$ ). Students took an average of 39.43 minutes to complete the pre-test and 34.65 minutes for the post-test, resulting in a mean time savings of 4.78 minutes ( $SD = 3.80$ ).

The test indicated a statistically significant reduction in time,  $W = 0.00$ ,  $p < .001$ . This suggests that, in addition to improving their performance, students became more efficient and likely more confident in completing the assessment tasks after the intervention.

**Table-1**  
**Summary of Performance and Time Efficiency Results (N = 23)**

Measure	Pre-Test	Post-Test	Difference	Test Statistic	p-value	Effect Size
Score (M ± SD)	5.91 ± 4.15	8.17 ± 5.10	2.26	t(22) = -4.42	< .001	d = 0.92
Time (M±SD, minutes)	39.43 ± 2.02	34.65 ± 4.91	-4.78	W = 0.00	< .001	—

Note- Effect size d based on Cohen's convention. Wilcoxon test used due to non-normal time difference distribution.

## 3. Teachers' Responses on the Vertical and Crosswise Method

The two Class V mathematics teachers, who were involved in the study, were interviewed regarding their observations. Both educators acknowledged the effectiveness of the Vedic Vertical and Crosswise method in enhancing students' speed and interest in multiplication tasks. They reported that the technique fostered greater enthusiasm, especially among average and high-performing students, and served as a motivational tool in math instruction. However, both educators also identified significant challenges. One teacher emphasised the abstract nature of the method, noting difficulties in conceptual understanding among younger learners. The other teacher expressed concern over its limited accessibility for students with weaker foundational skills and highlighted the need for appropriate teaching aids and training. Overall, both teachers supported its use as a supplementary method, rather than a primary instructional approach, in the Class V curriculum.

## Discussion and Conclusion

The results of this study indicate that the implementation of the Urdhva Tiryagbhyam Sutra, a Vedic multiplication technique, had a significant impact on both the speed and accuracy of Class V students' multiplication performance. Quantitative

data revealed a marked improvement in post- test scores compared to pre-test scores, supported by a statistically significant t-value and p-value ( $p < .001$ ). In terms of speed, the reduction in average completion time from 39.43 to 34.65 minutes further demonstrated the effectiveness of the technique in enhancing computational efficiency.

These findings align with earlier studies (Prasad, 2016; Patel, 2015) that have emphasised the benefits of Vedic mathematics in improving arithmetic performance. Moreover, qualitative feedback from teachers and classroom observations underscored increased student engagement, reduced anxiety, and heightened confidence in mathematics following exposure to the technique.

While the intervention showed promising outcomes, some students initially struggled to adapt to the new method, highlighting the need for structured teacher support and additional practice opportunities. The brief eight-week intervention period, while effective for this initial study, represents a limitation and prevented the exploration of other Vedic techniques or long-term retention.

In conclusion, the Urdhva Tiryagbhyam Sutra presents a culturally relevant, pedagogically effective alternative to traditional multiplication methods. Integrating such techniques into elementary curricula, along with targeted teacher training and continuous student practice, can play a critical role in improving foundational mathematical skills. Future research should investigate the long-term effects of Vedic methods and their applicability to other mathematical operations across diverse educational settings.

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