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AN EMPIRICAL STUDY ON ROLE OF VEDIC MATHEMATICS FOR IMPROVING OBSERVATIONAL ABILITY AMONG THE HIGH SCHOOL STUDENTS

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Abstract**:** In today's mathematics classrooms, students often struggle with lengthy and time-consuming calculations that affect both accuracy and confidence. While various strategies have been introduced to enhance computational skills, the potential of Vedic Mathematics remains underexplored at the secondary school level. Addressing this gap, the present study examines the impact of Vedic methods on minimizing calculation time and improving observational ability among Grade IX students when solving cube root problems. A sample of 80 students was trained to solve cube roots using both conventional and Vedic approaches. The time taken (in minutes) for each method was recorded and analyzed using a paired t-test, revealing a statistically significant reduction in calculation time with the use of Vedic techniques. The findings demonstrate that methods such as digital roots and pattern-based estimation foster active observation, logical reasoning, and deeper engagement with numbers. Thus, integrating Vedic Mathematics into regular pedagogy not only accelerates computational speed and minimizes time but also promotes meaningful mathematical understanding and learner confidence.

Keywords: *Vedic Mathematics, Vilokanam, Observational Ability, Traditional Method, Calculation Speed and High School Students.*

INTRODUCTION

Mathematics serves as the foundation for logical reasoning, analytical thinking, and problem-solving skills essential for academic and real-life success. However, many students perceive mathematics as difficult and time-consuming, largely due to conventional teaching methods that emphasize memorization and lengthy procedures. This challenge highlights the need for innovative strategies that make mathematical learning both effective and enjoyable. Originating from ancient Indian traditions and later organized by Swami Bharati Krishna Tirthaji, Vedic Mathematics introduces sixteen core formulas (sutras) and several sub-rules that enable simplified and faster arithmetic operations. Such methods enhance computational fluency and accuracy while motivating learners to actively explore numerical relationships instead of depending on mechanical memorization. A central aspect of Vedic Mathematics is Vilokanam—the power of keen observation—which enables students to recognize numerical relationships and apply logical reasoning instantly. When applied to operations such as finding cube roots, Vedic methods guide learners to identify patterns in the last digits, deduce cube bases, and determine results swiftly through reasoning rather than repetition. In contrast to traditional methods that often limit creative thinking, Vedic Mathematics integrates observation, intuition, and

analysis, fostering both cognitive engagement and mathematical confidence. Despite its potential, research exploring the effect of Vedic techniques on students' calculation speed, time efficiency, and observational ability remains limited, especially at the secondary school level. Therefore, this study aims to examine the impact of Vedic methods on improving the calculation speed and observational ability of Grade IX students, thereby addressing a significant gap in mathematics education.

REVIEW OF LITERATURE

Several studies have highlighted the effectiveness of Vedic Mathematics in enhancing students' mathematical performance and cognitive skills. According to Reddy (2014), students who practiced Vedic Mathematics demonstrated better speed and accuracy in arithmetic than peers taught through conventional instruction. Similarly, Kumar and Rani (2016) observed that when Vedic strategies were incorporated into regular lessons, students became more engaged and self-assured in solving mathematical problems. *Sharma (2018)* emphasized that the use of sutras promoted mental flexibility and reduced dependency on calculators, enabling learners to perform quick mental calculations. In a study by *Patel and Singh (2020)*, students applying Vedic methods demonstrated better retention and understanding of mathematical concepts, suggesting that these techniques enhance both computation and comprehension. Furthermore, *Das and Thomas (2022)* examined the role of Vedic Mathematics in developing observational and analytical skills, noting that students became more adept at recognizing numerical patterns and relationships. Despite these findings, few studies have specifically examined the impact of Vedic methods on cube root calculations and their role in improving observational ability and time efficiency among Grade IX students in government schools. This gap highlights the need for the present study, which seeks to explore how Vedic Mathematics can enhance calculation speed, minimize computation time, and strengthen observational skills in secondary-level learners.

OBJECTIVES OF THE STUDY

1. To determine the extant level of observational ability among Grade IX students enrolled in Government schools.
2. To develop, implement, and evaluate the feasibility of integrating the Vedic Mathematics methodology as a targeted intervention for enhancing the observational ability of Grade IX students.
3. To quantify the differential effect of the implemented Vedic Mathematics intervention on the improvement of observational ability among the participating Grade IX students.
4. To assess the direct impact of the Vedic Mathematics methodology on the calculation speed and computational efficiency of Grade IX students.
5. To examine the relationship between the pre-test and post-test scores of the experimental group based on their calculation speed.

OPERATIONAL DEFINITIONS

1. Vedic Mathematics:

Vedic Mathematics refers to a set of ancient Indian mathematical techniques derived from the *Vedas*, designed to simplify and speed up arithmetic calculations. In this study, it specifically includes methods for finding cube roots using sutras such as pattern observation and digital roots.

2. Vilokanam:

Vilokanam means "observation" in Sanskrit. In this study, it refers to the students' ability to observe number patterns, identify relationships, and apply logical reasoning while solving mathematical problems using Vedic techniques.

3. Observational Ability:

Observational ability refers to the skill of carefully noticing, identifying, and understanding patterns or relationships between numbers. In this study, it is measured by how effectively students recognize patterns while solving cube root problems.

4. Traditional Method:

The traditional method refers to the conventional mathematical approach taught in schools for solving cube roots, which involves step-by-step division or factorization without the use of Vedic techniques.

5. Calculation Speed:

Calculation speed refers to the amount of time a student takes to perform mathematical computations accurately. A shorter time indicates a higher calculation speed.

6. High School Students:

In this study, high school students refer to learners studying in Grade IX and Xin schools, who participated in the research as the sample group.

RESEARCH METHOD

The present study was conducted in three phases:

Phase 1: Pre-Test

The pre-test was conducted to assess the students' observational ability in mathematics.

Phase 2: Intervention (Training)

Students were trained through Vedic Mathematics techniques to enhance their observational ability in mathematics.

Phase 3: Quasi-Experimentation

The study adopted a quasi-experimental pre-test–post-test design to evaluate how Vedic Mathematics methods influence ninth-grade students' observational skills and computational speed.

METHODOLOGY

- **Design of the study**

Quasi- Experimental design. Pre-Post-test equivalent group design.

- **Subject: Sample design of the study**

The study involved a sample of 80 IX standard students from a Government school in the Karur district. The sample was divided into two groups: an experimental group and a control group. The study sample was evenly distributed across all categories to maintain balance and comparability. Both the experimental and control groups consisted of 10 boys and 10 girls from Tamil medium and 10 boys and 10 girls from English medium. In total, the sample included 20 boys and 20 girls from each medium, ensuring equal representation for reliable and unbiased analysis.

RESEARCH TOOLS

To achieve the objectives of the study, the investigator developed and validated the following tool. An Observational Ability Test consisting of 20 questions was prepared to assess the students' ability to observe and identify numerical patterns. Item analysis was conducted to ensure the quality of the tool by determining the difficulty level, discrimination power, and distractor efficiency of each item.

DATA COLLECTION

This Experimental investigation was executed at the Government High School, Andankovil East, Karur district, following official institutional clearance. Adopting a robust experimental design, the study utilized a total sample size of 80 high school students (40 boys, 40 girls). Participants, drawn equally from both Tamil and English mediums of instruction, were systematically divided into two groups: Experimental (n=40) and Control (n=40).To establish baseline equivalence, a validated Observational Ability Pre-Test (comprising 20 items, scored out of 100 marks, with a 60-minute time limit) was administered to both groups. The Experimental group subsequently received a structured Vedic Mathematics intervention specifically focusing on cube root calculation, delivered through targeted practice exercises and worksheets. Conversely, the Control group was instructed using conventional pedagogical methods. Upon completion of the intervention phase, an identical Post-Test was administered. Performance metrics, namely the raw score and completion time, were meticulously documented for both testing phases. The collected data were then subjected to rigorous statistical analysis, employing techniques such as the paired samples t-test, to quantitatively evaluate the efficacy of the Vedic methods in enhancing student observational ability and improving the efficiency of cube root calculation.

STATISTICAL TECHNIQUES

Statistical techniques used for analyzing the data were

1. *Descriptive Analysis* – Mean and Standard Deviation
2. *Differential Analysis*-Paired "t"- test
3. *Relational Analysis* - "r" Correlation co-efficient.

DATA ANALYSIS

To ensure the fidelity and methodological rigor of the statistical inferences, external consultation with expert statisticians was secured for the data analysis phase. Following the implementation of all requisite data

safeguards and cleaning procedures, the empirical data were systematically classified and analyzed across three distinct levels: descriptive, differential, and correlation. In the descriptive analysis, measures such as the mean and standard deviation were calculated to summarize the data. To determine the significance of differences between the two groups, the t-test was employed. The results and findings are presented in tabular form for clarity. Additionally, to examine the relationship between values and academic achievement**,** thePearson product-moment correlation coefficient (r) was calculated.

DESCRIPTIVE ANALYSIS

The section deals with descriptive analysis of the whole sample.

Table 1

The mean score percentage of the Pre-test and Post-test scores of Control and Experimental group students based on Observational Ability

Ability	Control group Mean Score		Gain Score of Control group	Experimental group Mean Score		Gain Score of Experimental group
	Pre-test	Post-test		Pre-test	Post-test	
Observational Ability	19.25	19.75	0.5	20	38.75	18.75

The results presented in Table 1 indicate a marked enhancement in the observational ability of the experimental group, showing a 93.75% improvement compared with only a 2.60% increase in the control group. The mean score of the experimental group rose from 20.00 to 38.75, whereas the control group's mean score showed only a minimal increase from 19.25 to 19.75. These findings suggest that the intervention produced a substantial positive effect on students' observational ability.

DIFFERENTIAL ANALYSIS

I. Comparison of Pre-test scores and Calculation Speed of Experimental and Control Group Students:

Mean and standard deviation of the Pre-test scores and Calculation speed of Experimental and Control group students and the calculated t-values are given in Table 2

Table 2

Mean and standard deviation of the Pre-test scores and Calculation speed of Experimental and Control group students based on Observational Ability

Observational Ability	Pre-test score			Level of Significance	Calculation Speed			Level of Significance
	Mean	S. D	t-value		Mean (in minutes)	S.D	t-value	
Experimental Group	48.75	17.63	0.16	Not Significant	58.78	2.56	0.9	Not Significant
Control Group	48.13	18.02			57.33	1.85		

The pre-test results revealed that there was no significant difference between the experimental and control groups in either observational ability or calculation speed. The mean scores for observational ability were 48.75 and 48.13, respectively, with a calculated t-value of 0.16, indicating statistical similarity between the groups. Likewise, the mean calculation speeds were 58.78 minutes for the experimental group and 57.33 minutes for the control group, with a calculated t-value of 0.90, which also falls below the critical value at the 0.05 level. These findings suggest that both groups were equivalent in their initial performance levels, confirming that any differences observed in subsequent post-test scores could be attributed to the experimental intervention rather than pre-existing disparities.

Research Question:

❖ **Is there any significant difference between the pre-test mean scores and calculation speed of the experimental and control group students?**

The t-values for both the pre-test mean scores (t = 0.16) and the pre-test calculation speed (t = 0.90) are lower than the table value of 1.99 at the 0.05 level, indicating that there is no significant difference between the experimental and control group students in either observational ability or calculation speed before treatment. This confirms that both groups were statistically equivalent in their initial performance levels prior to the intervention, ensuring the validity of subsequent comparisons in the post-test results.

II. Comparison of Pre-test and Post-test scores and Calculation speed of Experimental group students:

Mean and standard deviation of the Pre-test and Post-test scores and Calculation speed of Experimental group students and the calculated t-values is given in table 3

Table 3

Mean and standard deviation of Pre-test and Post-test scores and Calculation Speed of Experimental group

Experimental group	Pre-Test		Post-test		t value	Level of Significance
	Mean	SD	Mean	SD		
Scores	48.75	17.63	96.88	8.27	15.63	Significant
Calculation Speed (in Minutes)	58.78	2.56	27.38	4.44	38.75	

Findings from the experimental group revealed notable progress between the pre-test and post-test, reflected in both improved observational scores and faster calculation times. The mean score increased markedly from 48.75 (SD = 17.63) in the pre-test to 96.88 (SD = 8.27) in the post-test, with a calculated t-value of 15.63, demonstrating a statistically significant enhancement in performance. Similarly, the mean calculation speed improved considerably, decreasing from 58.78 minutes (SD = 2.56) in the pre-test to 27.38 minutes (SD = 4.44) in the post-test, with a calculated t-value of 38.75, which is highly significant. These findings suggest that the experimental treatment or intervention was highly effective in improving both the observational ability and calculation speed which minimized their calculation time of students in the experimental group.

Research Question:

❖ **Is there any significant difference between the pre-test and post-test scores and calculation speed of the experimental group students when taught through Vedic Mathematics techniques?**

The calculated t-values for both the observation ability scores (t = 15.63) and calculation speed (t = 38.754) are higher than the table value of 1.99 at the 0.05 level, indicating a significant difference between the pre-test and post-test results of the experimental group students. This shows that teaching through Vedic Mathematics techniques had a positive impact on students' performance, leading to a significant improvement in both their observational ability and problem-solving calculation speed. Furthermore, the computing speed of the experimental group students was considerably faster in the post-test compared to the pre-test, confirming the effectiveness of Vedic Mathematics in enhancing both accuracy and speed in mathematical computations.

III. Comparison of Post-test scores and Calculation speed of Experimental and Control group:

Mean and standard deviation of the Post-test scores and Calculation speed of Experimental and Control group and the calculated t-values is given in Table 4.

Table 4

Observational Ability	Post Test score			Calculation Speed		
	Mean	S. D	Calculated t-value	Mean (in minutes)	S. D	Calculated t-value
Experimental Group	96.88	8.27	15.46	27.38	3.31	40.23
Control Group	55	15		57.88	1.82	

Mean and standard deviation of Post-test scores and Calculation speed of Experimental and Control group based on Observational Ability

The post-test results reveal a substantial difference between the experimental and control groups in both observational ability and calculation speed. The experimental group achieved a much higher mean score of 96.88 (SD = 8.27) compared to the control group's mean of 55 (SD = 15), with a calculated t-value of 15.46, which is significantly higher than the critical value of 1.99 at the 0.05 level. Similarly, in calculation speed, the experimental group recorded a mean time of 27.38 minutes (SD = 3.31), considerably lower and faster than the control group's mean of 57.88 minutes (SD = 1.82), with a calculated t-value of 40.23, also exceeding the critical value. These results indicate that the experimental group students performed significantly better in both observational ability and calculation speed which minimized their calculation time, after being taught through Vedic Mathematics techniques, demonstrating the effectiveness of the intervention in enhancing mathematical performance and efficiency.

Research Question:

❖ **Is there any significant difference between the post-test mean scores and calculation speed of Experimental and Control group students?**

The calculated t-values for both the post-test mean scores (t = 15.46) and calculation speed (t = 40.23) are higher than the table value of 1.99 at the 0.05 level, indicating a significant difference between the control and experimental group students. The experimental group, taught through Vedic Mathematics techniques, demonstrated significantly higher post-test scores in observational ability and a remarkable improvement in calculation speed, with a noticeable reduction in computation time compared to the control group. These findings confirm that the application of Vedic Mathematics effectively enhanced both the accuracy and speed of the experimental group students, making them more efficient in solving mathematical problems.

RELATIONSHIP STUDIES

IV. Correlation between the Pre-Test, Post-Test scores and calculation Speed of Experimental group students:

Correlation between the Pre-Test**,** Post-Test scores and calculation speed of Experimental group students' values is given in table 5

Table 5

Correlation between Pre-Test and Post-Test scores and their calculation Speed of Experimental group students

S. No.	Experimental group	Number	Mean score		'r' Value	Level of significance	Strength of correlation
			Observational Ability	Speed (in minutes)			
1	Pre-Test	40	48.75	58.78	- 0.26	0.01	Weakly negative
2	Post-Test	40	96.88	27.38	- 0.17	0.01	Weakly negative

The correlation analysis between observational ability and calculation speed in the experimental group was carried out for both the pre-test and post-test phases. During the pre-test, the mean score for observational ability was 48.75**,** and the mean calculation speed was 58.78 minutes, producing a correlation coefficient (**r**) of –0.26**,** which was significant at the 0.01 level. In the post-test, the mean observational ability increased to96.88**,** while the mean calculation speed improved to 27.38 minutes**,** yielding an r-value of –0.17, also significant at the 0.01 level. These outcomes demonstrate a weak but significant negative correlation between observational ability and calculation speed in both assessments. The findings suggest that as students' observational skills improved, their calculation time decreased and indicating enhanced mental efficiency. Furthermore, the results implied that Vedic Mathematics training positively influenced cognitive processing, fostering faster problem-solving without a strong inverse dependence between the two variables.

Research Question:

❖ **Is there any significant relationship between the pre-test and post-test scores of Observational ability and calculation speed (in minutes) of experimental group students?**

The analysis revealed that there was a significant relationship between the pre-test and post-test scores of Observational Ability and calculation speed among the experimental group students at the 0.01 level of significance. In both cases, the strength of the correlation was weakly negative, indicating that as students' observational ability increased, their calculation time decreased slightly. This suggests that improvement in observational skills was modestly associated with faster calculation performance, reflecting the positive influence of Vedic Mathematics training on students' cognitive efficiency and problem-solving speed.

EDUCATIONAL IMPLICATIONS OF THE STUDY

1. **Enhanced Problem-Solving Efficiency-** By promoting rapid and accurate computation, Vedic Mathematics supports mental agility and strengthens conceptual comprehension.. Studies confirm these techniques enable students to solve complex problems rapidly and confidently.
2. **Improved Exam Performance & Confidence-**By enhancing calculation fluency, Vedic Math helps students perform better in all type of exams builds self-confidence, and promotes mathematical literacy.
3. **Cognitive Skills Development-** Regular practice with these techniques sharpens concentration, memory, analytical thinking, creativity, and mental agility. It is a key to cognitive growth.
4. **Curricular Integration required-** To maximize these advantages, educational curricula should be adapted to include Vedic techniques in parallel with conventional methods, achieving a balance between accuracy and creativity.
5. **Teacher Training & Ongoing Support-** Effective implementation depends on equipping educators through training, professional development, and integrating these methods into teacher preparation programs.
6. **Lifelong Mental Abilities & STEM Readiness-** Mastering quick mental computation lays the groundwork for lifelong critical thinking, adaptability, and readiness for STEM-related studies and challenges.

SUGGESTIONS

- Future studies can explore how Vedic Mathematics skills are retained over time and their long-term impact on students' academic performance in mathematics and other STEM subjects.
- Researchers may examine the applicability of Vedic Mathematics techniques to problem-solving in subjects such as physics, computer science, engineering, and economics.
- It is suggested to assess teachers' attitudes toward Vedic Mathematics, including their perceptions of its usefulness and their readiness to incorporate it into the regular curriculum.
- The integration of technology-based tools, such as visualization or interactive platforms, can be explored to enhance the teaching and learning of Vedic Mathematics.
- Comparative studies can be conducted between Vedic Mathematics and other innovative teaching methods, such as Montessori, inquiry-based, and problem-based learning, to evaluate their relative effectiveness in improving observation and problem-solving skills.
- Further research can investigate the adaptability and effectiveness of Vedic Mathematics in educational systems outside India to understand its global transferability and cross-cultural relevance.

CONCLUSION

The findings of this study indicate that instruction through Vedic Mathematics substantially enhances students' pattern recognition, computational accuracy, and cognitive flexibility. Learners trained in Vedic techniques demonstrated not only improved speed and precision in mathematical tasks but also greater confidence and numeracy competence. These results underscore the effectiveness of Vedic Mathematics as acognitive enrichment tool, promoting advanced analytical reasoning and adaptive thinking. The pedagogical implications are significant: incorporating Vedic strategies into mainstream mathematics education can foster deeper conceptual understanding, strengthen observational and critical thinking, and provide effective support for students facing challenges with conventional approaches. To optimize these benefits, systematic teacher professional development and thoughtful curriculum integration are recommended. Moreover, future studies should examine the sustainability and transferability of these skills across STEM domains and investigate how blending Vedic methodologies with digital learning environments can further enhance mathematical proficiency and engagement.

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