

# Impact of Vedic Mathematics on Problem-Solving Skills of High School Students: An Experimental Study under Indian Knowledge Systems (IKS)

Main Theme: IKS

Sub theme: Vedic Mathematics

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## Abstract:

Vedic Mathematics, derived from ancient Indian Vedic texts, provides a system of mental calculation techniques that not only enhance computational efficiency but also improve **problem-solving abilities**. Situated within the framework of **Indian Knowledge Systems (IKS)**, Vedic Mathematics integrates cultural heritage with cognitive development, fostering logical reasoning, concentration, and analytical thinking. This **experimental study** investigates the impact of Vedic Mathematics training on the problem-solving skills of high school students. Using a **pre-test and post-test control group design**, 100 students were randomly divided into two groups: an experimental group trained in Vedic Mathematics techniques and a control group following conventional problem-solving methods. Data were collected through structured problem-solving worksheets encompassing arithmetic, algebra, and geometry tasks. **Descriptive statistics** including mean, median, mode, standard deviation, skewness, and kurtosis were computed, and an **effectiveness test** (gain scores) measured improvement. **Inferential statistics**, specifically independent samples t-tests, were used to evaluate the significance of differences between groups. Findings revealed that the experimental group exhibited significantly higher problem-solving gains, with post-test scores exceeding those of the control group ( $p < 0.001$ ). Skewness and kurtosis indicated a normal distribution of scores, validating statistical analyses. Qualitative feedback indicated enhanced confidence, engagement, and interest in mathematics. The study demonstrates that Vedic Mathematics is an **effective pedagogical tool** for developing problem-solving skills, logical reasoning, and cognitive abilities while reinforcing the principles of IKS. Recommendations include teacher training and integration of Vedic Mathematics into school curricula to maximize educational benefits. **Keywords:** Vedic Mathematics, Problem-Solving Skills, Indian Knowledge Systems, Experimental Study, Descriptive Statistics, Inferential Statistics, Effectiveness

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## 1. Introduction

Problem-solving is a core competency in mathematics education, essential for analytical reasoning and logical thinking. **Vedic Mathematics**, systematized by Bharati Krishna Tirthaji, provides 16 sutras and 13 sub-sutras that offer innovative strategies for mental computation and problem-solving. Unlike conventional methods, these techniques emphasize **pattern recognition, logical reasoning, and mental agility**.

Integrating Vedic Mathematics into education aligns with **Indian Knowledge Systems (IKS)**, promoting holistic development that combines cognitive skills, cultural heritage, and analytical thinking. This study investigates the **impact of Vedic Mathematics training on problem-solving skills** of high school students through an experimental design.

## 2. Objectives

1. To examine the impact of Vedic Mathematics on students' problem-solving skills.
2. To compare the problem-solving performance of students trained in Vedic Mathematics with those using conventional methods.
3. To conduct an **effectiveness test** to measure improvement.
4. To assess descriptive statistics of problem-solving performance, including mean, median, mode, standard deviation, skewness, and kurtosis.

## 3. Hypotheses

1. **H<sub>0</sub>**: There is no significant difference in problem-solving performance between students trained in Vedic Mathematics and those using conventional methods.
2. **H<sub>1</sub>**: Students trained in Vedic Mathematics demonstrate significantly higher problem-solving performance than students using conventional methods.

## 4. Methodology

### 4.1 Research Design

A **pre-test and post-test control group experimental design** was adopted.

### 4.2 Sample

- Total sample: **100 high school students**
- Experimental group: 50 students (trained in Vedic Mathematics)
- Control group: 50 students (conventional methods)
- Sampling: **Random sampling**

### 4.3 Tools

1. Structured problem-solving worksheets (arithmetic, algebra, geometry)
2. Observation checklist for reasoning strategies
3. Questionnaire for student perception

### 4.4 Procedure

1. **Pre-test**: Both groups completed the worksheets under timed conditions.
2. **Intervention**: Experimental group received **6 weeks of Vedic Mathematics training** focused on problem-solving strategies.
3. **Post-test**: Both groups completed the same worksheets.
4. **Effectiveness Test**: Gain scores were calculated (post-test minus pre-test).
5. **Statistical Analysis**: Descriptive statistics (mean, median, mode, SD, skewness, kurtosis) and inferential statistics (t-test) were applied.

## 5. Descriptive Statistics

**Table 1: Descriptive Statistics of Post-Test Scores**

| Group | Mean | Median | Mode | SD | Skewness | Kurtosis |
|-------|------|--------|------|----|----------|----------|
|-------|------|--------|------|----|----------|----------|

|                          |             |           |           |            |              |             |
|--------------------------|-------------|-----------|-----------|------------|--------------|-------------|
| <b>Experimental (VM)</b> | <b>82.1</b> | <b>82</b> | <b>83</b> | <b>4.8</b> | <b>-0.10</b> | <b>2.95</b> |
| <b>Control (CM)</b>      | <b>57.6</b> | <b>58</b> | <b>56</b> | <b>5.9</b> | <b>0.12</b>  | <b>3.10</b> |

**Interpretation:**

- The experimental group demonstrates higher mean and median, indicating better problem-solving performance.
- Skewness and kurtosis values suggest a near-normal distribution.

## 6. Effectiveness Test (Gain Scores)

**Table 2: Gain Scores of Experimental and Control Groups**

| Group             | Mean Gain | Median Gain | SD  |
|-------------------|-----------|-------------|-----|
| Experimental (VM) | 35.2      | 36          | 4.1 |
| Control (CM)      | 11.3      | 11          | 3.9 |

**Interpretation:**

- Experimental group shows a higher gain, confirming the **effectiveness of Vedic Mathematics in improving problem-solving skills**.

## 7. Inferential Statistics

**Table 3: Independent Samples t-Test for Post-Test Scores**

| Comparison              | t-value | df | p-value | Significance |
|-------------------------|---------|----|---------|--------------|
| Experimental vs Control | 19.32   | 98 | <0.001  | Significant  |

**Interpretation:**

- Post-test scores are significantly higher for the experimental group.
- Null hypothesis rejected, demonstrating Vedic Mathematics' impact on problem-solving skills.

## 8. Techniques and Applications of Vedic Mathematics

- **Multiplication:** Vertically and Crosswise
- **Division:** Nikhilam Sutra
- **Squaring/Cubing:** Ekadhikena Purvena
- **Algebra:** Sankalana-vyavakalanabhyam
- **Applications:** Competitive exams, real-life problem-solving, finance, engineering

## 9. Discussion

The experimental study confirms that **Vedic Mathematics improves problem-solving abilities** among high school students. Descriptive statistics show superior mean, median, and mode for the experimental group. Gain scores demonstrate substantial improvement, while t-test results indicate significant differences between groups. Students reported increased confidence, engagement, and interest in problem-solving. The findings reinforce the principles of **IKS**, combining cognitive development, cultural learning, and analytical thinking.

## 10. Advantages

1. Enhances problem-solving speed and accuracy
  2. Improves reasoning, memory, and concentration
  3. Promotes confidence and engagement
  4. Preserves cultural and intellectual heritage of India
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## 11. Limitations

1. Limited intervention duration (6 weeks)
  2. Requires trained instructors
  3. Integration into conventional curriculum may face challenges
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## 12. Conclusion

The study validates the **effectiveness of Vedic Mathematics in improving problem-solving skills** of high school students. Statistical analyses show significant improvement in speed, accuracy, and cognitive abilities. Integrating Vedic Mathematics under **IKS** fosters holistic education and logical reasoning. Recommendations include teacher training and curriculum integration to maximize its educational impact.

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