

Vedic Mathematics: Improving Speed of Basic Mathematics

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ABSTRACT

Vedic Mathematics is an Indian ancient system of mathematical calculations or operations techniques developed in the year of 1957 with 16 Sutra's (formulae) and 13 sub-Sutra's (sub-formulae). In competitive examinations, students find difficult to solve the aptitude questions effectively with very less or small time durations. Even though students are able to understand the problem, they are not able to speedup calculation process. In this paper some basic mathematical calculations, multiplication, square root, cube root and subtraction of fractional decimal numbers are distributed to a group of 26 students, whom are competitive examination writing students and told to solve questions without and with using Vedic methods techniques. The time taken to complete the calculations are taken in terms of minutes before and after adopting Vedic method's techniques and are analyzed using paired t-test. This paper could able to find that Vedic method significantly improves the speed of calculations while performing some basic mathematical operations. Wish this paper could play an active and supportive role in actual research of Vedic mathematics and techniques to improve the speed of calculations especially while writing any competitive examinations.

Keywords: Vedic Mathematics, T-test, Quantitative aptitude.

I. Introduction:

Veda is Sanskrit word which means "Knowledge". Vedic mathematics is the name given to Indian ancient system of mathematics, or set of some precise rules with which any arithmetic, algebraic, geometry or trigonometry problems can be easily solved. The system is based on 16 Vedic sutras, which are set of word formulae describing steps or logic involved while solving whole range of mathematical problems, which are considered as very difficult or cumbersome in traditional method. Vedic mathematics was initially rediscovered from Indian scriptures between the years 1911 to 1918 and fully developed in 1957 by Jagadguru Sri Bharathi Krishna Thirthaji Maharaja, a scholar of Sanskrit, Mathematics and philosophy.

The students who faces competitive examinations like Bank Probationary officers exam, IBPS exams, FDA, SDA, Bank Clerks examinations in India finds difficulty in order to solve aptitude or reasoning problem questions. The Vedic mathematics has mainly 16 formulas which can

solve some basic mathematical operations like, multiplication of 5 digit numbers, multiplication of numbers near to base, square, square root, cube, cube root, calendar problem, subtraction and division. These methods can be considered as shortcut methods and which will dramatically reduce the burden of competitive examinations reasoning problems and also students can able to solve more no of problems within a short duration of time.

In this paper an empirical study is conducted to know whether a Vedic mathematics technique improves the speed of basic mathematical operations. A set of mathematical questions are distributed to competitive examinations writing students before and after adopting Vedic mathematics techniques. The basic mathematical operations includes square root, cube root, multiplication of 4 digit numbers, multiplication of numbers near to base, subtraction using the rule all from nine and last from ten. The time taken by the students before and after adopting Vedic methods is noted down in terms of minutes. Initially hypothesis is constructed and is evaluated as significant or not with the help of paired t-test. This paper finds that Vedic method significantly improves the speed of calculations while performing some basic mathematical operations.

Related research

There is only few related study on role of Vedic Mathematics in improving speed of basic mathematical operations or calculations are available in literature. The Vedic mathematics system has become popular even outside of India. In 1981, some British mathematician like Kenneth Williams, Andrew Nicholas and Jeremy Pickles shown interest and delivered lectures on it in different places of London by extending the Bharathi Krishna Thirthaji introductory book. The Vedic mathematics techniques help in rapid or fast calculations in some situations. It improves the concentration and logical thinking which are the crucial need in respect of the mathematical training of competitive examination writing students. Vedic mathematics techniques are the one of the stream, when attaining proficiency in rapid arithmetic and aptitude or reasoning. The Trachtenberg speed arithmetic, Lester Meyers' arithmetic are some other techniques or methods also helps to improve or increase the proficiency in rapid arithmetic.

Vedic Mathematics Techniques used in this study

This study considers some Vedic mathematics techniques, which includes 'UrdhvaTiryakbhyam Sutra' (Vertical and Crosswise), 'Nikhilam Navatas' Charamam Dasatah' means all from 9 last from 10, cube root of perfect cubing, square root of perfect square, subtraction using the rule all from 9 and last from 10, Multiplication of numbers with a series of 9's in the multiplier, multiplication of numbers with series of 1's 9's in the multiplier and multiplication of numbers with similar digits in the multiplier.

Urdhva Tiryakbhyam Sutra (Vertical and Crosswise): This is the general formula which is applicable to all cases of multiplication [3, 8]. The rule of multiplication for 3 digit number (708 x 908) is as follows.

$$\begin{array}{r} 7 \quad 0 \quad 8 \\ 7 \quad 0 \quad 8 \end{array}$$

Step 1: (8x8)

$$\begin{array}{r} 7 \quad 0 \quad 8 \\ \quad \quad \times \quad \quad \\ 7 \quad 0 \quad 8 \end{array}$$

Step 2: (8x0) + (0x8)

$$\begin{array}{r} 7 \quad 0 \quad 8 \\ \quad \quad \times \quad \quad \\ 8 \quad \quad \quad \end{array}$$

Step 3: (7x8) + (8x7) + (0x0)

$$\begin{array}{r} 7 \quad 0 \quad 8 \\ \quad \quad \times \quad \quad \\ 7 \quad 0 \quad 8 \end{array}$$

Step 4: (7x0) + (0x7)

$$\begin{array}{r} 7 \quad 0 \quad 8 \\ 7 \quad 0 \quad 8 \end{array}$$

Step 5: (7x7)

Final Answer =501264

Step 1: 64 (6 carry) = 4
 Step 2: 0+6 = 6
 Step 3: 112 (11 carry) = 2
 Step 4: 0 + 11 (1 carry)= 1
 Step 5: 49 + 1 = 50
 Final Answer =501264

N

atas' Charamam Dasatah' (ai

): This formula can be very

effectively applied in multiplication of numbers, which are nearer to bases like 10, 100, 1000 i.e., to the powers of 10. The steps are as follows.

1. Find the Base and find Difference from given number
2. Number of Digits on the RHS= Number of zeros in the base
3. Multiply the difference on the RHS
4. Put the cross answer on the LHS (subtract the cross values)

(base is 100)

$$\begin{array}{r} 92 \quad -08 \\ 95 \quad -05 \\ \times \end{array}$$

87 40For example- 92 x 95

Final Answer = 8740

Cube root of perfect cube

1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729
10	1000

Note that all cube roots end with same number as their corresponding cubes except 3 & 7 and 8 & 2 which end with each other

The method can be explained with an example, Find the cube root of 456533

Step 1: We shall represent the number as

$$456 \mid 533 \text{ (3 digit on RHS, immaterial even though there is no digit is on LHS)}$$

Step 2: Cube root ends with 3, thus answer at this stage is 7

Step 3: To find the left hand of answer we take number which lies left of the slash is 456

Step 4: Find the two perfect cubes between which the number 456 lies in the number line
 $(343 < 456 < 512)$ viz. between 7 & 8

Step 5: Out of the above 2 numbers, take smallest one viz. 7 we write answer as 77.

Thus 77 is cube root of 456533

Subtraction using the rule all from 9 and last from 10:

For example subtract 759. 59 from 100000

- Start from LHS and subtract all digits from 9 and the last digit from 10

100000.00

- 759.59

99240.41

Square root of perfect square

Find the square root of 7744.

1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100

Step 1: The number 7744 ends with 4. Therefore square root ends with ___2 or___ 8.

Step 2: Take complete Number 7744

Step 3: 7744 lies between 6400 (which is square of 80) and 8100 (which is square of 90)

Step 4: From Step 2 we know that square root ends with 2 or 8. of all the numbers between 80 & 90 (81, 82, 83, 84, 85, 86, 87, 88, 89). Thus out of 82 & 88 one is the correct answer

Step 5: Observe the Number (7744) is ether closer to 6400 or 8400. It is closer to 8400. So Answer is 88.

Multiplication of numbers with a series of 9's in the multiplier: Multiply 6554 by 9999

6554
9999

65533446

Subtract 1 from 6554 and put it on left side of the answer

Subtract each of the Digits (6553) from nine i.e.. 9-6, 9-5, 9-5, 9-3

Multiplication of numbers with series of 1's in the multiplier: Multiply 4569 by 1111

Step 1: Write down the unit place as it is -----9

- Step 2:** Add (9+6) = 15, 1 as carry -----5
- Step 3:** Add (9+6+5)= 20, 20+1=21, 2 as carry -----1
- Step 4:** Add (9+6+5+4)=24, 24+2=26, 2 as carry -----6
- Step 5:** Add (6+5+4)=15, 15+2=17, 1 as carry -----7
- Step 6:** Add (5+4)=9, 9+1=10, 1 as carry -----0
- Step 7:** Add (4+1) = 5 -----5

Final Answer is = **5076159**

Multiplication of numbers with similar digits in the multiplier: multiply

444 by 333

444 x 3 x 111 ----- 444 x 3 = 1332 x 111

- Step 1:** Write down the unit place as it is - 2
- Step 2:** Add (2+3) = 5 ----- 5
- Step 3:** Add (2+3+3) = 8 ----- 8
- Step 4:** Add (3+3+1) = 7 ----- 7
- Step 5:** Add (1+3) = 4 ----- 4
- Step 6:** Write down 1 as it is = 1 ----- 1

Final Answer is = **147852**

Objective and Methodology of the study

- The main objective is to know whether a Vedic mathematics technique improves the speed of the basic mathematical operations.
- The sub objective is to find the decreased time difference in terms of minutes before and after adopting Vedic mathematics techniques while solving some basic mathematical operations.

This study is based on primary and secondary data sources. The primary data is collected from students of BANK PO, BANK clerks and IBPS competitive examinations writing students. These students belong to one of the competitive examinations training centre at Mangalore City in Karnataka State of India. The qualitative data collection instrument chosen is the secondary data and focus group interactions. Secondary data sources are newspaper, journals, magazines, web links and related research papers. Based on focus group interaction a hypothesis is developed and to test the hypotheses paired t-test is used.

The population or sample size is 26 are collected from one of the competitive examinations

training centre at Batala City in Punjab State of India. A set of mathematical questions are distributed to respondents, which includes basic mathematical operations, square root, cube root, multiplication of 4 digit numbers, multiplication of numbers near to base, subtraction using the rule all from nine and last from ten. The time taken by the students before and after adopting Vedic methods is noted down in terms of minutes. A hypothesis is developed and tested its significance using paired t-test.

Hypothesis and Paired t-Test

The scores of 26 persons are listed using Table-1. Table-1 includes serial number, time taken for completion of mathematical operations before and after adopting Vedic mathematics techniques in minutes, their difference and difference square

Table 1: Paired T-test table for before and After Adopting Vedic Mathematics Techniques

Sr. No.	Before adopting Vedic mathematics techniques (x)	After adopting Vedic mathematics techniques (y)	Difference (d=x-y)	d ²
1	10	7	3	9
2	10	6	4	16
3	15	8	7	49
4	15	7	8	64
5	18	15	3	9
6	15	12	3	9
7	12	9	3	9
8	18	13	5	25
9	15	10	5	25
10	10	7	3	9
11	10	6	4	16
12	13	9	4	16
13	18	12	6	36
14	9	7	2	4
15	19	17	2	4
16	13	9	4	16
17	8	6	2	4
18	15	9	6	36
19	10	8	2	4
20	14	12	2	4
21	14	10	4	16
22	15	13	2	4
23	8	7	1	1
24	11	9	2	4
25	15	12	3	9
26	15	11	4	16
Total			94	414

Null Hypothesis (H₀): $\mu_x = \mu_y$, Mean score before and after adopting Vedic mathematics techniques are same. In other words, there is no significant difference between before and after adopting Vedic mathematics techniques while solving some basic mathematical problems.

Alternative Hypothesis (H₁): $\mu_x \neq \mu_y$ (Two tailed)

H₁: There is a significant difference between before and after adopting Vedic mathematics techniques while solving some basic mathematical problems.

Test statistic. Under H₀, the test statistics is=

$$\frac{d}{s/\sqrt{n}} \sim t_{n-1} = t_4$$

$$d = \frac{\sum d}{n} = \frac{94}{26} = 3.6153$$

$$s^2 = \frac{1}{n-1} \sum d^2 - \frac{(\sum d)^2}{n} = 3.4892$$

(after using $\sum d=94, \sum d^2=414, n=26$)

$$|t| = \frac{d}{s/\sqrt{n}} = 9.6795$$

The tabulated value of t for 25 degree of freedom (d.f.) and at 5% significance level is ($t_{0.025}$) =2.064. Since calculated value of t (9.6795) is greater than tabulated t, it is significant at 5% level of significance. Hence null hypothesis is rejected and alternative hypothesis is accepted.

If we consider, one tailed t-test (right tailed), μ_x , there is a significant decrease in time before and after adopting Vedic mathematics techniques while solving some basic mathematical problems. The tabulated value of t for 25 degree of freedom (d.f.) and at 5% significance level is ($t_{0.05}$) =2.064. Since calculated value of t (9.6795) is greater than tabulated t, it is significant at 5% level of significance.

From both the alternative hypothesis we can conclude that Vedic mathematics techniques improve the speed of calculations while solving some basic mathematical problems.

Research Question: Whether Vedic mathematics improves speed of basic mathematical operations? About 98% respondents out of 26 members agree that Vedic mathematics improves the calculation speed. Where as only 2% replied no improvement in speed.

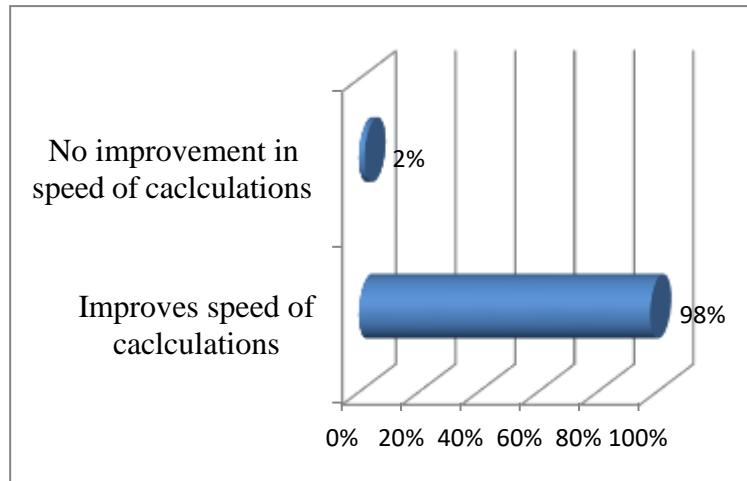
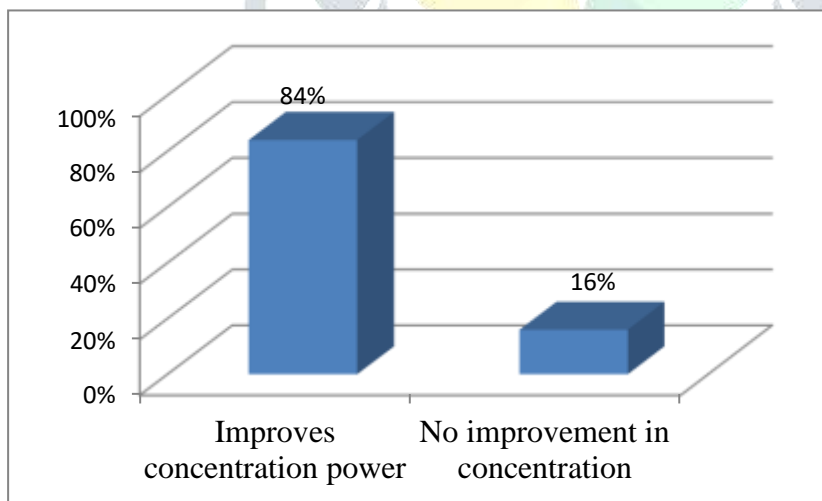


Figure 3: Graph showing the percentage of speed improvement and no improvement using Vedic mathematics techniques

Research Question: Whether Vedic mathematics improves concentration?

About 84% respondents out of 26 members agree that Vedic mathematics improves the concentration. Where as only 16% replied that Vedic mathematics does not improves concentration power.

Figure 4: Graph showing the percentage of concentration improvement and no improvement due to Vedic mathematics techniques



improvement due to Vedic mathematics techniques

Research Question: Whether Vedic mathematics improves logical thinking?

About 80% respondents out of 26 members agree that Vedic mathematics improves the logical thinking. Where as only 20% replied no improvement in logical thinking

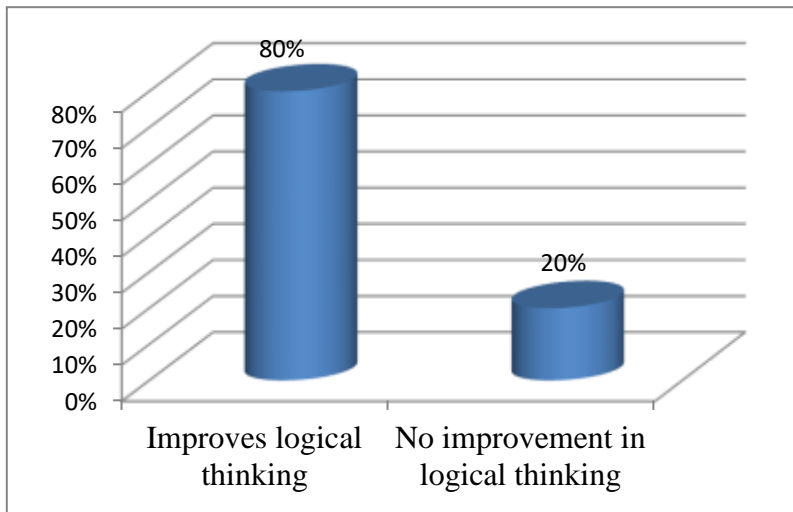


Figure 5: Graph showing the percentage of improvement in logical thinking and no improvement due to Vedic mathematics techniques

Research Question: Practice is required for Vedic mathematics Techniques.

All the 100% respondents out of 26 members agree that continuous practice is required in order to familiarize and remember Vedic mathematics techniques.

Limitations and Scope of Research

This study is limited by the following factors:

- The population or sample size is very much limited comprised with only 26 people. The future study requires more samples for higher accuracy.
- The study considered only few mathematical operations. The future study requires more basic mathematical operations.
- The study considered time in terms of minutes. For the accurate result the future study requires more advanced form of time maintenance in terms of even seconds.

Conclusion

Vedic Mathematics is an ancient Indian mathematics system developed based on 16 formulae and sub formulae which is originally referred in Sanskrit as sutras. In order to become expert in Vedic mathematics techniques a person requires continuous practice and a very good interest. This paper found that Vedic mathematics techniques significantly reduce the time required for completing some basic mathematical calculations. The Vedic mathematics techniques can reduce the burden and overhead of students in competitive examinations while Solving quantitative aptitude and reasoning problems. It is considered as one of the short cut method for solving basic mathematical operations.

In this paper, a set of mathematical operations are considered, which includes square root, cube root, multiplication of 4 digit numbers, multiplication of numbers near to base, subtraction using

the rule all from nine and last from ten. The paper statistical proved that Vedic mathematics techniques significantly reduce the time duration while solving some basic mathematical problems. All the respondents found that in worst case at least one minute can be saved, if we adopt Vedic mathematics techniques for solving problems of basic mathematical operations. Null hypothesis is disproved and alternative hypothesis are selected based on paired t-test. Wish this paper could play an active and supportive role in actual research of Vedic mathematics and techniques to improve the speed of calculations especially while writing any competitive examinations.

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