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Comparison of Conventional to the *Vedic* Mathematics System: Through Statistical Analysis of Pre and Post Test Result

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Abstract

Any business, like mining, where observation and procedure call for a lot of fast calculations, must prioritize speed and accuracy. India has a wealth of minerals, and government agencies such as NMDC actively participate in the process of extracting minerals from ore. However, our methods must be tweaked. Quick calculations are necessary for field work. Compared to the standard approach, the vedic mathematics system is incredibly rapid and easy to use. The goal of the work was to compare the vedic mathematics system to the conventional system, through the performance of group of students in terms of accuracy and speed in a pre-test and post-test on basic mathematics multiplication. Mathematics test was conducted before and after workshop on vedic mathematics, for 25 students from the Department of Mathematics of first year from Satya Sai Women College Bhopal. The outcomes demonstrated that the students result in the test after workshop was remarkably better than in the test before workshop in terms of speed and accuracy in spite of the fact that the vedic methods were newly introduced to them and conventional methods were known to them from long time. Statistical analysis was done which shows that vedic math's increases speed and accuracy by significant difference and students were happy to use vedic math's methods.

Keywords: *ANOVA, Confidence Interval Graph, F- Statistic, p-Value, t-Test, Tukey Test, Vedic Mathematics*

1.0 Introduction

Mathematics is concrete part of education system which is introduced from primary education; many subjects that need mathematics can be difficult to tackle if basic mathematical concepts are not understood. Unfortunately, mathematics is psychologically attached to factors like fear, anxiety, low self-esteem and lack of confidence[1]. Actually, these unfavorable preoccupations have had a bad impact on the students' performance. Unfortunately, our conventional system of mathematics is overruled by fear of failure; on contrary *vedic* mathematics[2] is quick easy and interesting[1]. Whole paper is organized in sections; first section is introduction to *vedic* mathematics. Section II discusses statistical tools used and methodology. In section III, results and discussion with graphs are done. The final section includes a possibility for additional research as well as references and summarizes the entire notion. "*Veda*" is a *Sanskrit* term that denotes knowledge[3]. It is a gift from ancient Indian sages and is passed down orally ("sruti") from one era to the next. *Sthapatya-veda*, a supplement to the *Atharva veda*, is an ancient Indian mathematical system that was rediscovered by Bharati Krishna Teerthaji, who is regarded as the father of *vedic*

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Table 1. Multiplication strategies in vedic mathematics

Urdhva TiryagBhyam	Based on a vertically and crosswise process
Nikhilam navatashcharamam Dashatah	All from nine and last from ten
Algorithmslike Yavadunam formula	For cubes and squares
base method	Multiplication

mathematics (1884-1960). Swamiji discussed 16 sutras and 16 upa sutras with different mathematical concepts. It is extremely powerful tool with high precision, promptness and simplicity; such characteristics make it applicable to many different mathematical processes, from simple to complex including fields like astronomy, electronics medicine, mining or other streams of engineering anywhere when high speed is essential. In *vedic* mathematics, methods for determining products are covered in great detail. Among the many multiplication strategies few proposed are (Table 1). Multiplication strategies in *vedic* mathematics.

2.0 Statistical Tools and Methodology

2.1 ANOVA

One-way variance study[4,5] (ANOVA) is used to relate the mean between the groups and determine any statistically substantial alterations between the means. Specifically, it does testing of null hypothesis and alternative hypothesis H_α.

H_0: $\mu_1 = \mu_2$, where μ is mean and H_α: Means with statistically significant difference.

2.2 Tukey Post-hoc Test

Omnibus test statistic[6,7] is limitation for one-way ANOVA, it cannot specify groups statistically significantly different from each other, for this post hoc test like Tukey test is applied.

2.3 Confidence Interval Graphs

Confidence interval graph[7,8] (Graph 2) that display the 5% and 95% confidence bounds by superimposing an error bar or confidence interval on each bar.

t-Test: To assess whether there is a noteworthy difference among the means of two groups and their relationships, a t-test is an inferential statistic is used. When the data sets have a normal distribution, t-tests are employed.

Experiment was done to draw comparison of the performance of first year B.Sc. mathematics students with prior mathematics background from Satya Sai Women College Bhopal. The main aim was to compare speed and accuracy for competitive exams. The pre-assessment for the Mathematics capability in lengthy multiplication was conducted on 29th Sep 2022 followed by the post-assessment on 30th Sep 2022, after conduction



Figure 1. Online workshop on *vedic* math.

of 2 hours workshop on multiplication using *vedic* math Figure 1.

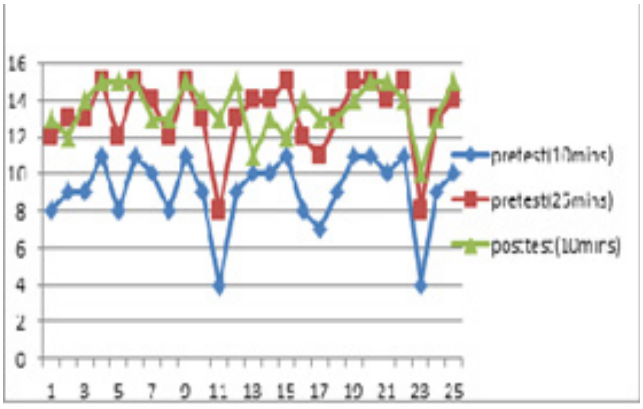
Data was collected from total 25 students. The Mathematics Competency Test consisted of 15 questions; 10 minutes time was given. Marks obtained were plotted in Graph-1 expressing marks of pretest and post test with time limits 10mins, also pretest when total 25 minutes were given one-way ANOVA test was applied to obtain F-statistic and P value. F-statistic is ratio of variation between sample and variation within samples or F-statistic=(mean sq tretment)/(mean sq error)

Greater variance between sample means compared to variation within samples is represented by a larger F-statistic, which also shows differences in group means. We look at the p-value that corresponds to the F-statistics

to determine whether change amongst the group means is statistically significant. This value tells results are significant over all or not, but it won't tell where exactly difference occur. Given the same sample sizes of group, we used the Tukey post-hoc test to get one to one assessments in pairs of group means, and verified the same by confidence interval graph and t-test.

3.0 Results and Discussion

The ratio of pupils who answered the questions appropriately was good but due to time limitation psychological Incidences like mathematics anxiety was observed and 15 minutes extra were given for pretest and scores were recorded. Though in post test which was conducted after workshop students were relaxed happy and finished test within 10 minutes. Graph 1 shows the same.



Graph 1. Statistical results.

3.1 ANOVA Test

Since the P-value (Table 3) is less than 0.05, we can say it is less then significance level so we can reject, since the P-value is less than 0.05, we can say it is less then significance level so we can reject.

H_0: $\mu_1=\mu_2$ i.e. our null hypothesis hence can say that all population means are not equal. There is statistically significant difference. Though if we give extra time and do analysis F-statistics is 0.8617 and P-value is 0.3759 which is more than 0.05 hence we need to accept null hypothesis.

3.2 Tukey Post-hoc Test

This shows the mean difference of about 4.44 in pretest and post-test results.

Table 2. Result data

Result Data				
Event	**Group Size**	**Group Mean**	**Standard Deviation**	**Standard Error**
Pre Test	25	9.12	1.9434	0.3887
Post Test	25	13.56	1.3565	0.2713

Table 3. ANOVA results

ANOVA Results					
Case	**DF**	**Sum of Sq. (SS)**	**Mean sq. (MS)**	**F-statistics**	**P-value**
Amongst Groups	1	246.42	246.42	**87.7424**	0
Within Groups	48	134.8055	2.8084		
Total	49	381.225			

Table 4. Mean comparison

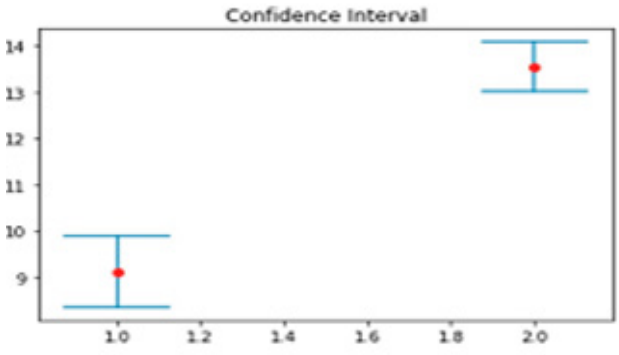
Comparison of Means - Tukey HSD, FWER=0.05						
group1	group 2	Mean diff	p-adj	lower	upper	reject
posttest	pretest	-4.44	0.001	-5.393	-3.487	True

3.3 Confidence Interval Graph

The same can be observed in the confidence interval graph, Graph 2 also t-test

t-value calculation

$$s^2 = \left\{\left[\left(\frac{df_1}{df_1 + df_2}\right) \times s_1^2\right] + \left[\left(\frac{df_2}{df_1 + df_2}\right) \times s_2^2\right]\right\}$$



Graph 2. t-test.

$$= \left[\frac{24}{48} \text{x} 3.78\right] + \left[\frac{24}{48} \text{ x } 1.84\right] = 2.81$$

$$s_{M1}^2 = \frac{s^2}{N_1} = \frac{2.81}{2.5} = 0.11 \& \qquad s_{M2}^2 = \frac{s^2}{N_2} = \frac{2.81}{2.5} = 0.11$$

$$t = \frac{M_1 - M_2}{\sqrt{s_{M1}^2 + s_{M2}^2}} = \frac{-4.44}{\sqrt{0.22}} = -9.37$$

Keeping significance level 0.05 and one tailed test, the t-value is -9.36728 and p-value is less than .00001. The result is significant at p less than .05.

4.0 Conclusion

There is strong evidence by all statistical methods that the *vedic* mathematics improve the marks. Graph 1, shows that students had basic understanding and knowledge but lacks confidence and speed. Time was important factor as when extra 15 minutes time was given then 45% students score well. So we can conclude that using *vedic* math can increase speed by more than 50%. The advance tools use

Table 5. Result data

Pretest			Posttest	
N_1	25		N_2	25
$df_1 = N_1 - 1$	24		$df_2 = N_2 - 1$	24
M_1	9.12		M_2	13.56
SS_1	90.64		SS_2	44.16
$s_1^2 = SS_1/(N_1 - 1)$	3.78		$s_2^2 = SS_2/(N_2 - 1)$	1.84

in mining industry require lot of study of data for which many techniques were use *Vedic* math's can increase speed by many folds which in turn can improve efficiency and speed both.

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6.0 Reference

1. Karani KP. An empirical study on role of *vedic* mathematics in improving the speed of basic mathematical operations. Int J Manag. 2016; 6(1).
2. Sharma T, Khubnani R, Subramanyam C. Study of mathematics through indian *veda's*: A review. J Phys Conf Ser. 2022; 2332(1):012006. https://doi.org/10.1088/1742-6596/2332/1/012006
3. Khubnani R, Sharma T, *et al*. Applications of *vedic* multiplier - A review. J Phys Conf Ser. 2022; 2225(1):012003. https://doi.org/10.1088/1742-6596/2225/1/012003
4. Hogg RV, Craig AT. Introduction to mathematical statistics. Macmillian Publishers. 1978.
5. Adekeye KS. An introduction to industrial statistics (concepts and practice). Adewumi Printing Press. 2000.
6. Springer L, Stanne ME, Donovan SS. Effects of small group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. Rev Educ Res Spring. 1999; 69:21-51. https://doi.org/10.2307/1170643
7. Nordin A. Prosiding simposium kebangsaan sains dan Matematik ke V. Universiti Teknologi. 1992. 20-22.
8. Mokhtar SF, Yusof ZM, Misiran M. Journal of Applied Sciences Research. 2012; 8(8):4133-4137.
9. Khashi'ie NS, Said RM, *et al*. A comparison study of students performance in pre and post result of a mathematics competency test. MATEC Web of Conferences. 2017; 87(10):04001. https://doi.org/10.1051/matecconf/2017870400
10. Nagpal A, Khubnani R. Stastical testing of cancer patients in J and K and Rajasthan with Punjab. JASRAE. 2019; 16(6):1692-1694.
11. Ahani E. Ogundeji RK, Abbass MO, Okafor RO. Predicting students performance upon graduation using logistic models. 2009: pp.103.
12. Khubnani R. Statistical comparison of melanomaserene due to water of beas in northern India. Our Heritage. 68 (1):9000-9013.