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Sikander

Assistant Professor, Department
of Mathematics, A.I.J.H.M.
College, Rohtak, Haryana, India

The necessity of teaching Vedic methods for learning calculus to undergraduate students

Sikander

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Abstract

India, the sacred land's narrative, boasts a rich cultural heritage. Rishis' discoveries in ancient India can point the way to the rest of the globe. The Vedas and other ancient literature provide a never-ending supply of information. One of ancient India's offerings is Vedic Mathematics. It enables us to answer nearly any mathematical problems in a shorter amount of time using only mental calculations. There isn't much of a requirement for paperwork. In today's competitive world, every fraction of a second counts in competitive exams involving power tests.

Keywords: Vedic mathematics, effectiveness

1. Introduction

The language in which Vedas were composed became too old in the later Vedic period. As a result, the Vedangas have emerged as an auxiliary in the field of Vedic studies. They are considered sciences that help the people to understand and interpret the Vedas which are written centuries ago. The Vedangas were divided into six subjects such as phonetics (Śikṣā), grammar (Vyākaraṇa), etymology and linguistics (Nirukta), poetic meter (Chandas), rituals and rites of passage (Kalpa), timekeeping and astronomy (Jyotiṣa).

The astronomy or Jyotiṣa Shastra is divided into three Skandas (means the big branch of a tree shooting out of the trunk) and VM is a part of that. It is named VM because the system of mathematics is discovered from ancient Vedic Literature. The ancient Indian Rishis have mentioned 16 Formulae (Phrases) and thirteen sub-Formulae in Sanskrit which enable us to solve all mathematical problems in easy 2 or 3 steps with no pen and paperwork.

Though the origin of VM is controversial the discovery in the field of Calculation of numbers is very wonderful (Rani, U., 2014). In 1965, the book on VM was printed for the first time, written by Sri Bharati Krishna Tirtha Maharaja, the Shankaryacharya of the Puri, this book was published by his disciples posthumously and reprinted fifteen times (Rani, U., 2014).

Bharti Krishna Tirtha admitted that sixteen Formulae and thirteen sub-Formulae in Sanskrit mentioned by him were not in Parishishtas of Atharvaveda (Sthapathya-Subveda), but they occur in his own Parishishtas (appendix) and not any others (Shukla, K.S., 1991). Having a good knowledge of Vedas and Mathematics, Tirtha Maharaja has created the Formulae and sub-Formulae, so the title VM is not acceptable (Vasanth Kandasamy, W. B., 2006). The controversy of origin and manning is beyond this paper but the effect of it in teaching mathematics, especially at the school level has been studied.

2. Objectives of the study

Considering Undergraduate Training and Validation sets, the objectives are:

- To analyze Average scores-Pre-Test.
- To equate Average scores Post-test.
- To relate Average scores Post-test based on gender.
- To equate the Average scores of the Pre-test & post-test.

3. Delimitations of the study

Delimitation is some aspects or circumstances of the study that the researcher cannot control but beliefs may negatively affect the results of the study.

- The present study was delimited to 58 students of under-graduate reading in the four selected schools of District Jind, Haryana only.

Corresponding Author:

Sikander

Assistant Professor, Department
of Mathematics, A.I.J.H.M.
College, Rohtak, Haryana, India

- The present study was carried out based on achievement scores on the Calculus Test of sampled 58 students of under-graduate
- The present study is also delimited to calculus up to three-digit numbers using conventional and Vedic methods of calculus.

3.1 Need for Study

- To discover the course of action affecting the performance of students in teaching VM.
- To discover the feasibility of the technique in solving operations such as square, and square roots equations efficiently and quickly.
- In designing syllabus and courses for Teaching of Calculus using VM techniques for undergraduate classes.

4. Statement of Research Problem

The analysis has been done in contemplation to make Math more fun-loving, easier, and more interesting. The objective problem was to effectively teach students the concept of calculus with the help of Vedic Maths.

The motivation behind the study was to ensure students in solving sums quickly, easily too with increased efficiency leads to their enhanced performing ability while solving the operations in many competitive exams which will help them to score well.

5. Methodology

The classroom-based, analytical research analysis initiated by teachers has been carried out.

5.1 Plan

The researcher utilized a collected and assembled pre-test-post-test study approach during which control, and sampling were done. The scientist intended to teach the academics mostly on the pattern for two weeks before administering a pre-and-post-test would be determined its success. The experiment stayed three weeks, comprising pre-and post-test preparedness.

Just after the pre-test, learners were exposed to the Vedic Absolute Math pattern, which would have been supported by a great deal of effort, and, finally, a post-test has been held for about the same.

The information was analyzed and approximated in the same week, considering the timeframe and the researchers' scores. The scientist initially administered a pre-test consisting of six questions that the majority of academics could answer in under ten seconds. Later, the scientist educated the newest way of functioning and provided practice for it.

Later, the observer administered the post-test, which had a series of questions of the very same location as the pre-test.

The information was analyzed to examine the waiting period learners take to implement by conventional process and by VM methodology and to verify the efficacy of both topics upon which a pre and post-test with almost the same complexity location were established and the conclusions were documented. The period when researchers finished both examinations with each design was recorded.

5.2 Observation

The experimenters discover the excitement of scholars to explore some great stuff that is calculus using a new technique called VM. They don't want to miss even a single class of this.

Initially, it was difficult for the students to understand, but as they begin to comprehend, they felt interested and eager to take a few more classes. Further, as the completion of the

course, they were looking for learning other traditional and novel techniques that can make their calculation part strong and they can solve any sum easily and quickly with improved efficacy.

5.3 Reflect

The experimenter observed the results post-session obtained by students and made the desired changes required as per the performance of the individual student. For example, there are students who can solve problems very quickly and easily while there are some students also who need the contents' explanation repeatedly and at a slow pace. After the completion of the training course, almost about 80% of scholars showed significant enhancement in the execution of Mathematical operations.

5.4 Designing of the study

• Population

All under-graduates of Govt. College, Jind, and Haryana have been considered as the total population for the current research.

• Sample & Sampling

For the present study, 58 students (both Boys and girls) were randomly selected from the four undergraduate classes. The classes were selected using the purposive sampling (as the principles were very cooperative) method.

Further, the students at each college were randomly (by blindfold method) assigned as the Control group-C.G. and Experimental group-E.G.

Control Group-28

Experimental Group-30

Table 1: Sampling distribution of E.G., and C.G. M-Male, F-Female

Experimental			Control			Total
M	F	M+F	M	F	M+F	
19	11	30	15	13	28	58

• Experimental design of the study

The design of any research is the most important part which leads all research to great success. As the present piece of research work falls under Experimental Research, True Experimental Design or Between Subjects Design has been followed. More specifically, Randomized Pre and Post-test Group designs had been selected to know the exact effect after including the independent parameter, the Vedic Method of Calculus.

Though this design has some limitations like subject sensitization, the difference in cultural background, carryover effects, and situational variable but most of the extraneous variables like history, maturation, differential selection of subjects, sensitization of pre-testing was controlled by randomization.

• The procedure of the study

Following the selection of respondents, an individual where participants were randomized to the C.G and E.G. At the start of the research, then a self-made Calculus Test as a Pre-test on both the groups (of students) to measure their pre-experimental achievement scores, the previous knowledge on calculus. The experimental groups of different undergraduate classes were given the treatment of independent variables i.e., they were taught calculus through the Vedic method whereas the control groups of different schools were kept in control

i.e., they were taught by the regular conventional method of calculus.

As four different undergraduate classes were selected, the Vedic method of Calculus was taught to different groups in different college periods, and this had been continued only for twenty teaching days. After the treatment was over, a self-made calculus test as a Post-test was administered on both C.G. and E. G.'s, and scores were collected.

• Research tools

For the present study, two self-made achievement tests on calculus (Calculus Test) have been used, one for the Pre-test and the other for Post-test. There were 20 items in each, having the same difficulty level and almost in the same pattern. The content validity was found satisfactory by a group of experts consisting of teacher educators and mathematics teachers. Only test-retest reliability was established and was found 0.71.

The scoring keys of both the calculus tests were simple, for every right answer, 1 mark was awarded while 0 for an incorrect response. The sum of the score of the total 20 items was considered the final mark. Twenty minutes is permitted for the students to complete the Pre-test and twenty minutes for Post-test and the recording key for the Pre, Post-test is ranged from 0 to 20.

• Variables of the present study

Generally variable refers to something liable to vary or change on account of something. A variable is a concept or construct possessing certain attributes liable to vary in terms of their quantitative or qualitative value from situation to situation (Mangal, S. K., 2013). Like any experimental research, the present study has the following variables.

• Independent variable

The Independent variable of experimental research is known for its independent existence and ability to create consequential changes in the variable which is dependent. The Vedic method of calculus was used as the independent variable.

• Dependent variable

The dependent variable of experimental research is known for its dependable existence on the independent variable. It is the circumstance or characteristics that change, appear, or disappear by the effect of the independent variable. It is the changes that result due to the independent variable.

For the present study, the achievement of scholars in mathematics on calculus in a specific time limit was used as the dependent variable.

• Uncontrolled Variables

Uncontrolled variables are those variables in experimental research which are beyond the control of the researchers. For the present study, socio-economic status, self-concept, attitude, and interest were uncontrolled variables.

• Controlled Variable

Controlled variables are those variables in experimental research that are within the control of the researchers. For the present study, classroom conditions, timing and average ages were uncontrolled variables.

6. Analysis and data interpretation

This plays the most important role in any research work which provides a link between the data (whether qualitative or quantitative) the researcher has and the information or interpretation he can derive from his research data collected from different sources.

To know the effectiveness of the Vedic method of calculus over the traditional method, above mentioned null hypotheses would be tested for a two-tailed test using a t-test.

6.1 Testing of Null hypothesis - No. 1

To test the null hypothesis No. 1 'There is no significant difference between Average scores of both C.G. and E.G., of the under-graduate after Pre-test', t-test for a small sample is used with the above-mentioned formula. The necessary values for calculation as at-value of both C.G. and E.G., are given in Table 2.

Table 2: Necessary values for calculation t-value of C. G. and E. G. on Pre-test

Group Name	N	Aver.	S.D. (σ)	t-value (Calculated)	t-value (Table value)	df	Status of Null-Hypoth.
EG	30	8.00	3.12	0.565	2.00 @0.05 level	56	Failed Reject
CG	28	8.43	2.58		2.66 @0.01 level		

The t-value calculated using table 2 came out to be 0.57 (or 0.565) is less than the table value at both 0.05 and 0.01 with df 56 ($N_1 + N_2 - 2$). Therefore, the null hypothesis cannot and has not been rejected at both levels of significance. This indicates that the "difference between the Mean of the control and experimental groups is not statistically significant". So, both the groups had performed similarly in respect of the pre-test on calculus knowledge.

6.2 Testing of Null hypothesis - No. 2

To test the null hypothesis No. 2, 'Not much deviation was found between mean scoring values of control and experimental groups of under-graduates after Post-test', t-test for the small sample is used with the same formula used for testing the null hypothesis - 1. The necessary values for calculation - t-value of C.G. and E. G. are given in Table 3.

Table 3: Necessary values for calculation- t-value of C.G. and E. G. on Post-test

Group Name	N	Av	S.D. (σ)	t-value (Calculated)	t-value Tabular	df	Null-Hyp
EG	30	17.83	1.90	16.02	2.00 @0.05 level 2.66 @0.01 level	56	Rejected
C G	28	10.46	1.64				

The t value calculated using Table 3 was come out to be 16.02 higher as compared to the significant value 0.05 as well as 0.01 with deg of freedom 56. Therefore, the "null hypothesis" has been rejected at both significant values. This indicates that the deviation in mean scoring values of the control and

experimental groups is statistically significant at 0.05 and 0.01 levels of significance.

The research hypothesis revealed that much variation in mean scoring values of both groups on the Post-test may be

accepted. So, the Experimental group having more mean value has performed better in the post-test.

As other variables are constant for both groups, the change in the dependent parameter (achievement in calculus) is the result of the independent variable (Vedic method of calculus). Thus, it can be concluded that the Vedic method of calculus is more effective over the conventional method in terms of students' achievement in the Post-test.

6.3 Testing of Null hypothesis - No. 3

To test the null hypothesis No. 3 Not much deviation was observed in Mean scoring values on the Calculus Test amongst the Experimental Group after Post-test on basis of gender, same formula has been used to calculate t-value. The necessary values for calculation and t-value of boys as well as girls of the Experimental Group on the Post-test are given in Table 4.

Table 4: Necessary values for calculation- t-value of boys, girls of the Experimental Group on Post-test

EG	N	Av.	S.D. (σ)	t-value	Tabular t-value	df	Status of Null-Hypothesis
B	19	17.63	1.89	0.77	2.05 @ 0.05 level	28	Failed to reject
G	11	18.18	1.85		2.76 @ 0.01 level		

The t value calculated using Table 4 was come out to be (0.77) which is greater as compared to significant values 0.05 and 0.01 with df equal to 28 i.e., ($N_1 + N_2 - 2$). So, the null hypothesis could not be rejected at both levels of significance. This indicates that the deviation in mean scoring values of the boys as well as girls of the Experimental Group is not statistically significant. It may be concluded that gender could not play any role in the Post-test of sixth graders on the VM of calculus.

6.4 Testing of Null hypothesis - No. 4

To test the null hypothesis No. 4 'Not much deviation was found in mean scoring values on the Calculus Test of the Control group of under-graduates after Post-test based on gender, the same formula has been used to calculate t-value. The necessary values for calculation and t-value of boys as well as girls of Conventional Group on Post-test are given in Table 5.

Table 5: Necessary values for calculation and t-value of boys, girls of Conventional Group on Post-test

CG	N	Av.	S.D.	t-value	Tabu t-value	df	Status of Null-Hypothesis
B	15	10.93	1.12	1.65	2.06 @ 0.05 level	26	Failed to reject
G	13	9.92	1.94		2.78 @ 0.01 level		

The t value calculated using Table 5 was come out to be 1.65 which is less than the significant values 0.05 and 0.01 with df 26 ($N_1 + N_2 - 2$). Therefore, the null hypothesis cannot be rejected at both levels. This indicates that deviation in mean scoring values of the boys as well as girls of the Conventional Group is not statistically significant. As the difference in means of boys and girls are not significant it may be concluded that gender could not play any role in the Control group on the Post-test of under-graduates on the Vedic method of calculus.

6.5 Testing of Null hypothesis - No. 5

To test the null hypothesis No. 5 'Not much deviation was found in mean scoring values between both Conventional

Group and E.G., on the Calculus Test of the E.G, the same formula has been used to calculate t-value.

The necessary values for calculation and t-value of pre, and post-test of the E.G., are given in Table 6.

Table 6: Necessary values for calculation and t-value of Pre-test & post-test of Experimental group

E.G.,	N	Ave	S.D.	t-value	t-value Table value	Df	Status of Null-Hypo
Pre-test	30	8.00	3.12	14.89	2.00 @ 0.05 level	58	Rejected
Post-test	30	17.83	1.90		2.66 @ 0.01 level		

6.6 Testing of Null hypothesis- No. 6

To test the null hypothesis No. 6 'Not much deviation has been found in mean scoring values Pre, Post-test on Calculus Test of Conventional Group, the same formula has been used to calculate t-value. The necessary values for calculation -t-value of pre, post-test of Conventional Group is given in Table 7.

Table 7: Necessary values for calculation of t-value of pre, post-test of C. G.

C.G.	N	Average	S.D.	Cal t-value	Table t-value	df	Null- hypo
Pre-test	28	8.43	2.58	3.62	2.00 @ 0.05 level	58	Rejected
Post-test	28	10.46	1.64		2.66 @ 0.01 level		

The t value calculated using Table 7 was come out to be (3.62) which is higher compared to significant values at both 0.05, and 0.01 with deg of freedom 58. So, the null hypothesis is rejected at both levels. This indicates that the deviation in mean scoring values of the Pre, and post-test of the Conventional Group is statistically significant.

As the difference in mean is significant it may be concluded that students of the experimental group have performed better. But the mean score is very less in comparison to the average score of the E.G.

7. Conclusion

Vedic Mathematics may be learned from a young age, and a fundamental understanding of the multiplication table will aid a student's understanding of the topic. Vedic Math engages both the left and right hemispheres of the brain. Language is processed in a logical and sequential way on the left side of the brain. The right side of the brain is more visual, processing information instinctively, holistically, and randomly, which helps with memory and focus. You are actually concentrating since you are conducting math mentally without the aid of a pen or paper, which improves your attention abilities.

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