A Comparative Study of Effectiveness of Teaching Mathematics through Conventional & Vedic Mathematics Approach

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ABSTRACT

Vedic mathematics is the name given to the ancient Indian system of mathematics that was rediscovered in the early twentieth century from ancient Indian scripture namely Atharvaveda. The study was intended to compare the effectiveness of teaching mathematics through conventional and Vedic mathematics approach in the terms of students' achievement in mathematics. In this experimental study, pretest-posttest equivalent control groups design was used having randomly selected sample of 30 students in each group from BKT Inter College, Lucknow. The study covered the major topics of UP Basic Education Board class VIII mathematics syllabus viz., square, square-root, factorization of algebraic expressions and simultaneous simple equations. Mean, standard deviation, *t*-test and effect size were used for analyzing the data collected through self-made Achievement Tests in Mathematics (ATM) as pretest and posttest. Students' achievement in mathematics of experimental group on posttest was significant over that of control group. No significant difference was found between male and female students in each group on posttest. Effect size was calculated as Glass' Δ which was 0.902. Thus the Vedic mathematics approach is found highly effective for enhancing the students' achievement in mathematics as well as that of male and female students equally.

Keywords: Effectiveness, Vedic mathematics, conventional approach, achievement in mathematics

We use mathematics in our all endeavors; therefore it becomes a part of our life. Our imaginations do involve mathematics. From beggar to businessman, everyone uses mathematics in their life. The education commission (1964-1966) recommended mathematics as a compulsory subject for students at all school level. The National Policy on Education (1986) has also considered the importance of mathematics in general education and suggests that mathematics should be visualized as the vehicle to train a child to think, reason, analysis and articulate logically apart from being a specific subject. But due to lack of understanding its essence and technique of teaching, mathematics is now considered as a dry subject by many learners. Now a learner shows no interest in learning mathematics, teacher is teaching and students are learning just for the sake of obtaining marks. Most of the problems in Mathematics have magic and mysteries. Our ancient scholars understood all these mysteries and developed some simple ways and techniques to solve mathematical problems. One such technique is Vedic mathematics as it helps to solve mathematical problems very much faster than the traditional methods of solving problems. The National Policy of Education (NPE-1986) stated "Mathematics could be considered as a medium to train a child to develop his thinking capacity, to develop his reasoning power, and to coherent logically". So mathematics should be shown as a way of thinking, an art or form of beauty, and as human achievement and it can be achieved easily through Vedic mathematics as it not only helps in generating interest and concept clarity in students but also stabilizing the knowledge for longer duration too.

Need and significance of the study

Mathematics is the study of numbers, quantity, space, structure and change. It is a branch of science that uses numbers and symbols which are arranged using systematic mathematics rules. It can create moment of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more efficient solution, or notice hidden connection. But the essence and nature of teaching of mathematics is degrading day by day which creates a fear and phobia among students. Due to excessive use of electronic gadgets and internet-software, student and teacher both are diverting their path from efficient and effective teaching learning process.

Now a student is laying less stress on mental calculation and is more dependent on the gadgets and software for the solution. Vedic mathematics is a unique method of solving problems by the use of fast calculations. It is unique system as it helps to solve all kinds of mathematical problems easily and efficiently. Tiwari, Gankhuyag, Kim & Cho (2008) found that the proposed Vedic multiplier circuit seems to have better performance in terms of speed. The goal of teaching mathematics is not just academic achievement but its personal and professional growth also. Vedic mathematics not only helps in understanding the concept efficiently but also brings interest while learning mathematics through magical techniques.

And these techniques help the students to resist the concepts for longer duration. Vedic mathematics is found more effective in solving multiplication problems than traditional technique (Sharma, 2014). Jiji (2012) also found Vedic mathematics is more effective, in terms of students' achievement in mathematics, than talk and chalk method. But almost all the studies were conducted on English medium students (e.g., Jiji, 2012; Sharma, 2014), covering only few topics (e.g., multiplication and divisions in arithmetic) and no practical significance (effect size) was given. So to overcome this knowledge gap, the present study was conducted on students of class VIII Hindi medium government school of Lucknow.

The study covered the major topics viz., square, square-root, factorization of algebraic expressions and simultaneous simple equations. So the results of the study can contribute an effective and interesting mathematics problem solving approach with high speed and accuracy to educational planners and curriculum developers.

Operational definitions of the key terms used

Effectiveness

In the study, effectiveness is described as significant mean difference of a group over the other group on posttest in terms of students' achievement in mathematics. In this fashion, the group having greater mean is called more 'effective' than the other group.

Achievement in mathematics

Measurement of students' grasp of knowledge or their proficiency in certain skills based on taught mathematical themes during experimental treatment. Here in this study it means achievement score in mathematics obtained through ATM.

Vedic mathematics approach

Solving mathematical problems easily with the help of some *sutras*, specifically based on the book Vedic Mathematics, authored by Sri Bharati Krishna Tirath Maharaja (1884-1960) of Govardhan Peetha, Puri (India). But it is originally rediscovered from *Atharvaveda* (Sthapathya-subveda).

Conventional method

A teacher centered traditional method of teaching with a due weightage to talk and chalk, based on problem solving approaches given in class VIII mathematics text-books of UP Basic Education Board.

Objectives of the study

- ❑ To compare the means score on the achievement in mathematics of the two groups of the students on pretest.
- ❑ To compare the means scores on the achievement in mathematics of the two groups of students on posttest.
- ❑ To compare the means scores on the achievement in mathematics of male and female students of the control group on posttest.
- ❑ To compare the means scores on the achievement

- in mathematics of male and female students of the experimental group on posttest.
- ❑ To calculate the effect size of the Vedic mathematics approach over conventional approach on posttest.

Null Hypotheses

- ❑ **H₀1:** There is no significant difference in the mean scores of experimental and control group on pretest.
- ❑ **H₀2:** there was no significant difference in the mean scores of experimental and control group on posttest.
- ❑ **H₀3:** There is no significant difference in the mean scores of male and female students of the control group on posttest.
- ❑ **H₀4:** There is no significant difference in the mean scores of male and female students of the experimental group on posttest.

Population

All the students of class VIII of Hindi medium schools of Lucknow district for the academic year 2015-16 following the UP Basic Education Board syllabus were constituted the population for the study.

Sample & sampling

In the study, BKT Inter College, Lucknow was selected using purposive sampling. Further eighth standard 60 students from BKT Inter College, Lucknow were randomly selected as the sample. In this manner the selection and the assignment of the students were performed randomly into two groups; Experimental group & Control group. So the number of students in each group was 30.

Experimental design

Since the nature of the present study was Experimental. For this purpose the pretest- posttest equivalent groups design was selected.

Procedure of the study

The pretest was administered on the students in order to acquire their pre-experimental achievement score. The groups were randomly assigned to one control and another experimental group. The experimental group was taught using the Vedic mathematics approach while the control group was taught using traditional approach. The experiment had been continued for 25 working days. The posttest was administered on both the groups, after the treatment was over.

Research tools

Self-made Achievement Tests in Mathematics (ATM) as pretest and posttest were administered for testing the class VIII students' achievement in mathematics. The test-retest reliability was established and it was found that 0.87 and 0.83 respectively. The content validity of the tests was evaluated by a committee, which consisted of mathematics teachers and teacher educators. The validity was found satisfactory.

Variables under the study

Independent variables: Approaches of teaching mathematics i.e. Vedic mathematics and conventional (traditional) mathematics.

Dependent variables: Students' achievement in mathematics.

Variables uncontrolled: Interest and attitude, socio-economic status, self-concept.

Variables controlled: Time, average-age, classrooms-conditions.

Delimitations of the study

- ❑ The present study was confined to the class VIII Hindi medium students from Lucknow district under UP Basic Education Board curriculum only.
- ❑ The present study was carried on class VIII students' in terms of their achievement in mathematics only.
- ❑ The present study covered these topics only viz., square, square-root, factorization of algebraic expressions and simultaneous simple equations. So only few Vedic mathematics sutras were used to teach these topics.

Analysis and interpretation of data

In analysis the collected data were tabulated and statistical techniques were employed as per research design of the study. All the hypotheses were tested at 0.05 level of significance.

Testing the hypothesis No. 1

The null hypotheses No. 1 was that there was no significant difference in the mean scores of experimental and control group on pretest. This hypothesis was tested by calculating means, standard deviation and *t*-value. The means, standard deviation and *t*-value are given in the table 1 below:

Table 1: Mean, Standard deviation and *t*-value of Achievement in Mathematics on pretest

Groups	N	Mean	S.D.	*t*-Value	Null Hypothesis
Experimental Group	30	5.97	2.32		
				0.066	Failed to reject
Control Group	30	5.93	2.39		

The null hypothesis was failed to reject on the basis of the above table and *t*-value was 0.066. This indicates that there was no significant difference between control and experimental group in terms of their achievement in mathematics on pretest.

Testing the hypothesis No. 2

The null hypotheses No. 2 was that there was no significant difference in the mean scores of experimental and control group on posttest. This hypothesis was tested by calculating means, standard deviation and *t*-value. The means, standard deviation and *t*-value are given in the table below:

Table 2: Mean, Standard deviation and *t*-value of Achievement in Mathematics on posttest

Groups	N	Mean	S.D.	*t*-Value	Null Hypothesis
Experimental Group	30	8.53	1.31		
				4.214	Rejected
Control Group	30	6.60	2.14		

The null-hypothesis was rejected and the research hypothesis was accepted on the basis of the Table 2, i.e. it can be seen that the difference in the means of students' achievement in mathematics from Control Group and Experimental Group is significant. Thus Vedic mathematics approach is effective over the conventional approach of teaching mathematics in terms of students' achievement in mathematics.

Testing the hypothesis No. 3

The null hypothesis No.3 was that there was no significant difference in the mean scores of male and female students of the control group on posttest. This hypothesis was tested by calculating means, standard deviation and *t*-value. The means, standard deviation and *t*-value are given in the table below:

Table 3: Mean, Standard deviation and t-value of Achievement in Mathematics of Control group on posttest

Students	N	Mean	S.D.	*t*-Value	Null Hypothesis*
Male	18	6.56	1.93		
				0.97	Failed to reject
Female	12	6.67	2.12		

Critical value of t with 28 df at 0.05 level is 2.05

From the Table 3, it can be seen that the difference in the achievement in mathematics of the male and female students from control group is not significant therefore the null hypothesis was failed to reject. This indicates the achievement in mathematics of male and female students from control group were same on posttest.

Testing the hypothesis No. 4

The null hypothesis No. 4 was that there was no significant difference in the mean scores of male and female students of the experimental group on posttest. This hypothesis was tested by calculating means, standard deviation and *t*-value. The means, standard deviation and *t*-value are given in the table below:

Table 4: Mean, Standard deviation and t-value of Achievement in Mathematics of Experimental group on posttest

Students	N	Mean	S.D.	*t*-Value	Null Hypothesis*
Male	17	8.24	1.53		
				1.027	Failed to reject
Female	13	8.92	2.21		

Critical value of t with 28 df at 0.05 level is 2.05

From the Table 4, it can be seen that the difference in the achievement in mathematics of the male and female students from experimental group is not significant therefore, the null hypothesis was

failed to reject. This indicates that the achievement in mathematics of male and female students from experimental group were same on posttest**.**

The calculation of effect size

After testing the hypotheses, the practical significance must be calculated (Sulivan & Feinn, 2012). Here Table No. 5 shows the calculation of effect size for understanding the practical significance of Vedic mathematics approach.

Table 5: Calculation of Effect size (Glass' Δ)

Groups	Mean	S.D.	Effect size (Glass' Δ)
Experimental Group	8.53	1.31	$\Delta_{E-C} = \dfrac{(8.53 - 6.60)}{2.14}$
Control Group	6.60	2.14	$= 0.902$

Here Glass'Δ was calculated as effect size of Vedic mathematics approach over conventional approach of teaching mathematics which was 0.902.

Discussion of the results

In this study, the control and experimental group were found equivalent in the terms of their achievement in mathematics at the time of starting the treatment. So there is no need to use analysis of covariance (ANCOVA) in the study (Best & Kahn, 2006). Vedic mathematics approach is found effective over the conventional approach of teaching mathematics in terms of students' achievement in mathematics. This finding is supported by many studies only on the multiplication operation (e.g., Sharma, 2014); square and square-root (e.g., Jiji, 2012). Whereas in the study, the Vedic mathematics approach is found effective over the conventional approach of teaching mathematics covering the experiment on the major topics viz., square, square-root, factorization of algebraic expressions and simultaneous simple equations. Conventional as well as Vedic mathematics approach of teaching mathematics produce similar results on male and female students' achievement, i.e. Vedic mathematics is equally effective for male and female students.

As the assumptions of NPC are followed, the effect size (Glass' Δ=0.902) can be described as only 18.41% students of the control group performed better than mean score of experimental group in

terms of their achievement in mathematics while scores of remaining 81.59% students of the control group were less than mean score of experimental group. Thus we can say that the Vedic mathematics approach is highly effective for enhancing the students' achievement in mathematics. It may be noted that to calculate Glass' Δ, there was used standard deviation of control group because the control group is the original representative of the population and not affected by experimental treatment (Coe, 2002). So this provided unbiased effect size. On the basis of above findings, it can be concluded that Vedic mathematics can be extended by teachers, curriculum developers for elementary and secondary classes.

In this context, every teacher should inculcate the habit of reading books related to Vedic mathematics; at least some periods should be allotted in the class to use Vedic mathematics tricks. So students can actively participate in solving problems. Schools should also realize the classrooms are not meant only for transaction of knowledge but also for developing creative abilities and talents through joyful teaching-learning approaches. With the help of Vedic mathematics students can score high marks and also excel in competitive examinations. In the present scenario, almost all the competitive examinations contain reasoning aptitude sessions, in which students have to score good marks. Since education has its main aim to transfer the cultural-heritage from one generation to other. In this order Vedic mathematics should be conserved as non-materialistic Indian cultural-heritage also.

Many further studies may be conducted at higher level of education through qualitative or mixed approach of the study, as the case may be; for testing the effectiveness of Vedic mathematics in other various terms viz., attitude towards mathematics, interest in mathematics, motivation level, speed and accuracy in a particular time phase using various Vedic sutras. Various problems faced by the students while using the Vedic mathematics may be diagnosed and remediated.

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