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The Impact Of Teaching Calculus Through Vedic Mathematics Techniqueson Problem-Solving Skills Of Students – An Analysis

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Abstract
Vedic Mathematics, an ancient system of mathematical techniques based on the Vedas. It offers simple, fast and intuitive methods for solving complex problems. The purpose of this study is to investigate the effectiveness of Vedic Mathematics techniques in enhancing the problem-solving skills of students. Through pre and post-intervention assessments and qualitative feedback, the researcher evaluates the impact of a Vedic Mathematics-based curriculum on students' problem solving skills like computational speed, accuracy, logical reasoning. The experimental group, comprising 30 secondary school students, underwent a 12-week program integrating Vedic sutras, while a control group of 30 students followed traditional mathematics instruction. Findings of study highlights a statistically significant improvement in the students of experimental group's problem-solving skill to solve problems related to calculus as compared to the control group students. The findings highlights that the Vedic Mathematics is an effective pedagogical tool to foster problem-solving skills in student.
Keywords: *Calculus, Problem solving skills, Impact.*

1. INTRODUCTION

Mathematics is usually considered as a challenging subject because of its abstract nature and complex calculations yet its importance is accepted by all. In today's world, Mathematical proficiency is essential for success in not only academics but also in almost all professions as it gives scope to develop problem solving skills like logical reasoning and analytical ability etc. Problem-solving skills in mathematics, is the ability to understand a mathematical problem and applying mathematical knowledge, logical reasoning, and creative thinking to find solutions to problems. It is the process of working through new and unfamiliar challenges. Problem solving skill helps:

- To improve analytical abilities, which are useful in many situations?
- To understand math concepts and the relationships between them more deeply.
- To transfer and apply to other problem-solving situations in life
- To make learning mathematics more fun and exciting.

So it is noteworthy that main goal of teaching mathematics to students is to develop skills like problem solving. It has been felt by scholars, academicians and other stakeholders from society that available so called modern conventional methods or techniques of teaching need some alternatives as through these methods achievement of goal of development of these skills seems difficult so there is increasing interest in alternative innovative teaching methods. Vedic Mathematics, an ancient system of mathematical techniques, mainly from the Atharva Veda, offers such unique and alternative techniques to simplify complex calculations of mathematics and can enhance problem-solving skills. Based on 16 sutras and 13 sub-sutras, Vedic Mathematics uses intuitive, efficient, and flexible problem-solving methods that differ from modern conventional approaches. That is why the researcher want to know if Vedic math can help create more versatile and skilled problem-solvers who can bridge ancient wisdom with modern learning needs and if it's a valuable addition to traditional teaching methods, potentially making math more accessible, enjoyable, and effective for students. The present research paper studies the impact of Vedic Mathematics techniques on students' problem-solving skills. By examining how these methods improve problem solving skills; this study aims to contribute to the understanding of effective mathematics education. The investigation tries to find whether using Vedic Mathematical techniques or methods can

lead to significant improvements in students' ability to solve mathematical problems, suggesting its potential as a transformative teaching tool.

2. Literature Review

Overview of existing research on Vedic Mathematics and problem-solving skills: Some studies on various aspects relevant in context of the present research have been reviewed by the investigator.

1. Vyas in 2020 studied effectiveness of methods of Vedic Mathematics in context with some variables (**Teaching methods:** Vedic method and traditional, **Gender:** girls and boys, **Scholastic Achievement:** high, low) for students of class 9th. Study was conducted on 9 class students in Ahmedabad district in Gujarati medium only. **Major finding** of the study was that Vedic methods are more effective than traditional method.

2. Sneha Amit Vaidya in 2019 studied "The Contribution of Vedic Mathematics in Advance Calculus" by explaining almost each and every Sūtras with meaning, their applications in solving all types of equations starting from linear, quadratic, cubic, quartic to ordinary and partial; linear and non-linear differential equations. Also determinant and matrices; in differential calculus for finding derivative of product of two and three functions, successive differentiation till nth order derivative of the product of two functions by using Leibniz, Taylor's and Maclaurin's theorem; integration problems based on partial fraction and integration by parts are also demonstrated.

3. Prabha s Rastogi in 2019 studied "Contribution of Vedic mathematics Vedic Mathematics in advance calculus" She found that Sūtras can be effectively used in basic as well as in higher mathematics.. Intrinsic sūtra mathematics is useful in bringing back fun and interest of students in an abstruse subject like Mathematics. A systematic study of Vedic Mathematics will be very helpful for students and researchers. The modern teaching of one way calculations is rigid and boring. Vedic Mathematics has a number of general techniques as well as specific techniques that and that are applicable for special cases. This flexibility gives opportunity to students to use their own approach which promotes creativity and intuition. In this rapidly changing world, flexibility and adaptability are absolutely essential for success. By Vedic Sutras complex and long calculations can be done with greater accuracy in short span of time as compared to calculations done by conventional techniques.

4. Prasad Girraj in 2018 studied how Vedic mathematics effect mental ability and academic achievement of students of upper primary level. He conducted his study on 100 students (50 girls+50boys) and by his experimental study he found Vedic mathematics has positive effect on mental ability and educational achievement.

5. Rajesh Thakur in 2015 studied "Effectiveness of Vedic Mathematics Method and Traditional Method for secondary school students Mathematics achievement". The researcher selected 200 Students of Delhi city for the experiment. The aim of the study was to find out the effect of learner's Mathematics Development Program on Mathematics achievement of Students. So firstly researcher developed the Mathematics Development Program which was used for Students. Then, the researcher took the help of other researchers, subject's experts, teachers and students to develop the Mathematics Achievement test. To measure the Mathematics Achievement the experiment was conducted using two groups only post test experimental design. The researcher selected one groups for the experiment by using Vedic method teaching Mathematics and one group of control group. At the end of experiment to measure the achievement of given Program, post test of 100 marks was administered over all of the Students. After collection of data, data were analyzed using proper statistical techniques and it was found that Vedic method is more effective than traditional methods.

6. Chaudhary, Vitthalbhai V in 2017 studied "Effectiveness of Vedic mathematical techniques in teaching of students of class viii" He stated his observation as Vedic mathematical techniques are quite effective in teaching mathematics to students of class viii. It not only improves their mathematical achievement but also eliminates a sense of phobia for mathematics and enhances confidence in doing mathematical problems efficiently.

7.Dhivyadeepa E in 2012 studied how Vedic mathematical techniques are effective in learning the skills

of arithmetic at IV grade level. He conducted his study on the students of standard IV in Coimbatore district. The students face more difficulty in the above two topics. Hence the investigator prepared Vedic Activities for the skills of Arithmetic such as Addition, Subtraction, Multiplication and Division for eliminating the difficulties faced by the students in learning Mathematics. The results of the study reveal that learning through Vedic method helped to improve the achievement of students in Addition, Subtraction, Multiplication and Division. Hence it is the need of the day to develop and introduce Vedic method for better teaching-learning process at school level.

8. BHORANIYA (2015) studied "Effectiveness of Vedic mathematics method vis a vis Traditional method for secondary school students in mathematics achievement" He found that. If teaching is done through Vedic mathematics assisted teaching method then the attitude of student towards that subject can be positively developed.

3. Research Gap

After reviewing, the related literature it is observed by the researcher that very few studies have been conducted on the effectiveness of teaching calculus through Vedic mathematics on the problem solving skill of senior secondary school students. No doubt a little research work has been done to find effectiveness of teaching through Vedic mathematics on problem solving skills of students but it is confined to simple multiplication, Division and factorization but no significant research on the topic like calculus has been done. Overall, the review of literature highlights the idea thatmostly the researches in related areas are confined up to secondary school.

Till today No significant studies are found on the Senior Secondary school students. Therefore, the researcher finds some of the questions that need to be focused are:

1. Do topic like calculus can be taught at senior secondary level through Vedic mathematics?
2. How effective is teaching calculus through Vedic mathematics?
3. What is effectiveness of teaching calculus through Vedic mathematics on problem solving skills of senior secondary students?

4. Significance Of The Study

The significance of the study lies in power of Vedic mathematical techniques to change mathematical education in a positive manner. Through such study, it could be quantify how these methods can improve problem-solving skills of senior secondary students. The study might demonstrate how these skills give students a practical advantage in time-constrained settings of this competitive era Thus, this type of study could provide data-driven insights to refine teaching practices, optimize student outcomes, and promote Vedic Mathematics as a valuable educational tool.

5. Research Problem

To study the impact of teaching calculus through Vedic mathematics on problem solving skills of students."

6. Research Aim

The researcher want to find out how effective is Vedic mathematics in teaching integration and differentiation based problems and want to find out that whether Vedic sutras based techniques of doing integration or differentiation are quite quick and logical or not?

7. ResearchObjectives

Without objectives research has no importance so it is necessary to frame research Objectives. The prominent objective of the research is:

- To analyze the impact on problem-solving skills of senior secondary school students of district Gurugram from Haryana state using Vedic Mathematics techniques.

  On the basis of the objective of the present research the hypothesis is framed is as follows:

H0: There is no significant difference in the problem-solving skills of senior secondary school students when taught calculus using Vedic Mathematical techniques.

8. ResearchMethodology

Methodology of the study is as:

Research design: Quasi-Experimental

Population: Senior Secondary school students (Grade 12^{th})

Sample: 60 students of grade 12^{th}

Sample selection: By stratified random sampling

Data collection Tools: pre-tests, post-tests

The researcher has chosen two different government schools of district Gurugram of Haryana state. There were total 60 Students, who were selected as sample for the research. These students were divided in two groups by random sampling technique as mentioned in previous chapter. From these two groups one was selected as Experimental group and other one was selected as controlled group. There were 30 students (15 from each school) in experimental group and 30 students (15 from each school) in controlled group from both selected schools. Control Group students were taught the same content as per their normal regular Mathematics classes in school and Experimental Group students were taught the same content through Vedic Mathematical methods.

9. RESULTS AND DISCUSSION

After the completion of intervention, a Post-test was conducted and data was collected and analyzed using Mean, Standard Deviation and t-value. M.S Excel Software has been used by the researcher for the Data Analysis and Hypothesis testing.

Table 1: N, Mean, Standard Deviation, SED and t- value of students of equivalent groups

Group	Experimental Group	Controlled Group
N	30	30
Mean	13.3	13.2
SD	1.6	1.6
d.f	58	
S.E.D	0.413	
t- value	-0.242	

From above table it is seen that the mean scores of the students of experimental and controlled group are 13.3 and 13.2 respectively. The standard deviations are 1.6 for both the groups, df is 58, standard error of deviation is 0.413 and t value is -0.242. Using a t-distribution, the two-tailed p-value for t=−0.242, degree of freedom =58 is approximately 0.81

Significance Testing:

- ***At α=0.05:*** $|t|=0.242<2.001$, and $p=0.81>0.05$.thus fail to reject the null hypothesis and hence there is no significant difference between the pre-test scores of the control and experimental groups.

- ***At α=0.01:*** $|t|=0.242<2.663$, and $p=0.81>0.01$.thus fail to reject the null hypothesis indicating there is no significant difference between the pre-test scores of the control and experimental groups.

Thus the pre-test scores for problem-solving skills in calculus are statistically similar between the control and experimental groups. This confirms that both groups have comparable baseline abilities, making them suitable for comparing the effectiveness of traditional methods vs. Vedic Mathematics in improving problem-solving skills using post-test data.

After intervention a post test was conducted for experimental and controlled groups and data analysis was done as follows:

Table – 2: N, Mean, SD, SED and t- value of students of equivalent groups

Group	Experimental Group	Controlled Group
N	30	30
Mean	17.4	15.5
SD	1.6	1.3
d.f	58	
S.E.D	0.376	
t- value	-5.053	

From above table it is seen that the mean scores of the students of experimental and controlled group are 17.4 and 15.5 respectively. The standard deviations for experimental and controlled groups are 1.6 and 1.3 respectively, degree of freedom is 58, and standard error of deviation is 0.376 while t value is -5.053. Using a t-distribution, the two-tailed p-value for t=−5.053, degree of freedom =58 is approximately **0.00001**

Significance Testing:

- ***At α=0.05:***

|t|=5.053 >2.001, and p=0.00001 < 0.05.thus the null hypothesis is rejected and hence there is significant difference between the post-test scores of the control and experimental groups.

- ***At α=0.01:***

|t|=5.053 >2.663, and p=0.00001 < 0.01.thus the null hypothesis is rejected indicating there is significant difference between the post-test scores of the control and experimental groups.

8.1 RESULTS OF THE STUDY

The statistical analysis of data revealed that Vedic mathematics based teaching methods for calculus is quite effective for senior secondary classes than traditional modern methods being used in schools. The main findings of the study are: -Vedic Mathematics techniques for teaching calculus have positive impact on the problem-solving skills of students.

9. IMPLICATIONS

Implications of study are as follows:

1. Vedic Mathematical methods can be helpful in development of Logical Reasoning as well as creative thinking ability of students that can help in solving calculus based problems more efficiently
2. Vedic mathematics can help students by providing alternative techniques and hence can foster creative problem – solving approaches.
3. Vedic Mathematics can increase mental calculation ability with accuracy and hence give more confidence to the students at all level.
4. Further research can explore how Vedic Mathematics influences abilities such as memory, concentration, and logical reasoning etc.

10. **CONCLUSION**

10.1 Summary of findings and their relevance:

This study demonstrates that Vedic Mathematics techniques significantly enhance students' problem-solving abilities, as evidenced by improved computational efficiency, accuracy, and logical reasoning. The integration of Vedic sutras into the curriculum not only accelerated students' ability to solve mathematical problems but also fostered greater confidence and enthusiasm for learning. The experimental group's superior performance compared to the control group underscores the value of Vedic Mathematics as a complementary approach to traditional methods. While the study's findings are promising, limitations such as the sample size and duration of the intervention suggest the need for further research to validate long-term effects and scalability across diverse educational contexts.

Nonetheless, this research advocates for the inclusion of Vedic Mathematics in mathematics education to cultivate versatile and proficient problem-solvers, paving the way for innovative teaching strategies that bridge ancient wisdom with modern learning needs.

11. Suggestions for Future Research

On the basis of the finding of the study researcher finds worthwhile to give some suggestions for future research. Here are the suggestions:

- Future research can expand the sample size and include students from diverse backgrounds to generalize the findings more broadly.
- Long-term studies can be conducted to study the sustained impact of Vedic Mathematics on students' performance in higher education and competitive examinations.
- The effectiveness of Vedic Mathematics could be explored in other branches of mathematics like algebra, trigonometry etc.

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