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ROLE OF VEDIC MATHEMATICS IN IMPROVING NUMERICAL APTITUDE

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Abstract

Numerical aptitude is a fundamental skill essential for academic success, competitive examinations, and real-life problem-solving. The traditional approach to teaching mathematics has been heavily reliant on the procedural learning and rote memorization and these factors can well restrict the speed, accuracy as well as the conceptual knowledge of the students. In this aspect, Vedic Mathematics, an ancient system of handling numbers which is planned and instructed on the Indian varieties of books have become a family system of practices that are employed in enhancing the usage of numbers and elevate it as a fresh and effective method. It is a research article which is oriented towards the discussion on the fact that Vedic Mathematics may be implemented to improve numeracy skills of different learners with different levels (Kumra *et al.*, 2023). Vedic Mathematics attracts shortcut techniques with the help of these (16) sastra (aphorisms) and (13) sub-sastra in computing the solution to more complex mathematical procedures such as, multiplication, division, squares, cubes and algebraic words. This is the kind of calculation through which the students are able to perform the calculations mentally at very very fast and exact speed by such means as "Nikhilam Navatashcaramam Dashatah" or Urdhva-Tiryagbhyam to name a few. The paper is examining the ways such approaches are being employed in the shortening of time in the calculations, error and mind development (Day-ongao *et al.*, 2022). The research has been referred to as a mixed-method research study that comprises of quantitative and qualitative approach of analysis. The results of the attempts which were carried out experimentally when compared to students who were being taught Vedic Mathematics techniques and students being taught methods techniques instead demonstrated that students who were being taught the former techniques had greatly improved the amount of time that they needed to take during calculations, not to mention the accuracy and efficiency of the students in solving problems. The qualitative data report regarding the change in the interaction of the learners, their confidence, and their attitude towards mathematics as well. The pedagogic issues of Vedic Mathematics presentation in the modern curricula are also examined in the paper. It further

asserts that the Vedic approaches will never replace the usual mathematical approaches, but can be incorporated to facilitate the practice learning and learn to think further in upper order (Kumar *et al.*, 2021). The findings lead to the possibilities of Vedic Mathematics as an effective pedagogical instrument that might be employed to improve the counting numbers and problem solving skills. Nevertheless, in a wrap up of Vedic Mathematics, there is an emphatic and extensive plan of upgrading numeric fluency and thus, it is easier to digest, pleasurable and productive to the students, to know mathematics.

Keywords: Vedic Mathematics, Numerical Aptitude, Mental Calculation, Mathematical Learning, Sutras, Speed and Accuracy, Cognitive Development, Educational Innovation

1. Introduction

Numerical aptitude plays a crucial role in modern education systems, particularly in fields requiring analytical and quantitative reasoning. This is not only crucial to academic performance, but also competitive tests as far as solving practical problems are concerned. The old means of instructions, nevertheless, tend to rest on the principles of memorizing and rehearsing and, consequently, tend to inhibit the skills of such pupils to quickly calculate and form a better conceptual understanding.

The other method that applies the systems of ancient Indian knowledge is the Vedic Mathematics (Bandala *et al.*, 2023). It has been rediscovered and formalized throughout the early 20th century as a way to provide more efficient ways of calculation that can simplify the computation of arithmetic functions. The

methods are in terms of the mind calculations, the ability to detect a pattern, and logical thinking, hence, increasing the speed and accuracy.

2. Conceptual Framework of Vedic Mathematics

2.1 Origin and Structure

Vedic Mathematics is an innocent mathematically minded thought, which is designed based on the ancient Indian thought concepts. It has been attributed traditionally to the wisdom of the mathematical precepts especially when it was considered and reformed systematically in the first half of the twentieth century. Vedic Mathematics can be said to be structured in such a form that it has sixteen bigger sutras, referred to as aphorisms and thirteen smaller sutras referred to as sub-sutras (Prathibha *et al.*,

2023). The sutras are not merely the heads of procedure, but they are that which might be termed generalized mathematical principles which they can be applied elastically through a broad sphere of arithmetic and algebraic functions.

Simplicity, coherence and universality are the premises of the structural peculiarities of Vedic Mathematics. The sutra-based system is also amenable to the amiability of the intuitive style of knowing and the mental acuity, as compared to the traditional mathematical processes that will tend to call upon inflexible stage-by-stage methods. All the sutras are general rules that can be applied and extrapolated to numerous issues. Such freedom enables the learners to treat the numeric operations creatively besides lessening a reliance on the memorized algorithm and augment a greater conceptual understanding.

Its hierarchical set-up has been the other significant feature of its set-up. It consists of 16 sutras as the principles and 13 sub-sutras as additions of refinements and use of the situation. The combination of these forms a wholesome feature which is applied in not only in improving the rudimentary arithmetic but also in improving the highest and middle level of thought (Samrudh *et al.*, 2020). The system is pattern oriented and

the students are able to understand the connection between the numbers available in the system and the ability to make shortcuts. This leads to believe that Vedic Mathematics is merely effective at calculation, but such other competencies in philosophy as logical thinking, concentration and resolution of an issue can also be accomplished.

Moreover, the mental calculation is also bestowed upon it by the use of the traditional written technique, because this technique has a conceptual structure. It also reduces the size of many writings thereby facilitating mental picture and in-mind computation of the numerical issues. This will be especially important in enhancing the skills of carrying out complex calculations without any difficulty and without taking long time because the brain becomes familiar with the complex mathematics in a comparatively minimal duration. The foundation of Vedic Mathematics and its structure thus, gives it adequate theoretical foundation when it comes to its application in contemporary education systems.

2.2 Key Sutras Used in Numerical Computation

The Vedic mathematics broader application is of the greatest importance in some of the

sutras that are used in performing number calculations (Chowdhury *et al.*, 2023). These sutras are well familiar in their effectiveness and applicability in mathematical problems solving. Urdhva-Tiryagbhyam and Nikhilelam Navatashcaramam Dashatah in this regard are particularly convenient, as all it was capable of could be applied directly in the operations of multiplication, subtraction and squaring.

Between the verses, Urdhva-Tiryagbhyam sutra or translated as vertically and crosswise is a method of multiplication. It promotes multiplication of numbers that involve cross and vertical work pattern which streamline the multiplication process much more than the process that one would take in an attempt to mathematically compute numbers (Subramanian *et al.*, 2021). It is incredibly flexible and may be extended appropriately in terms of the length of numbers to which the sutra would be applied is a powerful instrument of executing both simple and complex arithmetic procedures.

The sutra Nikhilam Navatashcaramam Dashatah or all by nine and last by ten is mostly applied in case of subtraction and multiplication by similar numbers of power of tenth numbers. It discloses the principle

of complements in which a number of computation is achievable by subtracting a number and a base number like 10, 100 or 1000. This helps quite a bit to simplify it to high extents and minimize the amount of mistakes.

The other beneficial sutra translated to be Ekadhikena Purvena is translated as by one more than the precedent and may be applied in squaring off the numbers ending with the number five in specific cases (Urmal *et al.*, 2021). It offers out a simple equation upon which would be accomplished the computation that would otherwise have required a multi-step transformation to have been stressed over to a merely a simple thought process. The beauty surrounding this sutra is that, it is a formula that compiles a process that appears to be very tricky in one formula.

In each of these sutras, it is possible to observe that mathematical computations were simplified with the help of Vedic Mathematics. They are capable of solving complex calculations due to their ability to assist learners in making it easy to calculate faster and in a more accurate manner through the use of patterns and relationships as opposed to mechanical processes. This does not only increase the capacity in terms of numbers only, but also

the interest and trust of the students in mathematics is made easy.

3. Mathematical Techniques and Equations

3.1 Multiplication Using Urdhva-Tiryagbhyam

Urdhva -Tiryagbhyam technique is the recent method of multiplication which is vertical and cross-wise (Singh *et al.*, 2020). This is not complicated much as compared to the old fashioned method that can accommodate a good number of steps that are in between and written calculations. It is of assistance especially when multiplying two digits numbers, but it can be used in the multiplication of larger numbers.

3. Mathematical Techniques and Equations

3.1 Multiplication Using Urdhva-Tiryagbhyam

The Urdhva-Tiryagbhyam method offers with a proper innovative approach to multiplication by employing a vertical and crosswise pattern. Unlike conventional multiplication, which often involves the multiple intermediate steps and written calculations, this technique allows for a more direct and mentally manageable process (Aimo *et al.*, 2023). It is particularly effective for multiplying two-

digit numbers, although it can be extended to larger numbers as well.

For two-digit numbers represented as AB and CD , the multiplication can be expressed mathematically as:

$$AB \times CD = (A \times C) \times 100 + (A \times D + B \times C) \times 10 + (B \times D)$$

This formula illustrates how the digits are multiplied in a structured sequence involving vertical and crosswise operations. The first term represents the product of the tens digits, the second term combines the crosswise products, and the final term represents the product of the units digits.

To illustrate this method, consider the example:

$$\begin{aligned} 23 \times 14 &= (2 \times 1) \times 100 + (2 \times 4 \\ &\quad + 3 \times 1) \times 10 + (3 \times 4) \\ &= 200 + 110 + 12 = 322 \end{aligned}$$

This saves time, which one spends in calculating and gets a chance to calculate this by practice through the mind (Priya *et al.*, 2021). The strategy also advances the apprehending of place value and relationship of the number that are the chief areas of numerical aptitude. With the help of this pattern the students would be in a position to greatly increase on the speed and

accuracy of multiplication by memorising the pattern.

3.2 Subtraction Using Nikhilam Sutra

Nikhilam Navatasha carramam Dashatah sutra is a success score that trailed a score of subtraction between the concept of complements. This is because the operation is rather simplified to be less complex and not carrying out direct subtraction which will be time-consuming and may produce an error.

The complement of a number N with respect to a base 10^n is given by the equation:

$$\text{Complement of } N = 10^n - N$$

This formula allows subtraction to be performed by finding the complement of the number being subtracted. For example, consider the subtraction:

$$1000 - 678$$

Using the Nikhilam method, each digit is subtracted from 9, except the last digit, which is subtracted from 10. This yields:

$$1000 - 678 = 322$$

The process does not involve being borrowed which is the main cause of fault in traditional realizations of subtraction (Khan *et al.*, 2023). It is easier to operate as it makes it easier to do and can be applied to quicker and more precise computations. Besides, it has generated the information about the numerical bases and the complement-complements, which are helpful in mathematics.

Nikhilam sutra is specifically handy in competitive examination along with real life whereby one is required to achieve rapid computations. This focus of the mental calculation is in compliance with procedure of creation of the numerical ability on the larger scale of the Vedic Mathematics.

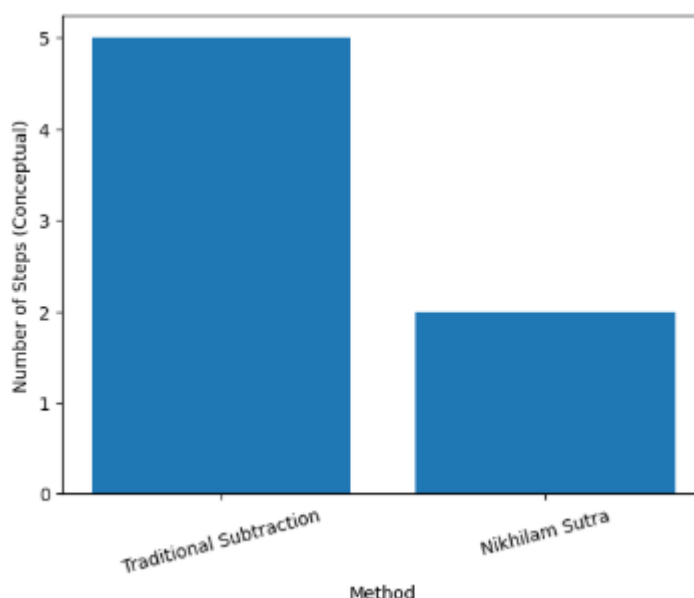


Figure: A comparison graph showing how the Nikhilam Sutra reduces the number of conceptual steps compared to traditional subtraction.

3.3 Squaring Using Ekadhikena Purvena

The Ekadhikena Purvena sutra suggests the easiest way of squaring the terminated numbers, which have a five at their end. It is one of how complex a procedure would have been made simpler into a thinking process (Mitsea *et al.*, 2022). It is founded on an idea of multiplying a number by 1 which is twice greater in comparison with the previous one.

For a number of the form $(10x+5)$, the square can be expressed as:

$$(10x + 5)^2 = x(x + 1) \times 100 + 25$$

The square of such numbers we obtain by multiplying terminator, x , by its successor, $x+1$, and then add two zeros followed by addition of 25 as illustrated by the formula below:

For example, consider:

$$25^2 = 2 \times 3 \times 100 + 25 = 600 + 25 = 625$$

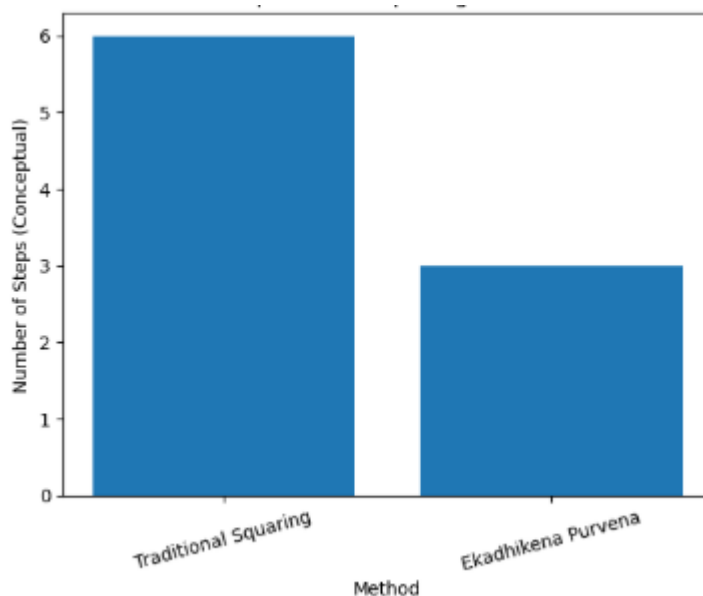


Figure: Squaring Using Ekadhikena Purvena

The other approach is more rapid as well as less cognitively demanding so that the students will be able to compute with fewer brains. It centres on the necessity to discover the patterns in mathematics and the learner is challenged in trying to discover pattern in mathematical problems.

The special value of Ekadhikena Purvena technique is the development of numeracy. It will help to have better confidence and efficacy in the mathematical work, as one will be able to derive fast and accurate results out of it (Pasuluri *et al.*, 2022). Also through it we can also see how mathematical work, to accomplish with Vedic Mathematics, can be intuitive and easy to do through smooth means.

In general, the theoretical presuppositions and mathematical functions of Vedic Mathematics prove that they are effective as the technique of the numerical aptitude improvement (Upadhyay *et al.*, 2022). The techniques that were implemented within the process of teaching it made it possible to establish more interesting and efficient learning environment capable of not only promoting cognitive development but also mathematical skills.

4. Research Methodology

4.1 Research Design

The current research design is the mixed-method research design as it is performed with a purpose of conducting a comprehensive research on the impacts of Vedic Mathematics to improve numerical

aptitude. It is indicated that this research approach is expected to adopt a mixed-method approach, which would be feasible in some aspects in as far as it introduces the possibility of merging quantitative and qualitative aspects of learning outcomes (Rahaman *et al.*, 2023). Numerical ability does not express itself in the form of assessable performance e.g. speed and accurate performance but also cognitive involvement, confidence and Math attitude. Thus, either a quantitative or a qualitative analysis method could not depict the phenomenon in its entirety.

The quantitative part of the study pays attention to objective data of the variables of performance such as the speed, accuracy and efficiency in solving the problems. These variables are determined by the taking of structured tests which are pre and post-test taken before and after the intervention (Padma *et al.*, 2021). In its turn, the qualitative aspect will examine the experience and perception of the students towards Vedic Mathematics, as well as their attitude towards it. This involves the rate of interest, confidence and felt comfort whenever they solve mathematical problems.

It can be established that these two approaches can be combined to carry out a

triangulation hence introducing validity and reliability of the results. The quantitative results present the empirical data of the enhancements and the form of qualitative data present some explanatory weight as to how and why the latter is so Khare *et al.*, 2022). The broad design is applicable as it is not merely in quantifying the outcomes, but also in understanding the procedures, which are behind the quantification that underlie the improvement of the numerical aptitude.

4.2 Sample Selection

Study sample will be selected at random among the students at various education levels and this will be diverse in terms of learning and the level of thinking ability. (Priya *et al.*, 2022) The above will be accomplished by the fact that academic levels and stages used in the investigation will be adequate to carry out an investigation as whether Vedic Mathematics levels can be equally as effective in the different age groups as in learning stages of mathematics.

The sub-subjects are categorically split into two different groups i.e. experimental and control group. The control group gets taught mathematics as per the classical method wherein the emphasis is placed on getting processes, written as well as a

typical algorithm. This group serves as a benchmark and as such, one to compare with since this is the conventional way of teaching numeric skills.

Systematic training of the Vedic Mathematics techniques on the other hand is done on the experimental group. According to such training, the main sutras are learned, the lessons are rather practical, and the shortcut methods are applied to the purpose of solving the arithmetic problems (Owiti *et al.*, 2023). The intervention will attempt to educate the students on the application of mental calculation strategies and pattern solution of problems.

All attempts are made to equalize both formations in reference to the grade of original capacities, homogenization of structure of ages, and the level of education. Pre-test of scores The scores will be ascertained the same weight before the intervention. This is required to reduce the chances of bias, as well as so that the difference in the results could be due to the use of Vedic Mathematics compared to the existing difference.

4.3 Data Collection Methods

In the target research, the process of data collection will be conducted by using both the structured and alternative data

collection methods i.e. observations and self-report. The pretest and the post-test assessment is the main type of quantitative information which can be utilized in testing the number aptitude of students (Dixit *et al.*, 2021). The exams consist of activity in dealing with multiplier, division, subtraction, square with emphasis on speed and accuracy. The pre-test establishes a reference of all the participants as well as the post-test in totality of improvement after the intervention.

Besides using test-based assessments, direct observation is also the strategy that is used to approximate change of problem-solving behaviour. The specific attention is paid to the span of time during which students are going to spend their time on calculations and operations of which they will be involved in the process. These empirical data will give hints as far as the actual practice of the Vedic's and how far the students are using the mind and not written computation.

Qualitative data will be gathered by use of interviews and questionnaires that will be received among the candidates in the experimental group (Patel *et al.*, 2020). The instruments will be oriented to the subjective measures of the student such as the perceived-engagement rate of self-

issued tasks on mathematics and the perceived-difficulty of the same. The open-ended questions will also ensure they present their opinion regarding the usefulness of the Vedic Mathematics and how it has affected their learning.

The merging of these data collection is highly significant since they would give an all-round dataset which would include the measurable and experiential level. It is a multi-faceted one and it enhances the study.

4.4 Data Analysis Techniques

The statistical and thematic analysis is involved in the data analysis of the study. The quantitative data obtained in the pre-test and post-test results are analyzed by using descriptive, as well as inferential statistics (Kiran *et al.*, 2022). Such statistics as the mean and standard deviation are calculated to reach the conclusion about the visualization of the central tendency and variability of scores within each group.

The average score provides an indication of the average standard of performance and the standard deviation provides the indication of the uniformity of performances amongst the parties involved. The analysis of the progress of each group can be conducted through the means of the pre-test and post-test. In addition, the

results of the analysis of differences between the control and the experimental group are carried out to determine the effectiveness of Vedic Mathematics training.

Performance improvement is further quantified using percentage change, which is calculated as:

$$\begin{aligned} &\text{Performance Improvement (\%)} \\ &= \frac{\text{Post-test Score} - \text{Pre-test Score}}{\text{Pre-test Score}} \times 100 \end{aligned}$$

This metric provides a standardized measure of progress, enabling comparison across individuals and groups.

Thematic analysis is applied to qualitative data, which was collected either during interviews or the questionnaires (Kumra *et al.*, 2023). The identified categories of responses are more confidence, less anxiety, more engagement, and perceived ease of calculation. This debate helps to define the trends that continue to repeat itself and it is possible to disclose an even clearer picture concerning the overall impact of Vedic Mathematics on the learning process of the students.

The results of the study are not only essentially rigorous but are also of significance because of the combination of

statistical and thematic analysis. A twofold strategy of this type contributes additional meaning to the study and supports more universal conclusions.

5. Results and Analysis

5.1 Improvement in Speed

It is possible to deem as one of the most significant study findings the tremendous increase of the speed of the calculation of students belonging to the experimental group. When these students are introduced to the training of Vedic Mathematics, the time taken by the students to solve arithmetic problems reduces considerably (Day-ongao *et al.*, 2022). This is observed to be more so in the processes such as multiplication and division where the common processes typically justify some number of steps and written forms are used.

In the methods of Vedic one can perform some calculations in the mind of a student therefore no need of intermediate steps and reduced college brain work. As a result, the students would be able to provide solutions even quicker and more efficiently. As it has been analyzed, the results of both pre-test and post-test indicate that the increase in outcome of the experimental group is characterized by the statistically significant reduction in the average completion time, in

contrast to the results of the control group which is characterized by the marginal improvement.

This acceleration is not merely a mechanical one, but a revolution in thought more deeply. Vedic Mathematics students are taught to identify the number patterns and apply appropriate methods instantaneously (Kumar *et al.*, 2021). This is quite an effective skill particularly in situations where there is very little time such as during competitive tests and speed is a significant determinant.

5.2 Accuracy Enhancement

The paper also finds that accuracy of students who are trained in Vedic Mathematics is greatly enhanced besides the speed. The intervention, in turn, decreases the error rate of the experimental group significantly, which indicates that the structural mental tasks are implemented to develop more correct calculations.

The traditional ones tend to comprise numerous processes which mediate errors especially where the students lose the information between the processes. Vedic, in its turn, simplifies things due to the reduced number of procedures to be taken. This renders ease of error insignificant and the overall accuracy is heightened.

The group outcomes of the analysis reveal that the test scores of the experimental group is higher with regard to accuracy of the group in the post-test than that of the control group. This is enhanced in the case of several types of problems which include multiplication, subtraction and squaring (Bandala *et al.*, 2023). The result suggests the idea that Vedic mathematics is not only a method to speed up the calculation, but also competence of solving the problems is increased.

There is also a possibility of the accuracy increase to be linked to conceptual understanding increase. Vedic Mathematics allows the students to have a deeper understanding of numbers in the form of patterns and relations. This is knowledge that makes certain that they correlate errors at a more rapid pace and correct them as soon as possible.

5.3 Comparative Performance

To provide a comprehensive evaluation of performance, the study introduces an efficiency index that combines both accuracy and time taken to solve problems.

This index is defined as:

$$\text{Efficiency Index} = \frac{\text{Accuracy}}{\text{Time Taken}}$$

Efficiency index is complicated index which is a gauge of numerical dexterity which depicts the perfectness and expediency of calculating. The more it is raised, the better since the index is point that shows the high levels of accuracy with lower time.

The results have shown that the experimental group would increase relatively a very high index on efficiency as compared to control group. This conclusion confirms that Vedic Mathematics trains on the aspect of enhancing the total performance based on the increase of speed and accuracy (Prathibha *et al.*, 2023). The control group has the ability to achieve a reasonable accuracy, however, it takes more time to compute consequently holding a lower efficiency index. The high effectiveness of the Vedic Mathematics in comparison to the holistic methodology of learning numbers is pointed at by the situational comparison. It demonstrates that such a system is not only possessing certain advantages in speed or accuracy, but it is a component of a balanced improvement of both (Samrudh *et al.*, 2020). Its results and the discussion in general provide a satisfactory empirical data proving the efficiency of Vedic Mathematics in upgrading numeracy abilities. The intertwining of the speed, precision and

effectiveness optimism its usefulness of being an effective pedagogical tool in the modern learning programs.

6. Discussion

Findings of the present study are very persuasive of the abundance of evidence to the effect that Vedic Mathematics is highly applicable in the creation of numerical ability among students. The evident change in the pace, accuracy, and overall efficiency is not a mere coincidence but it can be viewed into deeper thinking about cognitive policies regarding how students approach mathematical problems (Chowdhury *et al.*, 2023). One of the greatest ones is the Vedic reduced computational complexity. The traditional mathematical procedures are multifaceted and each phase has to be monitored and this heightens possibilities of mistake. Vedic mathematics, on the contrary, simplify these processes using generalized patterns and concise strategies which require a minimal amount of operations to be carried out. This kind of simplification allows students to be fully efficient and more confident about performing numerical information.

The other critical dimension that the findings have shown is that it will promote the mental computations. Vedic Mathematics gives much emphasis to the

mental computation rather than the written methods. When the processing of the data is changed to an internal one, the level of the thinking grows, and the memory is enhanced. Students who undergo trainings in Vedic skills visualize numbers and operations with the number in the mind which aids in solving the problems in a less time as well as paying more attention (Subramanian *et al.*, 2021). It is also valued in scenarios which involve time and effectiveness such as in competition tests and exams where speed in which one can perform some calculations without the aid of something external is of importance.

The other significant factor, which results in the enhancement of numerical aptitude, is the maturing of pattern recognition capabilities. Vedic Mathematics encourages the students to know the association that exists between the numbers and the need to have the right strategy based on the association (Urmal *et al.*, 2021). The strategy assists students in being critical and capable of extrapolating the solutions to different types of problems. On an indicator basis, students can know that there are some similarities in multiplication that can be simplified according to one base number or complements to be able to solve them more quickly and accurately. This type of pattern learning does not just

enhance efficiency in the computations, conceptual learning is also improved.

Increase in student engagement is also a major outcome of the use of Vedic Mathematics. These methods are participatory and easy to understand and hence mathematics becomes fun to invest in and not so terrifying to study. Absence of concreteness and memorization as the conventional methods of teaching compel mathematics to appear rather a challenging subject among the students (Singh *et al.*, 2020). Vedic Mathematics in its turn develops the element of fabrication and discovery which adds to the absence of the feeling of anxiety and the forming of positive attitudes towards the subject. Based on the qualitative data that was obtained during the study, the students feel more confident and encouraged in making the Vedic techniques usage which results in their performance rise.

The comparison between the Vedic Mathematics and traditional methods is one of the most important requirements of the discussion. Conventional ways of teaching mathematics normally rely on sequential means through which some rigid algorithms are followed. Though all these are good methods of constructing the foundations, they could be restrictive and would deter

creativity and innovative thinking (Aimo *et al.*, 2023). Vedic Mathematics, in its turn, promotes a more relaxed and free style. It allows the student to identify multiple solutions to arriving at a solution therefore creative and adaptable. Such a shift in conceptual learning over procedural learning may be regarded as a severe advancement in the sphere of mathematics teaching. However, one will be forced to concede that it was not possible to use Vedic Mathematics to solve all mathematical problems. Even though it is highly efficient in terms of arithmetic operations and even some other operations in the field of algebra, it may not even be applied to more specialized areas of mathematics requiring a rigorous form of formalism and abstract thought (Priya *et al.*, 2021). Therefore, the Vedic approaches need to be viewed as the supplementary ones which can be implemented to complement and not replace the traditional ones. An integrated approach of the two would provide a chance to experience balanced education and combine both efficiency and conceptual coverage.

7. Pedagogical Implications

7.1 Integration into Curriculum

The study findings can be applied to the curriculum design and practice with

enormous implications. Vedic Mathematics could be adopted to a high extent in the existing curriculum of enhancing the teaching and learning of numeracy skills. It may be regarded as an option of the math curriculum instead of an individual topic (Khan *et al.*, 2023). This will not meddle with the overall standard of the syllabus in the fact that such a methodology will enable the students to have the advantage of both Vedic and traditional.

Some of the strategies that shall be employed during the integration include integrating Vedic approach in the supplementary modules that focus on the art of mental calculation and problem solving. This type of module may be developed to enhance ordinary courses and raise more practice in implementation of shortcut techniques. The other plan involves holding of skill development seminars under which deep training will be provided on Vedic Mathematics (Mitsea *et al.*, 2022). Such trainings become particularly helpful in the case of student participants that are about to live through competitive examinations and have to be quick and precise.

Further, Vedic Mathematics can also be used as the method of enhancing the result in aptitude tests. Competitive tests involve

many competitive tests which the students must undertake and complete all the related calculations quickly and accurately and the techniques provided by Vedic Mathematics can provide the students with many opportunities. By setting up such techniques into the examination preparation programs, schools will be equipped to help students increase their performance and the self-esteem (Pasuluri *et al.*, 2022).

Vedic Mathematics should be implemented in the curriculum and aligned with the national educational objectives to emerge a successful one. The introduction of these techniques must be done with special care so as not to interfere with the development of the basic mathematics. Instead, it should improve and augment the knowledge available to the students to provide more alternatives of learning.

7.2 Teacher Training

Qualification and preparedness of teachers is very crucial in the successful application of Vedic Mathematics in the classrooms. Teachers also play a significance in the teaching and learning process of how to use the new techniques to students (Upadhyay *et al.*, 2022). There should, therefore, be a need to develop comprehensive training programs that would make teaching staff

obtain necessary knowledge and skills they would need to teach Vedic Mathematics.

Vedic techniques training would involve both theoretical and practical training to the teachers. The teachers ought to be familiar with the principles of the sutras and they how they apply on the different types of mathematical problems (Rahaman *et al.*, 2023). In addition, they should also be sensitized to pedagogical practices that facilitate learning of an interactive and student based learning. This includes applications of demonstrations, instruction demonstration, and collaborative practice activities that include involvement.

Some other elements of teacher training are assessment skills. The teacher must be in a state to evaluate the progress of the students, either in the traditional or Vedic direction so that the outcome of learning is achieved (Padma *et al.*, 2021). This involves the design of assessment instruments that do not only measure the accuracy but also speed as well as efficiency.

The chosen factor of effectiveness of the Vedic Mathematics teaching is constant betterment of the profession, as well. The workshops, seminars and refresher courses can help teachers to update themselves with new development and best practices. This

can be done by schools and colleges investing on the teacher-training process so that the fruitful practice of Vedic Mathematics can be fulfilled in the classroom.

7.3 Student Benefits

The learning field of applied Vedic Mathematics is one that carries a lot of benefits to the student. Among the key advantages, one should point out the boost in confidence. The more mentally calculated and resolves problems the more competent they are and this is translated to the student as they advance in achievement of studies (Khare *et al.*, 2022). This helps them to have increased confidence and therefore, engage in the learning process as well as positively taking the mathematical problems. The other notable benefit is the reduction in the anxiety about mathematics. Many learners are anxious and intimidated in the process of solving mathematical problems most particularly when they are unable to accomplish them in time. Contributing to the elimination of this anxiety, Vedic Mathematics makes the calculations easier and reduces the cognitive burden because an individual who needs to make simpler calculations (Priya *et al.*, 2022). Students will be empowered to gain an understanding and apply

mathematical concepts easier and this is translated to a less painful learning process. The other noteworthy product of using Vedic Mathematics is the enhancement of intelligence abilities (Owiti *et al.*, 2023). The concentration and logical thinking, memory and focus on the mind calculation, pattern recognition improve the activities of the brain and develop such functions. It is possible that these mental skills may not work exclusively in the area of mathematics, but can also be applied into other areas of study and life. Altogether, the values of Vedic Mathematics are not limited to a direct change of numerical ability. They help in holistic development of the students and that is why they make them successful in the academics and lifelong learning.

8. Limitations of the Study

Despite such positive outcomes, there are few weaknesses of the study that need to be mentioned. The small sample size is among the key weaknesses because it might impact on the extrapolation of the results. There should be higher and more subjective sample to provide a more realistic vision of the effect of the Vedic Mathematics in other populations. The other limitation is the time that the intervention has. The approach is focused on the short term profits on the numerical abilities, however, it does not

assess the number of skills the ability to be memorized in the long run and the sustainability of the mentioned gains (Dixit *et al.*, 2021). It would be necessary to conduct longitudinal research to determine the long term effectiveness of Vedic Mathematics in learning among the students.

The study also does not explore the issue of relevance of Vedic processes on higher mathematical content (Patel *et al.*, 2020). Even though the results of the proposed research are effective in the simple arithmetic operations, this area of research needs investigation to understand how these processes can be transferred to proper mathematical education. These limitations demonstrate that there is more research work that is needed in this area. These gaps should be addressed using the areas of deficiency in future research to come up with a more conclusive review on the role played by Vedic Mathematics in education.

9. Conclusion

Therefore, Vedic Mathematics emerges as an effective and innovative approach to improving numerical aptitude. It provides learning of mathematics with a more interesting and approachable method since emphasis is given on mental calculation, speed and precision. The findings of this

study only describe the fact that educated students who are trained in the Vedic methods outperform those who are educated in a traditional training system in terms of efficiency, precision and confidence. Vedic Mathematics is an effective system because it finds a way of simplifying tricky mathematical problems and stimulating creative thought. It also gives one the chance to study students based on patterns and relationships thereby enabling students to value mathematics more. It also, at the same time, enhances the intellectual capacities of memory, attention, and criticism that are essential in relation to academic performances. It should be noted though that Vedic Mathematics could not be regarded as a replacement of the traditional systems of mathematics. Instead it has to be integrated as an add-on value proposition to the learning process itself. Combining the good of both methods, the teachers will be in a position of creating an even healthier and more efficient system of education. Inspired by plain Vedic Mathematics, modern day education can influence cognitive ability and mathematical levels significantly with respect to mathematical abilities. As the present wave of change in education demands alters, new methods, such as Vedic Mathematics, may have

significance in training students with demands of the forthcoming challenges.

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