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Vedic Mathematics' Role in Revival of the Indian Knowledge System (IKS) and Integration with Contemporary Education

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Abstract

The Indian Knowledge System (IKS) encompasses a wide array of systematized disciplines that have been cultivated to a high level of sophistication in India since ancient times. Indian culture and philosophy have had a profound influence on the world, and the National Education Policy (NEP) 2020 highlights the importance of integrating IKS into Indian education. This emphasizes the need to foster a deep connection with India's rich and diverse cultural and intellectual heritage, both from ancient and contemporary perspectives. Among the many remarkable contributions of Indian knowledge is Vedic Mathematics, an ancient system of mathematics rooted in the Vedas. This unique approach offers innovative and efficient methods for solving complex mathematical problems using 16 primary sutras and 13 sub-sutras. Vedic Mathematics was rediscovered in the 20th century by Jagadguru Swami Bharati Krishna Tirthaji. It has the potential to transform modern education by providing students with simplified and faster techniques for mathematical problem- solving. The aim of this study is to explore the concept of Vedic Mathematics, explain its various sutras and sub-sutras and examine their relevance in the present era. Additionally, the paper will propose strategies to effectively incorporate Vedic Mathematics into the current educational school curriculum, enhancing the learning experience and offering a fresh perspective on mathematics education.

Keywords: Indian Knowledge System (IKS), Vedic Mathematics, Sutras and Sub-sutras.

Introduction

Indian knowledge system (IKS) represents a vast repository of wisdom accumulated over thousands of years, encompassing diverse fields including mathematics, astronomy, architecture, medicine, education and philosophy (Rao, 2006; Mahadevan & Bhat, 2022). It signifies the collective and interconnected wisdom of diverse Indian communities and encompasses traditional practices, indigenous technologies and holistic approaches (Ram & Neeta, 2024). It is the systematic transmission of knowledge from one generation to next generation. The Indian Knowledge System is based on the Vedic literature, the Upanishads, the Vedas, and the Upvedas (Mandavkar, 2023).In contemporary times, the significance of IKS has gained renewed attention as educators and policymakers seek solutions to address the limitations of current educational frameworks (Ram & Neeta, 2024). Indian culture and philosophy have had a profound influence on the world, and the National Education Policy (NEP) 2020 highlights the importance of integrating IKS into Indian education. The National Educational Policy 2020 (NEP 2020)

endorses the integration of Indian Knowledge System (IKS) into the curriculum at all levels of education. Among the many remarkable contributions of Indian knowledge is Vedic Mathematics, an ancient system of mathematics rooted in the Vedas. Vedic Mathematics is discovered by Jagadguru Shankaracharya Swami Bharati Krishna Tirthaji between 1911 and 1918. Sutras and methods used in Vedic mathematics make mathematical problems easier and faster to solve. In Vedic mathematics, the computations are made simpler by the 16 Sutras and 13 Sub-Sutras. Vedic methods, which date back five thousand years, may still capture the growing field of mathematics. One of the famous quotes of Shakuntala Devi that "without mathematics, there's nothing you can do. Everything around you is mathematics. Everything around you is numbers". Since mathematics is the foundation of all other information, it should be made simple and pleasurable for individuals who find learning it difficult. Mathematics taught through Vedic mathematics techniques makes learning an enjoyable task for the students. Ample studies has been carried out in the past and present to support the fact Vedic Mathematics enhance the computational ability and problem solving skills of the students. Like, Vedic Mathematics Techniques showed a promised effect in increasing students' problem- solving skills and improving motivation towards Mathematics (Ongao & Tan, 2022). It significantly reduces the time required for completing some basic mathematical calculations (Kaur, 2017).

The aim of this study is to explore the concept of Vedic Mathematics, explain its various sutras and sub-sutras and examine their relevance in the present era. Additionally, the paper will propose strategies to effectively incorporate Vedic Mathematics into the current educational curriculum, enhancing the learning experience and offering a fresh perspective on mathematics education.

Significance of the study

It is undeniable that the ability to compute fluently is essential for mathematical competency in the quickly evolving world of today (National Council of Teachers of Mathematics, 2000).The All-India percentage of third-grade students who can at least solve a numerical subtraction issue was 28.2% in 2018 and 25.9% in 2022, according to the Annual Status Education Report (ASER) 2024. In 2024, this percentage rose to 33.7%. Among children attending government schools, this percentage rose from 20.9% in 2018 to 20.2% in 2022 and then to 27.6% in 2024.This figure indicated a less significant improvement for pupils attending private schools since 2022. Since 2022, government schools in the majority of states have improved; in areas like Tamil Nadu and Himachal Pradesh, rises of more than 15 percentage points have been seen. This study also showed that the percentage of Std V students who can at least solve a numerical division issue has increased across the board in India. In 2018, it was 27.9%; in 2022, it was 25.6%; and in 2024, it increased to 30.7%. Government schools are also the primary force behind this development. Punjab and Uttarakhand are the states where government school performance has improved the highest (by more than 10 percentage points).The report also revealed that the performance of Std VIII students in basic arithmetic remains similar to earlier levels, going from 44.1% in 2018 to 44.7% in 2022 to 45.8% in 2024. Recently, the New National Policy on Education 2020 has put emphasis on enhancing the basic mathematical literacy under "Foundation Literacy and Numeracy: An Urgent and Necessary Prerequisite to Learning," which is regarded as an essential pre-requisite to enhance foundational literacy and basic mathematical operations like addition, subtraction, division, and multiplication. Apart from this, the highest priority will be given to achieve foundational literacy and numeracy by 2025 (Kour, 2024). In India, mathematics has a very long history that dates back thousands of years. Numerous important pillars of algebra, geometry, trigonometry, and calculus

were established in India, which is also where the place value number system—which includes zero—that we all use today to express numbers was initially created and implemented (NCFSE, 2023).
National education policy 2020 incorporation of Indian Knowledge System (IKS) into the curriculum at all levels of education. Vedic Mathematics proves to be highly beneficial for students ranging from the third grade to college level, as it aids in resolving numerous challenges associated with competitive examinations (Chauchan, 2024). Students taught with Vedic mathematics shows marked improvement in logical reasoning and mental calculations ability (Charu Garg, 2024). It gives best results and has wider application in Digital Signal Processing, Image Processing, Artificial Intelligence and huge computation processes(Sumathi & Indumathi,2021).From the above studies the researcher found that Vedic Mathematics has positive impact on student's problem solving skills,computational skills and numerical ability. So the researcher thought of exploring the relevance of Vedic mathematics in present scenario.

Objectives of the Study

1. To highlight the relevance of Vedic mathematics Sutras and Sub- Sutras in the present era.
2. To propose some strategies to incorporate Vedic maths in the existing school curriculum.

Research Methodology

In this paper, research methodology involves a comprehensive review of literature on Vedic Mathematics. This research relies on Secondary data, including research papers, journals, survey reports, articles and theses. This investigation highlighting a significant research gap, as limited work has been conducted in exploring the applications of Vedic Mathematics Sutras and Sub-Sutras in present era.

Vedic Mathematics

The term "Vedic Mathematics" refers to a supposedly old system of computation that Shri Bharati Krishna Tirthaji Maharaj (1884–1960) "rediscovered" from the Vedas between 1911 and 1918. According to Tirthaji, sixteen sutras, or word formulae, form the foundation of all Vedic Mathematics. Since these formulas are meant to explain how the mind functions naturally, they should be very helpful in pointing pupils in the direction of the best approach to solving problems (Joshi, 2017).Vedic Mathematics provides simple approaches that are easy to perform mentally, in contrast to older methods that frequently need intricate and time-consuming steps (Shekhar, 2024). The Vedic Mathematics Sutras has showed a promising impact on students' desire for mathematics and their ability to solve problems (Ongao & Tan, 2022).

OVERVIEW OF SUTRAS

Vedic mathematics is based on 16 sutras and 13 sub-sutras, each of which provides a unique approach to addressing mathematical problems ranging from elementary arithmetic to more complex algebra and calculus.
Here is a brief overview of the 16 main sutras and 13 sub- sutras

Table1: Name, Meaning & Uses of Sutras of Vedic Mathematics

S.No.	NAME	MEANING OF SUTRAS	USES OF SUTRAS
1.	Ekadhikena Purvena	By one more than the	Squaring numbers ending with 5

		previous one	
2.	Nikhilam Navatascaramam Dasatah	All from 9 and the last from 10	Subtraction near base numbers (10, 100, 1000, etc.)
3.	Urdhva Tiryak	Vertically and crosswise	Multiplication of two numbers
4.	Paravartya Yojayet	Transpose and adjust	Solving algebraic equations, especially fractions
5.	Sunyam Samyasamuccaye	When the sum is the same, that sum is zero	Solve equations where equal expressions appear on both sides
6.	Anurupye Shunyamanyat	If one is in ratio, the other is zero	Solving proportion based equations
7.	Yavadunam Tavadunikritya Varga Samam	Whatever the deficiency, lessen it and square	Squaring numbers below base 10,100, etc.
8.	Vilokanam	By mere observation	Quick mental math based on pattern recognition
9.	Sankalana vyavakalanabhyam	By Addition and by Subtraction	Solving linear equations
10.	PuranaPuranabyham	By the completion or non-completion	Useful for Simplifying fractions and complements
11.	Chalana-Kalanabyham	Differences and Similarities	Ratios and proportion problems
12.	Yaavadunam	Partial Products	Multiply numbers close to a base by breaking them apart
13.	Vestanam	Specific and General	Deriving specific solutions from general formulae
14.	Yavadvividham Vyashtih	Separately the particular from the general	Useful for separating individual components
15.	Samuccaye	Collective addition	Useful for quick summation techniques
16.	Ekanyunena Purvena	By one less than the previous one	Division, especially when divisor is one less than base

Table 2: Name, Meaning and Uses of Sub-Sutras of Vedic Mathematics

S.No.	NAME	MEANING OF SUB-SUTRAS	USES OF SUB-SUTRAS
1.	Antyayordashakepi	The last digit remains the same / The last digits make 10	Helps to find the last digit of a product, when numbers end in digits summing to 10
2.	Sopantyadvayamantyam	The last two and the last	Useful in problems where only the last two digits of the result are

			needed
3.	Ekaadhikena Purvena	One more than the previous	Extends the "Ekadhikena Purvena" technique for squaring numbers near powers of 10
4.	Paravartya Sutra	Transposition and adjustment	Helps in solving linear equations and balance complex algebraic expressions
5.	Calana-Kalanabhyam	Differences and Similarities	Additional methods for solving problems on ratios and proportions
6.	Gunakasamuccayah	The product of the sum	Helps in dealing with algebraic expressions involving products of sum
7.	Gunita Samuccayah	The product of the sum is the sum of products	Useful in factoring and simplifying expressions like (a + b) (a + c)
8.	Yavadunam Tavatirekena Varga Yojayet	By one less than the one so much is the square	Simplifying multiplication based on patterns in last digits
9.	Antyayordasake'pi	The last digit is as it is	Simplifying multiplication based on patterns in the last digits
10.	Antyayorekadhikaduhitayor	On the last two digits	Enables accurate results by focusing on the last two digits in calculations
11.	Ardhasamuccayah Samuccayoh	The sum of the half-sums is the sum	Technique for adding fractions with even terms
12.	Ekanyunena Sesena	One less than the one followed by the last	Helps in quick division.
13.	Sesanyankena Caramena	The last by the last, and the ultimate by one less than the last	A technique for division, dealing with recurring decimals

Source: https://www.geeksforgeeks.org/vedic-maths/

Together, these Sutras and sub-Sutras constitute the extensive body of knowledge known as Vedic Mathematics, which provides a wide range of methods and approaches for solving problems and performing mental calculations. Gaining an understanding of these ideas can greatly improve one's efficiency and mathematical ability.

Relevance of Vedic Mathematics in present era

Based on the past researches, the Researcher found the relevance of Vedic Mathematics in the present era.

Vedic Mathematics in Education: Education is one of the primary fields in which Vedic mathematics is used. Teachers can assist pupils in developing their mathematical abilities and boosting their confidence in handling challenging issues by imparting the system's methods and concepts. Students who have a fear of math or who struggle with standard methods of math instruction may find the system especially helpful.

Vedic mathematics can foster creativity and mental agility in addition to its practical uses. The system can aid in the development of critical thinking and problem-solving abilities that are applicable in a number of domains by pushing pupils to think creatively and unconventionally when solving mathematical issues.

Vedic Mathematics in Science and Engineering: Science and engineering domains can also benefit from the application of Vedic mathematics. Using the system's methods, calculations for complicated equations and large-number issues can be completed fast and precisely. In disciplines where exact computations are crucial, including physics, chemistry, and engineering, this can be especially helpful.

Apart from its pragmatic uses, Vedic mathematics has the potential to foster creativity and innovation in the domains of science and engineering. The system can contribute to breakthroughs and developments in various domains by pushing practitioners to think creatively and unconventionally when solving difficulties.

Vedic Mathematics in Finance and Economics: In economics and finance, Vedic mathematics can also be used. Complex financial equations and problems can be calculated fast and precisely using the system's methods. In industries where accuracy and precision are crucial, like accounting, investment banking, and financial analysis, this can be especially helpful.

Apart from its pragmatic uses, Vedic mathematics has the potential to foster creativity and innovation in the fields of economics and finance. The system can support innovations and enhance financial performance by pushing practitioners to think creatively and unconventionally while solving difficulties.

Vedic Mathematics in Cultural Preservation: In India, Vedic mathematics has been handed down through the ages and has grown to be a significant aspect of the nation's cultural legacy. India may contribute to the preservation of its own cultural identity and raise knowledge of its rich history and customs by encouraging the study and use of Vedic mathematics.

For practitioners, Vedic mathematics can be a source of pride and inspiration in addition to its cultural relevance. Learning and using this age-old mathematical method can encourage practitioners to develop and create in their professions while also giving them a sense of connection to their heritage and culture.

Vedic Mathematics in Competitive Exams: In competitive exams like UPSC, GPSC, CET, and others, Vedic mathematical computations are also beneficial. It saves students' time on these competitive tests

and makes complicated mathematical equations easier to calculate. Students can benefit from Vedic mathematics in ways that conventional mathematics may not be able to.

Vedic Mathematics in Machine Learning: Combining machine learning with Vedic mathematics offers a promising path for research and development. While Vedic mathematics offers age-old knowledge and sophisticated approaches to problem-solving, machine learning offers strong tools for data analysis, pattern recognition, and automation. By doing so we can uncover hidden knowledge in Vedic mathematics, improve learning experiences, and automate calculations.

Vedic Mathematics in Everyday life Calculations: The sutras improve general numerical literacy by facilitating rapid mental math, which enables people to complete calculations without the need of calculators. Vedic concepts can be used by individuals to track spending, manage budgets, and improve financial planning.

Challenges in incorporating Vedic Mathematics in existing School Curriculum

Vedic mathematics has many benefits, but there are a number of obstacles to overcome before it can be taught in schools. Here are a few of the main obstacles:

Lack of Awareness and Understanding: It is challenging to integrate Vedic Mathematics into standard curricula because many educators and institutions lack a thorough understanding of Vedic Mathematics and its advantages, and there are frequently insufficient training programs for teachers to comprehend and successfully teach these techniques.

Resistance to Change: Subjects like mathematics, where a well-established curriculum and teaching strategies already exist, traditional educational systems can take a long time to embrace innovative approaches. Teachers, administrators, and even parents may be resistant to change because they would rather stick with tried-and-true techniques than try anything new.

Overload in the Curriculum: The vast array of courses covered in today's school curricula leaves little room for extra content. It would take a lot of time and resources to carefully restructure current curricula in order to incorporate Vedic mathematics. Teachers could also be concerned about giving pupils too much information.

Lack of Standardized Resources: There are no standardized textbooks, exercises, or rules for Vedic mathematics that can be used in every school. Although there are many books and internet resources available, there isn't a unified, well-organized curriculum that schools can readily implement. Schools find it more difficult to apply the strategies in a methodical manner as a result.

Perceived Lack of Significance: In the current technological era, some parents, teachers, and students could believe that Vedic mathematics is obsolete. There may be a belief that more rapid mental computations are no longer required due to the increased use of computers, calculators, and other devices. Resistance may result from this, particularly in educational institutions that place a greater emphasis on digital literacy and contemporary practices.

Challenge of Assessing Achievement: Rather than academic grades, Vedic mathematics achievement is frequently evaluated based on quickness and mental acuity. It is challenging to analyse Vedic Mathematics' efficacy within the conventional academic framework because standardized assessments typically do not examine mental computation or the methods employed. This makes it difficult to defend its inclusion.

Teacher Training and Expertise: Teachers who are not only knowledgeable about the methods but also have the necessary training are needed to implement Vedic mathematics. Schools may have trouble

finding suitable teachers because Vedic approaches are not yet emphasized in most regions' teacher preparation programs. Furthermore, even with training, teachers may not feel confident or at ease teaching subjects outside of the traditional curriculum.

Cultural and Historical Context: Ancient Indian customs, which may be seen as culturally particular and not generally applicable, are the foundation of Vedic mathematics. The cultural roots of Vedic mathematics may raise questions regarding its suitability or potential conflicts with regional educational ideologies in non-Indian or international educational settings.

Strategies to incorporating Vedic Mathematics into the existing School Curriculum

Incorporating Vedic Mathematics into the existing school curriculum can be done strategically to maximize its benefits while addressing the challenges mentioned earlier. Below are some strategies that can help seamlessly integrate Vedic Mathematics into current educational systems:

Incorporate Vedic Techniques Gradually

Instead of redesigning the entire curriculum, start by, introducing Vedic Mathematics in small, manageable portions. As an example:

- Provide Vedic approaches as extra lessons in conventional math classes, especially for arithmetic (multiplication, division, square roots, etc.).
- Extra-Curricular Activities: Create workshops, math clubs, or after-school events for students to study Vedic approaches without disrupting the primary curriculum.

Teacher Training and Professional Development

- Effective teacher training is a crucial to the success of using Vedic Mathematics.
- Organize workshops and professional development events for teachers to study Vedic Mathematics techniques.
- Online Courses: Allow teachers to learn at their own speed using online courses and materials.
- Collaborate with Vedic Mathematics specialists to give training sessions and boost instructors' confidence in teaching these methods.

Pilot Programs and Research

Start with pilot programs in a few schools or classes to assess the effectiveness of Vedic Mathematics before continuing it out across the entire curriculum:

- Experimental Classes: Run Vedic Math as a pilot program in specific grades and gather feedback from both teachers and students.
- Impact Research: Conduct studies or research to demonstrate the benefits of Vedic Mathematics, such as improved calculation speed, better problem-solving skills, or enhanced cognitive abilities.

Integration into Existing Math Topics

Instead of teaching Vedic Mathematics as a separate subject, integrate its techniques into existing topics in the math curriculum:

- Mental Math Practices: Introduce Vedic methods like quick multiplication, division, and squaring as part of daily practice sessions.
- Application in Problem-Solving: Use Vedic techniques to solve word problems, algebraic expressions, and other standard math topics, showing how the methods can speed up calculations and improve results.
- Cross-Curricular Use: Apply Vedic Mathematics in subjects like physics or economics where calculations play a crucial role, demonstrating its practical utility.

Involve Parents and Communities

Engage the wider community in the learning process to foster support for Vedic Mathematics:

- Parent Workshops: Offer workshops for parents to understand the benefits of Vedic Mathematics and how they can help their children to practice at home.
- Community Awareness Campaigns: Run awareness campaigns in schools and local communities to explain the advantages of Vedic Mathematics, showcasing success stories from students.

Create Interdisciplinary Connections

Emphasize the cross-disciplinary nature of Vedic Mathematics:

- Collaboration with Science Teachers: Integrate Vedic techniques into subjects like physics and chemistry, where quick mental calculations can be helpful.
- Technology Integration: Pair Vedic techniques with modern technologies like coding, programming, or artificial intelligence to show how they complement each other.
- Art and Architecture: Show how Vedic Mathematics principles can be applied to geometry, design, and architectural structures, helping students see the relevance in real-world applications.

Emphasize Conceptual Understanding

Rather than solely focusing on speed and memorization, ensure that students understand the underlying principles of Vedic techniques:

- Focus on Patterns and Logic: Teach students to recognize patterns, relationships, and the logic behind Vedic techniques, ensuring that they understand the "why" behind the methods.
- Build on Existing Knowledge: Gradually integrate Vedic techniques with concepts students have already learned, such as multiplication tables, algebra, and number theory.

Highlight Real-World Applications

Demonstrate how Vedic Mathematics is useful in the real world, which will motivate students to engage with the methods:

- Showcase Careers: Highlight how Vedic Mathematics is used in fields like engineering, finance, cryptography, data science, and statistics.
- Practical Examples: Use real-life examples (e.g., calculating interest rates, project management, or architectural design) where Vedic techniques help streamline problem-solving.

Conclusion

Vedic mathematics is an effective toolset for streamlining intricate computations in a variety of fields. The sutras offer methodical approaches to solving mathematical issues, promoting effectiveness, originality, and greater comprehension. We can improve Mathematical competence and problem-solving abilities in a variety of domains, from engineering and architecture to economics and daily life, by incorporating these approaches into instruction and real-world applications. By adopting these strategies, Vedic Mathematics can be gradually and effectively incorporated into the existing school curriculum, enriching students' mathematical abilities and fostering a more innovative, dynamic approach to learning mathematics.

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