



Vedic Mathematics and Significance of Libraries in Preserving Vedic Sutras with Special Reference to Indian Knowledge System

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Abstract: Indian Knowledge System (IKS) is an indigenous knowledge which incorporates different fields like arts, science, mathematics, philosophy etc. Among different fields, Vedic Mathematics is one of the notable contributions of IKS, which is a collection of ancient techniques for carrying out mathematical operations more quickly and effectively. The purpose of this paper is to study about Vedic Mathematics and the need of preserving the Vedic Sutras, with a special focus on IKS. The study highlights how library helps in preserving this ancient knowledge. This paper included qualitative, quantitative and explanatory research methods to study about IKS and Vedic Sutras. A comprehensive literature search of previous studies and publications was carried out to explore the role of libraries in preserving IKS and Vedic Mathematics. Through the literature search it is found that IKS has a great influence in different disciplines, especially in Vedic Mathematics. The findings also include that libraries are essential in preserving the ancient manuscripts, documents etc. related to IKS and Vedic Mathematics. This paper discussed about the Vedic Mathematics and the role of libraries in preserving and promoting IKS and Vedic Sutras.

Keywords: Indian Knowledge System, Vedic Mathematics, Libraries, Ancient Knowledge Preservation.

I. INTRODUCTION

The Indian Knowledge System (IKS) is also known as Bhāratīya Jñāna Paramparā Vibhāga. The Ministry of Education (MOE) established the Indian Knowledge System Division in October 2020 to advance the interdisciplinary research on all facets of IKS. NEP 2020 acknowledges the rich heritage of Indian knowledge, which has evolved through time and experimentation and is founded on the ideas of Jan, Vignan, and Jeevan Darshan. It also seeks to integrate the IKS into the education system.

IKS incorporate a varied collection of knowledge which influenced the different disciplines like philosophy, mathematics, science, arts etc. Among these disciplines, Vedic Mathematics has benefited greatly from the contributions of IKS. It is an ancient methodology used for making calculations faster and in easier way. Between 1911 and 1918, Shri Bharati Krishna Tirthaji Maharaj "rediscovered" an ancient system of calculation from the Vedas, which is now known as "Vedic Mathematics".

IKS have existed for a very long time, but the advancement of technology and western thought has eclipsed them. In today's world it is necessary to raise public knowledge about IKS and change the mindset of the public. Therefore, we have to give importance in preserving the IKS properly which protects the cultural heritage of a nation and it can be used by future generations. Library plays an important role in maintaining and preserving the IKS and Vedic Mathematics by classifying, archiving and digitizing this knowledge.

II. Literature Review

Kumar & Charisma (2012) suggested a high speed Vedic multiplier by using ancient Vedic Mathematics procedure to boost the performance. Vedic Mathematics is an old mathematical theory with a special method of calculation which is based on 16 sutras. Prasad (2016) focus on Vedic Mathematics and their mathematical calculation, square root, multiplication, addition, subtraction etc. which help the students in their competitive examination. It facilitates the students who struggle with mathematics by enabling them to do calculation quickly or rapidly.

Libraries are actively working in conserving traditional knowledge through a variety of initiatives such as digitizing ancient manuscripts, documenting it and preserve it in digital repositories (Dangi & Saraf, 2017). They focus on the concept of Indian Knowledge System, along with its significance and the functions of libraries in preserving, maintaining and promoting this traditional knowledge in India. Vedic Mathematics has proven to be exceedingly efficient for mathematical mental calculation (Raikhola et al., 2020). The striking techniques are found in Sutras and Sub sutras for making mathematical calculation quickly and easily. He focuses on the thematic analysis of Vedic Mathematics.

According to Mandavkar (2023), the Indian knowledge system seeks to encourage and promote more research in order to address current social problems. It is the methodical transfer of information from one generation to the following. IKS seeks to

encourage further research in number of areas such as sustainable development, psychology, health etc. in order to solve the current social problems.

IKS encompasses wide range of information, beliefs etc (Timane & Wande, 2024). It includes various subjects like philosophy, science, mathematics etc. The Indian Knowledge System also emphasizes the need of inner development and self-realisation.

Shewalee (2024) concentrates on the significance of libraries in India to preserve and maintain the Indian Knowledge System. According to him, libraries are essential to advancement, preservation and dissemination of this ancient knowledge. In ancient period, libraries were housed the manuscript, literary works etc.

III. Objectives of the Study

1. To discuss about IKS and different sutras, sub-sutras and short tricks of Vedic Mathematics.
2. To examine the role of libraries in preserving IKS and Vedic Mathematics.
3. To study about different Government initiatives taken for preserving the ancient knowledge.

IV. Methodology

This paper included qualitative, quantitative and explanatory research methods to study about IKS and Vedic Sutras. A thorough literature review of previous research and publications was conducted to investigate the significance of libraries in conserving IKS and Vedic Mathematics. Secondary data pertinent to IKS and preservation of ancient knowledge were collected from Internet, research paper, theses and other online resources.

V. Vedic Mathematics

Ancient Indian mathematics is known as "Vedic mathematics" since it derives from Vedas, more specially from "Atharva Vedas". It is basically based on 16 sutras and 13 sub-sutras.

Table 1 shows the different Sutras, their meaning and sub-sutras.

Table 1: Sutras, Meaning of Sutras and Sub-sutras

SI No	Sutras	Meaning	Sub-Sutras
1	Urdhva-Tiryagbyham	Perpendicularly and crossway	Adyamadyenantya-mantyena
2	Nikhilam Navatashcaramam Dashatah	All from 9 and the last from 10	Sisyate Sesajnah
3	Ekadhikena Purvena	By one more than the previous one	Anurupyena
4	Paravartya Yojayet	Transfer and amend	Kevalaih Saptakam Gunyat
5	Shunyam Saamyasamuccaye	When the entirety is the similar that totality is zero	Vestanam
6	Anurupye Shunyamanyat	If one is in relation, the other is zero	Yavadunam Tavadunam
7	Sankalana-vyavakalanabhyam	By adding and by deduction	Yavadunam Tavadunikrtya Varganca Yojayet
8	Puranapurabyham	By the conclusion or non-completion	Antyayoradaskaepi
9	Chalana-Kalanabyham	Alterations and Resemblances	Antyayoreva
10	Yavadunam	Whatever the magnitude of its insufficiency	Samuccayagunita
11	Vyashtisamasthi	Share and Entire	Lopanasthapanabhyam
12	Shesanyankena Charamena	The remnants by the last digit	Vilokanam
13	Sopaantyadvayamantyam	The eventual and double the last but one	Gunitasamuccayah Samuccayagunitah
14	Ekanyunena Purvena	By one fewer than the preceding one	
15	Gunitasamuchyah	The product of the entirety is equivalent to the entirety of the product	
16	Gunakasamuchyah	The influences of the entirety are equivalent to the entirety of the factors.	

Vedic mathematics facilitates more precise and quick mental computations. Any difficult equation in addition, multiplication, square etc. can be solved only by mental calculations with the help of all the sutras and short tricks. Some of these are discussed below:

1. Addition using Vedic sutras:

The addition in Vedic mathematics can be done in a number of ways. In this section we will use the sutra Ekadhikena Purvena for addition of some numbers.

Example: $5637+7656+7724+5672$.

$$\begin{array}{r}
 \text{Solution:} \quad 5 \ 6 \ 3 \ 7 \\
 \quad \quad \quad 7 \cdot 6 \ 5 \cdot 6 \\
 \quad \quad \quad 7 \cdot 7 \cdot 2 \ 4 \\
 \quad \quad \quad \underline{5 \ 6 \ 7 \ 2} \\
 \quad \quad \underline{26 \ 6 \ 8 \ 9}
 \end{array}$$

Step1: Put the provided numbers in rows and columns, leaving a little space between each digit.

Step2: In column 1(from the right side), add first two digits, $7+6=13$

Step3: Since 13 is greater than 9 so mark dot (.) on 5(digit which is left to 6 in column 2).

In this case, the number with a (.) on it indicates one greater than the one before it.

Step4: Now, start by adding 3 with 4; $3+4=7$

Again start with 7 such that $7+2=9$

Step5: In the response space, write 9 below.

Step6: For the remaining columns, repeat the same procedure.

Thus the final answer is 26689

2. Subtraction using Vedic sutras:

In Vedic Mathematics, there are different distinct ways to accomplish subtraction. Among all, the sutra Ekadhikena Purvena and Param Mitra Unka are the most effective approaches. Here two numbers are called Param Mitra(best friends) if there sum is 10. In this section we will use the sutra Ekadhikena Purvena for subtraction of some numbers.

Example: 4567-3468

$$\begin{array}{r} \text{Solution:} \quad 4 \ 5 \ 3 \ 7 \\ \underline{3 \ 4 \ 6 \ 8} \\ 1 \ 0 \ 6 \ 9 \end{array}$$

Step1: Put the provided numbers in rows and columns.

Step2: In column 1(from the right side), 8 is greater than 7 so we cannot subtract it from 7.

Here 2 is the best friend of 8, so add 2 with 7, $2+7=9$. So, we write 9 on the answer space and mark dot (.) on 6, which is on the same row on column 2.

In this case, the number with a (.) indicates one greater than the one before it.

Step3: For remaining numbers, repeat the same procedure.

Thus the final answer is 1069

3. Multiplication using Vedic sutras:

For multiplication of any number there are several formulas in Vedic Mathematics. In this paper we will use the sutra Urdhva Tiryagbyham (perpendicularly and crossway) for multiply any numbers.

Case1: Multiplication of two digit numbers.

Example: 24×52

$$\begin{array}{r} \quad \quad 2 \quad \quad 4 \\ \times \quad 5 \quad 2 \\ \hline 4 \quad 8 \quad 2 \quad 0 \\ 1 \quad 2 \quad 0 \quad 0 \\ \hline 1 \quad 2 \quad 4 \quad 8 \end{array}$$

Step1: Multiply the unit digits or right most digits vertically i.e. $4 \times 2=8$ and write 8 in the answer space.

Step2: Multiply the first digit of first row with 2nd digit of 2nd row i.e. $2 \times 2=4$, multiply the 2nd digit of first row with the first digit 2nd row i.e. $4 \times 5=20$ and then add them i.e. $20+4=24$. Here 24 is a two digit number so we will write 4 as the 2nd digit of the answer and 2 is carry out to the left.

Step3: Last multiply the left most digit vertically i.e. $2 \times 5=10$ and add carried over number i.e. 2 with 6 so that we will get $10+2=12$. Write 12 as the 3rd digit of the answer. So the final answer is 1248.

Case2: Multiplication of three digit number:

Example: 342×244

$$\begin{array}{r} \quad \quad 3 \quad \quad 4 \quad \quad 2 \\ \times \quad 2 \quad 4 \quad 4 \\ \hline 8 \quad 3 \quad 4 \quad 4 \quad 8 \\ 6 \quad 8 \quad 8 \quad 8 \quad 8 \\ 6 \quad 8 \quad 8 \quad 8 \quad 8 \\ \hline 8 \quad 3 \quad 4 \quad 4 \quad 8 \end{array}$$

Step1: Multiply the unit digit or right most digits vertically i.e. $4 \times 2=8$ and write 8 in the answer space.

Step2: Multiply the 2nd digit of first row with 3rd digit of 2nd row i.e. $4 \times 4=16$, multiply the 3rd digit of first row with the 2nd digit 2nd row i.e. $2 \times 4=8$ and then add them i.e. $16+8=24$. Here 24 is a two digit number so we will write 4 in the answer and 2 will carry out to the left.

Step3: Multiply first digit of the 1st row with 3rd digit of the 2nd row i.e. $3 \times 4=12$, multiply 3rd digit of the 1st row with 1st digit of the 2nd row i.e. $2 \times 2=4$, at last multiply the middle digit of each row i.e. $4 \times 4=16$ and add all them and add the carried out number also i.e. $12+4+16+2=34$. Here 34 is a two digit number so we will write 4 in the answer and 3 will carry out to the left.

Step4: Multiply the 1st digit of first row with 2nd digit of 2nd row i.e. $3 \times 4=12$, multiply the 2nd digit of first row with the 1st digit 2nd row i.e. $4 \times 2=8$ and then add all them and add the carried out number i.e. $12+8+3=23$. Here 23 is a two digit number so we will write 3 in the answer and 2 will carry out to the left.

Step5: Lastly multiply the left most digit vertically i.e. $3 \times 2=6$ and add carried over number i.e. $6+2=8$. Write 8 as the last digit of the answer in the left side.

So the final answer is 83448.

4. Squares of any number using Vedic sutras:

We can use several sutras of Vedic Mathematics to square a number. In this section we will use the sub-sutra “Yavadunam Tavadunikritya Varganca Yojayet” to square a number. The meaning of this sutra is that whatever the deficiency, subtract that deficit from the given number and write alongside square of that deficit. This sutra is applicable to obtain squares of numbers close to base of powers of 10.

Case1: Numbers near and less than the bases of power of 10.

Example: 9987^2

Step1: First write the base and find the deficit. Here base is 10000 and deficit is $10000-9987=13$.

Step2: Square the deficit number i.e. $13^2=169$. Here 169 is a three digit number but the base has four zeros so we will write 0169 in the right side of the answer.

Step3: Subtract the deficit from the given number to get the left side of the answer i.e. $9987-13=9974$.

Therefore the final answer is 9974 0169.

Case2: Numbers near and greater than the bases of power of 10.

Example: 113^2

Step1: First write the base and find the surplus i.e. here base is 100 and surplus is $113-100=13$.

Step2: Square the surplus number i.e. $13^2=169$. Here 169 is a three digit number but the base has two zeros so we will write 69 in the right hand side of the answer and 1 is carried out to the left.

Step3: Add the surplus with the given number and add the carried out number to get the left side of the answer i.e. $113+13=126+1=127$.

Thus the final answer is 127 69.

Case3: Squares of numbers ending with 5 can be solved using the sutra “Ekadhikena Purvena.”

Example: 105^2

Step1: First find 5^2 i.e. 25 and write it on the right side of the answer space.

Step2: Now add one with the remaining digit i.e. $10+1=11$ and multiply it by 10 i.e. $11 \times 10=110$. Write 110 on the left side of the answer space.

Therefore the final answer is 110 25.

VI. Significance of Libraries in preserving IKS and Vedic-Mathematics

IKS includes Vedic Math which help in understanding the indigenous knowledge and concept of Mathematics. But the modernization and documentation errors have overshadowed the traditional knowledge. Therefore, it is now important to preserve this information. Library plays an important role in preserving the manuscripts, books and other materials pertaining to IKS. In ancient period, the libraries of Nalanda, Takshashila and Vikramshila were not only used to keep books, but also as a hub for research, scholarship, and the transmission of information to scholars. In medieval period, Islamic scholars and monarchs in India built libraries called Kutubkhana or Maktab to promote the study of Islamic literature, including the Quran, Hadith etc. During the British period, the Asiatic Society of Bengal and the National Library of India started preserving a variety of information that helps in understanding the cultural heritage and tradition of India (Shewale 50).

With the advancement of ICT, libraries started to digitize the old books and manuscript. The digitization of IKS allows libraries to preserve them in a digital format that is accessible to people worldwide. Libraries bridge the gap between traditional and modern knowledge which improve the interdisciplinary research.

Libraries preserve the documents or manuscripts related to Vedic Mathematics to protect the traditional knowledge and promote its application in contemporary education. It acts as a repository to conserve this ancient knowledge for future generation. It also helps in promoting the Vedic Mathematics and make sure that this indigenous knowledge will survive in modern time.

The role of libraries in promoting and preserving the Vedic mathematics in the following ways:

1. Sutras and Sub Sutras:

There are different Sutras and Sub Sutras in Vedic Mathematics. During ancient period, these Sutras and Sub sutras are handwritten on palm leaves or other delicate materials which are kept in the libraries of Nalanda and Takshashila. There are many printed books which include sutras and sub sutras published by different scholars are preserved in National Library of India, Delhi Public Library etc.

2. Short tricks in Mathematics:

In Vedic Mathematics there are different short tricks for operation like addition, multiplication etc. These short tricks are thoroughly explained in a number of publication and educational resources, which are preserved in libraries. Basic literature of "Vedic Mathematics" written by Sri Bharati Krishna Tirthaji Maharaja is considered as one of the main sources of learning these tricks which is often available in libraries.

3. Digitization of Ancient Manuscript:

Different digitization projects are undertaken by the libraries to preserve the ancient manuscript which include the sutras, sub sutras and short tricks of Vedic mathematics in digital format. There are different digital libraries such as Project Gutenberg, Google books etc., where the digital copies of Vedic sutras are preserved which are accessible freely or with limited access.

4. Educational Programs and Workshops:

Library also organizes different educational seminar, conferences and workshops on Vedic Mathematics which creates awareness among the people about its advantages and use in modern education. These programs help a larger audience in understanding the Vedic Mathematics.

VII. Major initiatives taken by the government for preserving the Indian knowledge System(IKS)

Indian Government has initiated a number of projects to preserve the IKS which includes Vedic Mathematics. Government has also taken various initiatives through libraries and other related organization to ensure its persistence and pertinence in modern society. Some of the major initiatives are as follows:

1. National Digital Library of India(NDLI):

NDLI is launched by the Ministry of Education, Government of India via National Mission on Education through Information and Communication Technology. NDLI digitize the ancient document and manuscript pertaining to Vedic Mathematics which includes Sutras, Sub sutras and different facets of Indian Knowledge System like Yoga, Ayurveda etc.

2. National Mission for Manuscript(NMM):

NMM is established by the Ministry of Tourism and Culture, Government of India in February 2003 to collect, preserves and digitizes the ancient manuscript of India. Historically, a large number ancient writings related to IKS and Vedic Sutras are handwritten on palm leaves, paper or other fragile materials which are meticulously preserved and digitized by NMM.

3. Traditional Knowledge Digital Library(TKDL):

TKDL is established in 2001 as a joint venture between Indian Ministry of Health and Family Welfare and Council of Scientific and Industrial Research (CSIR). It is a digital collection of indigenous and traditional knowledge of India which mainly focuses on medicinal plants and formulas utilized in Indian medical systems.

4. Kalasampada:

The Indira Gandhi National Centre for the Arts (IGNCA) launched digital library initiatives known as Kalasampada. It aim is to protect and preserve the cultural heritage and indigenous knowledge of India which includes rare books, manuscripts, audio, video etc.

VI. Conclusion

The IKS contains a wealth of intellectual and wisdom that provide a deeper comprehension of the universe and existence of human. Vedic mathematics has been greatly influenced by IKS, which has shaped its evolution and philosophical foundations. IKS and Vedic Mathematics can't be maintained and preserved without libraries. Libraries protect the ancient knowledge which includes old manuscripts; documents etc. and provide access to this knowledge through traditional collection and digital archives. The study concludes that in order to inspire the future generation for utilizing and understanding IKS and Vedic Mathematics, it is necessary to properly preserve this knowledge with the help of libraries.

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