A Comparative Study of Vedic System of Mathematical Operations and Present System of Mathematical Operations

(An Interdisciplinary Study)

A Thesis

Submitted in partial fulfillment of the requirement for the degree of

Doctor of Philosophy

IN

MATHEMATICS

Under the Faculty of Science

By

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Under the Supervision of

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ABSTRACT

The present venture is concerned with the study of comparison of Vedic System of Mathematical Operations and Present System of Mathematical Operations.

The present investigation which is entitled, "**A Comparative Study of Vedic System of Mathematical Operations and Present System of Mathematical Operations**" tried to identify difference in logical reasoning ability and mental calculation ability of two group of Class VIII Students out of which one group was taught with Vedic System of Mathematical Operations and the other group was taught with the present system of Mathematical Operations. There were four objectives of this study. On the basis of review of related literature and objectives of the study two research Hypotheses were formulated. Later on to analyse further the research hypotheses, 4 sub-hypotheses were formulated for each of the research hypothesis.

For the purpose of this research a 40 students of class VIII of 4 schools were divided into two groups of 20 each. One group was taught with Vedic System of Mathematical Operations and the other group was taught with present system of Mathematical Operations. A pre-test was conducted to test the entry level of the students and post-test was conducted to test the hypothesis. After teaching, a logical reasoning test and mental calculation

test was given to both the groups. Then the scores were computed and then Mean, SD and 't' value was computed. Significance Level of 't' value became the basis of acceptance/ rejection of Hypothesis. This acceptance/rejection of the hypothesis decided the effect of Vedic System of Mathematical Operations on the students.

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A Comparative Study of Vedic System of Mathematical Operations and Present System of Mathematical Operations

"Neglect of mathematics works injury to all knowledge, since he who is ignorant of it cannot know the other sciences or the things of the world." - Roger Bacon

Introduction

Mathematics is a fundamental part of human thought and logic, and integral to attempts at understanding the world and ourselves. Mathematics provides an effective way of building mental discipline and encourages logical reasoning and mental rigor. In addition, mathematical knowledge plays a crucial role in understanding the contents of other school subjects such as science, social studies, and even music and art.

Mathematical literacy is a crucial attribute of individuals living more effective lives as constructive, concerned and reflective citizens. Mathematical literacy is taken to include basic computational skills, quantitative reasoning, spatial ability etc.

Mathematics is applied in various fields and disciplines, i.e., mathematical concepts and procedures are used to solve problems in science, engineering, economics. (For example, the understanding of complex numbers is a prerequisite to learn many concepts in electronics.) The complexity of those problems often requires relatively sophisticated mathematical concepts and procedures when compared to the mathematical literacy aforementioned.

Math encourages logical reasoning, critical thinking, creative thinking, abstract or spatial thinking, problem-solving ability, and even effective communication skills.

Mathematics is a study of measurements, numbers, and space, which is one of the first sciences that humans work to develop because of its great importance and benefit.

Mathematics reveals hidden patterns that help us to understand the world around us. Now, much more than arithmetic and geometry, mathematics today is a diverse discipline that deals with data, measurements and observations from science, with inference, deduction, and proof; and with mathematical models of natural phenomena, of human behavior, and of social systems. The literal meaning of mathematics is “things which can be counted” now you can think that counting has vital role in our daily life; just imagine that there were no mathematics at all, how would it be possible for us to count members of the family, number of students in the class, rupees in the pocket, runs in a cricket match, days in a week or in a months or years? On a basic level you need to be able to count, add, subtract, multiply, and divide.

Even nature also embraces mathematics completely. We see so much of symmetry-around us and have a deep sense of awareness and appreciation of patterns. Observe any natural thing and find out symmetry or pattern in it. Change of day into night, summer into winter etc. In plants there are innumerable examples of symmetry, shapes, patterns, etc. Such examples exist in animals, in objects, in pictures and other things. The sun rises and sets at specified moment. The stars appear at fixed time. Mathematics runs in the veins of natural sciences like Physics and Astronomy. This subject is inextricably incorporated with world and the natural phenomena

The origin of the word "mathematics" is in Greek, which means tendencies to learn, and there are many branches of mathematics in science, that are related to numbers, including geometric forms, algebra, and others.

Mathematics plays a vital role in all aspects of life, whether in everyday matters such as time tracking, driving, cooking, or jobs such as accounting, finance, banking, engineering, and software. These functions require a strong mathematical background, and scientific experiments by scientists need mathematical techniques. They are a language to describe scientists' work and achievements.

As for mathematical inventions, they are numerous throughout the ages. Some of them were tangible, such as counting and measuring devices. Some of them are not as tangible as methods of thinking and solving. The symbols that express numbers are also one of the most important mathematical inventions.

Vedic Mathematics

Vedic mathematics is the name given to the ancient Indian system of mathematics that was rediscovered in the early twentieth century from ancient Indian scripture namely Atharvaveda. We use mathematics in our all endeavors; therefore it becomes a part of our life. Our imaginations do involve mathematics. From beggar to businessman, everyone uses mathematics in their life. The education commission

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

Mathematics is the study of numbers, quantity, space, structure and change. It is a branch of science that uses numbers and symbols which are arranged using systematic mathematics rules. It can create moment of pleasure and wonder for all

pupils when they solve a problem for the first time, discover a more efficient solution, or notice hidden connection. But the essence and nature of teaching of mathematics is degrading day by day which creates a fear and phobia among students. Due to excessive use of electronic gadgets and internet software, student and teacher both are diverting their path from efficient and effective teaching learning process. Now a student is laying less stress on mental calculation and is more dependent on the gadgets and software for the solution. Vedic mathematics is a unique method of solving problems by the use of fast calculations. It is unique system as it helps to solve all kinds of mathematical problems easily and efficiently. Tiwari, Gankhuyag, Kim & Cho (2008) found that the proposed Vedic multiplier circuit seems to have better performance in terms of speed. The goal of teaching mathematics is not just academic achievement but its personal and professional growth also. Vedic mathematics not only helps in understanding the concept efficiently but also brings interest while learning mathematics through magical techniques.

Atharvaveda – supposedly contains a set of sixteen sutras that describe all of mathematics. Sutra is often translated word formula and is short and easily memorized and recited. Vedic Mathematics is a system of mathematics based on these sixteen sutras. These sixteen sutras are given below

The 16 Sutras of Vedic Math

1. *Ekadhikina Purvena*

   (Corollary: Anurupyena)

   Meaning: By one more than the previous one

2. *Nikhilam Navatashcaramam Dashatah*

   (Corollary: Sisyate Sesasamjnah)

   Meaning: All from 9 and the last from 10

3. *Urdhva-Tiryagbyham*

   (Corollary: Adyamadyenantyamantyena)

   Meaning: Vertically and crosswise

4. *Paraavartya Yojayet*

   (Corollary: Kevalaih Saptakam Gunyat)

   Meaning: Transpose and adjust

5. *Shunyam Saamyasamuccaye*

   (Corollary: Vestanam)

   Meaning: When the sum is the same that sum is zero

6. *(Anurupye) Shunyamanyat*

   (Corollary: Yavadunam Tavadunam)

   Meaning: If one is in ratio, the other is zero

7. *Sankalana-vyavakalanabhyam*

   (Corollary: Yavadunam Tavadunikritya Varga Yojayet)

   Meaning: By addition and by subtraction

8. *Puranapuranabyham*

   (Corollary: Antyayordashake'pi)

   Meaning: By the completion or non-completion

9. *Chalana-Kalanabyham*

   (Corollary: Antyayoreva)

   Meaning: Differences and Similarities

10. *Yaavadunam*

    (Corollary: Samuccayagunitah)

    Meaning: Whatever the extent of its deficiency

11. *Vyashtisamanstih*

    (Corollary: Lopanasthapanabhyam)

    Meaning: Part and Whole

12. *Shesanyankena Charamena*

    (Corollary: Vilokanam)

    Meaning: The remainders by the last digit

13. *Sopaantyadvayamantyam*

    (Corollary: Gunitasamuccayah Samuccayagunitah)

    Meaning: The ultimate and twice the penultimate

14. *Ekanyunena Purvena*

    (Corollary: Dhvajanka)

    Meaning: By one less than the previous one

15. *Gunitasamuchyah*

    (Corollary: Dwandwa Yoga)

    Meaning: The product of the sum is equal to the sum of the product

16. *Gunakasamuchyah*

    (Corollary: Adyam Antyam Madhyam)

    Meaning: The factors of the sum is equal to the sum of the factors

Here is an example to show how fast the results can be achieved using Vedic mathematical operations-

Example-1:

Present/ Conventional System: Find 109^2=

```
   109
x  109
------
   981
  000x
 109xx
------
 11881
------
```

Vedic Mathematical Operation:

Find 109^2= (109+9)/9x9 = (118)/81 = 11881

First step: 109 is added by 9 and 118 is put as one part of the answer.

Second step: 9 is multiplied by 9, other part of the answer comes as 81. The product thus comes 11881.

This calculation is based on *Nikhilam Sutra (Corollary)* which means “whatever the extent of its deficiency, lessen it still further to that very extent, and also set up the square (of that deficiency)".

But for numbers above 10 We work exactly as before; but, instead of reducing still further by the deficit, we increase the number still further by the surplus. In above example 9 is surplus from 100 then 9 is added to 109 and becomes 118. After that that surplus 9 is squared and becomes 81. Putting 81 after 118 we get the answer 11881 which is the square of 109.

Some more comparison are given in detail in chapter-4 of this research thesis.

Role of Mathematics in Intellectual Development and Logical Reasoning:

Mathematics teaching is very important for intellectual developments there is no other subject in the curriculum likes mathematics which makes students' brain active. Problem solving help in the development of mental faculties.

Mental work is needed to solve mathematical problems. If a child, has a mathematical problem her/his brain becomes active in solving that problem. Each problem of mathematics posses such sequence which is necessary for constructive and creative process. In this way, all-mental abilities of child are developed through mathematics.

Moreover, mathematics makes the man very calculating so that she/he can economies time, money, speech, thought etc. It develops a strong will power, patience and self-reliance. It, also develop the faculty of discovery and invention.

Historically, learning mathematics and teaching it to all students at the school stage has been motivated by the belief that a study of mathematics helps students to learn to reason and apply such reasoning to everyday problems. It is believed that learning mathematics leads to learners' cognitive development. Thus, one of the important questions that all mathematics educators must constantly ask themselves is: Does the

mathematics that we teach (and that our students learn) lead to an enhancement of students' cognitive abilities?

This leads us to clarify what we mean by the understanding of mathematics that we seek to develop in our students. The deeper understanding that we are looking for must enable students to look at and understand a new situation, delve into the repertoire of mathematical knowledge that they have in terms of concepts, processes, and ideas and adapt or modify those ideas so as to apply them towards resolving a new problem situation. Such understanding calls for building deep connections between concepts, a variety of lenses and representations with which to view the concepts, and flexibility that allows one to sufficiently modify concepts so as to apply them to a new situation. It requires students to develop a rich network of ideas that one may draw from when faced with a novel situation. In this process, students develop habits of the mind that enable them to analyze other situations that they may encounter in life, mathematical or otherwise. This critical blend of processes is what mathematics educators refer to as problem-solving. It is this kind of cognitive development that most modern societies would like their citizens to develop.

Role of Speedy Calculations in Mathematics and Human Life:

A lot of attention and perseverance is required when it comes to doing mental arithmetic. Right from the exams in junior school to +2 boards, while shopping or saving, we need to apply mathematics daily. However, it is problematic to calculate complex equations in our heads. Maths play an important role- consciously or subconsciously in our day-to-day activities. Whether in school while giving answers to problems in algebra or geometry or while calculating how much change we need to give to a shopkeeper, we are always dependent on our math skills.

Learning to calculate by quick and effective mental arithmetic helps in making life easier; be it while measuring ingredients to make a dish or calculating the steps taken while running laps, basic math is essential. Though we have the "Calculator" app and other similar apps in our mobile phones it is not always convenient to take the mobile out, browse through the apps, find the right one, put the inputs and wait for the results.

The ability to calculate swiftly has its own benefits. Be it the board exams where time management is crucial or calculating the spend after shopping, the advantages of being able to do a quick calculation is unparalleled. Exercising the brain by doing mental arithmetic helps in making you smarter and more efficient. It betters your

rational thinking, helps in quick analysis and even helps to fight degenerative conditions like dementia or Alzheimer's.

Exercising the brain helps to prevent panic attacks and anxiety due to stress by settling the nerves. Solving games like "Sudoku" or playing brain enhancement **online math games** from the Play store helps in increasing the IQ level and alertness while having fun.

There are a lot of motives for doing mental arithmetic and increasing one's capability to do calculations in one's head. For example:

- It will increase the ability to think more clearly and be less dependent on calculators.
- Doing fast maths can be impressive in any gathering or job interviews.
- One won't get robbed when it comes to handling change money.
- One will need a smaller number of tutorials and save money likewise.

Everybody is not born with the same IQ but it is proven that exercising the brain by doing mental arithmetic can increase the IQ levels. The saying "practice makes a

man perfect" holds true in this case. The more one practice mental arithmetic the easier it will be to face life's challenges.

There are stories of people speaking a completely new language or developing a new set of skills after an accident. Our brain works in strange ways and it is completely possible to become a maths genius later in life.

Doing **mental maths** is an acquired skill achieved by repeated practice and exercising the brain. Mental arithmetic helps in activating areas of the brain responsible for spatial awareness. The frontal temporal region of the brain, which helps with long-term memory, gets activated when we do mental arithmetic, and this can help us in doing complex equations in our head.

Knowledge about the below inputs can help you increase your mental arithmetic skills:

- Addition and multiplication tables,
- Knowledge of the complements of the number 10, squares up to 15^2 (225) as well as the powers of 2, Pi, Golden Ratio
- Multiplying by powers of 10 with negative and positive exponents,

- Dividing by a number is the same as multiplying by its reciprocal,
- Learning the special products: $(a+b)^2 = a^2+2ab+b^2$, etc. and rules of factorization.
- Learning about polynomial, calculations for trigonometry, exponents, calculus, bar graphs, equivalent fractions can help make a strong base.

To master mental arithmetic it takes time, patience and repeated practice. It is not an overnight phenomenon so do not stress yourself if you feel that you are not progressing. A lot of people find it convenient to write the equations and calculations down on a piece of paper. Visualizing them helps in memorizing at a faster pace. However, some find it easier to retain everything in their heads.

Almost 50% of students face problems doing maths and that impacts the other subjects as well. Students face issues with multiplication and division, in doing fractions and decimals and get paranoid while doing calculations with bigger numbers.

There are a lot of new programs which help students to excel in mental arithmetic by-

- Increasing their reflexes

- Re-tuning the way they think logically
- Making them comfortable working with large numbers
- Teaching them the properties of the numbers

The fun element needs to be incorporated in all these so that the students find it easier to learn and it does not become a burden to them. One of the best ways is to learn through apps which we can download. One can also visit web pages where one can learn how to excel in mental arithmetic.

Mental arithmetic is captivating, and it shows how our brains can achieve unbelievable heights. We need to practice enhancing our reflexes to make life simpler. It is always good to utilize the different media assets to learn in a more efficient and fun way, but we should be regular in revising what we learn. This will help us master mental arithmetic and we can benefit tremendously from it.

Need for the Study:

The present world is changing rapidly, every sphere of human life is getting affected by this change. Growing young generation is required to cope-up with this change.

They need to be quicker and sharper in every field of life. As it has been discussed above, that effective knowledge of mathematics can play a vital role in making a student more reasoned, seasoned and sharper.

It has been observed recently that students are not taking interest in mathematics subject at primary and upper primary level and thus the enrollment in class IX in science stream especially maths stream is reducing markedly. Government is serious to bring change in this scenario because if this scenario doesn't change India will lag behind in the field of science and technology.

Going through the review of related literature and looking at the fact that students' interest is reducing in mathematics, the researcher thought that if mathematics is made interesting and easier for learners there interest can be regenerated. Besides, the researcher found that dependency on calculator is also affecting the calculation ability of the students especially at primary and upper primary level. The researcher also found that it appears that vedic mathematical pattern can be easily understandable for the students. It also appears that if students find it easy to do arithmetical calculations their interest in mathematics can also be regenerated. Thus the researcher decided to undertake a research work on the below given topic.

Statement of the Topic:

"A Comparative Study of Vedic System of Mathematical Operations and Present System of Mathematical Operations"

Objectives of Research:

1. To study about the basis of Vedic system of Mathematical Operations.

2. To compare different mathematical operations pattern in Vedic System and Present System

3. To study the effect of Vedic System of Mathematical operations on Logical Reasoning of the Learners.

4. To study the effect of Vedic System of Mathematical operations on mental calculations of the Learners.

Proposed Hypothesis:

1. No Hypothesis is required for objective-1

2. No Hypothesis is required for objective-2

3. There will be no significant difference in the ability of Logical Reasoning between the students learning Mathematical Operations from Vedic System and Present System.

4. There will be no significant difference in the ability of mental calculations between the students learning Mathematical Operations from Vedic System and Present System

Review of Related Literature

Study of Related Literature

A literature review is a comprehensive summary of previous research on a topic. Literature reviews survey scholarly articles, books, and other sources relevant to a particular area of research. The review should clearly enumerate, describe, summarize and objectively evaluate these past researches.

This study of related literature gives a theoretical basis for research and helps you (the researcher) to determine the nature of your research. The literature review acknowledges the work of previous researchers, and in doing so, assures the researcher of the current research that you have conceived your work well. It is assumed that the researcher has read, evaluated and assimilated that work, referring to previous work in the field of study.

A literature review creates a "scenario" for the reader, giving him a more complete understanding of the development of his research area. This scenario indicates that the researcher has actually absorbed all (or the vast majority) of previous, important work in his or her field of research.

In writing a literature review, the aim is to describe what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are. The literature review should be defined by a guiding concept (for example your research objective, the problem or issue you are discussing, or your reasoned thesis). It is not simply a descriptive list of available material or a set of summaries. .

Related literature review is the process of collecting, selecting, and reading books, periodicals, reports, abstracts, and other reference materials. The following information may be collected while conducting review :

1. Background knowledge of the problem and related concepts.

2. Theories that explain the existence of a problem and the possible relationship between certain factors and the problem

3. Data that confirms the existence and severity of the problem

4. General and specific findings of the study related to the problem

5. Recommendations for further study given in related studies

Why Review Literature?

Review of related literature is essential in research. Following are some obvious reasons-

1. It helps the researcher to identify and define a research problem

2. It helps to justify the need for study of a problem

3. It prevents unnecessary duplication of a study

4. It can be the source of the theoretical basis of the study

5. It enables the researcher to learn how to conceptualize a research problem and properly identify and operationally define study variables

6. It helps in creating and refining research equipment

7. It provides guidance for analysis and interpretation of data.

When to start reviewing related literature?

While the research problem is still being conceptualized, the researcher should start reviewing the literature in advance. In identifying and defining a research problem, the researcher must be able to show evidence that the problem actually exists and is worth investigating.

It is important that the researcher knows what is already known about the problem or what earlier researchers have found about it and what questions need to be answered before finalizing the research questions or objectives.

The theories that researchers use to explain the existence of a research problem and are used as a basis in the analysis of relationships between variables can be derived from references, books on theories, or from related studies. Therefore, the researcher should read enough literature already at the beginning of the research activity.

What material to choose to review?

1. General Reference

Examples are indexes, reviews and abstracts.

2. Primary Source

Examples are research found on published journals.

3. Secondary Source

It is a publication where, authors cite the works of others. Examples are books, encyclopedias. Secondary sources are good references for an overview of the problem.

The function of the review is to provide an insight into the trend to be followed in the area in which the research is to be carried out - it also helps to avoid

inadvertent duplication of well-established finding and to provide a path through which research can be conducted effectively; It also helps to delineate and helps to define the problem.

The review gives an understanding of the research methodology which refers to the way the study is conducted. It helps to know about the tools and related tools that have been shown to be useful and promising in previous studies.

The main objective of this chapter is to provide a systematic survey of the current study area / past research carried out in the relevant area.

Reviewing the literature means that it is able to identify the following points:

- ✓ What is established, rejected and accepted in your area'
- ✓ areas of conflict or conflict between different theories of thought
- ✓ Problems or issues that remain unresolved
- ✓ Emerging trends and new perspectives
- ✓ How your research builds on and differs from previous research.

Literature review offers much more than a summary of relevant sources. The task of review involves evaluating individual sources as well as synthesizing these sources to obtain a comprehensive view of the field. At this 'field level', a literature review discusses common and emerging perspectives, notable patterns and trends, areas of conflict and controversy, and gaps within the relevant literature. When you can see these things clearly, you will be able to set up your own research and contribute to the ongoing debate within the field.

In other words, when reviewing literature not only do you need to engage with a set of literature, you also need to be able to compare, contrast, synthesize and argue against that literature to make a contribution, indicate readiness.

Literature review exists within a variety of scholarly works with varying focus and importance. Short or short literature reviews may be presented in journal articles, book chapters or research work to set the background for the research work and provide a general understanding of the research topic.

However, the focus of a literature review in a research thesis is to identify gaps and argue for the need for further research. Depending on the author's purpose and the context in which the literature review will be presented, a selective or comprehensive approach may be taken.

In the selective approach, one or a limited number of sources are reviewed (for example an annotated bibliographic assignment, or the introduction of a journal article).

A comprehensive approach requires the review of multiple books and articles (such as in a review article), which can be submitted as a key chapter in a research thesis or self-published as a scholarly review article. can be done.

Reviewing literature is a continuous, non-linear and iterative process. Your literature review will help your questions, theories, and methods determine the parameters of your literature review - it is a cyclical process.

It is usually one of the first tasks that the research student undertakes and also one of the last that must be done before the research work can be completed. A literature review written in the early stages of research is prone to change because you need to review and revise it from time to time and make sure it is up to date. You will probably find yourself engaging with related literature in different ways at different stages of your research.

Babajee, Dr D. K. R. (2015), studied the various applications of Vedic Mathematics and found that the excess of the sum of the smaller sides of a right angled triangle over the hypotenuse is always even and using this property he

derived the old two-fraction method for generating Pythagorean Triples. He also developed a general method for squaring and extended Tirthaji cross-multiplication method for solving systems of linear equations.

Bengali, Saurabh Sunil and Franzon, Paul (2011), studied Vedic Mathematics and Its Applications in Computer Arithmetic. Multiplication, Squaring, Division, Sine and Cosine Vedic algorithms were designed inVerilog and compared to Design Ware block with criteria as cycle time, area and power. It is observed that Vedic multiplication performs better than Design Ware for cycle time, but has significantly larger area. Square outperforms Design Ware multiplication in all categories as itreduces the partial products itself. Though Sine for 8 bit performs better for cycle time and 8bit Cosine matches the performance with Design Ware other two functional implementations16 bit Sine and 16 bit Cosine are significantly slower and less efficient than Design Ware.Division proves to be better in all three criteria – cycle time, area and power. Hence it can be concluded that basic mathematical functions can effectively be implemented with Vedic Mathematics algorithms.

Vasantha Kandasamy, W. B. and Smarandache, Florentin (2006) did study on Vedic Mathematics - 'Vedic' Or 'Mathematics': A Fuzzy & Neutrosophic Analysis.

Eason, Rod (2018) did a study which includes a discussion of the evolution of modern science and a comparative view of Maharishi Vedic Science, the combination of which represents a new paradigm for the advancement of scientific knowledge. Research in consciousness is discussed from several points of view and also includes a connection with the physiology. The structure of the Veda and Vedic Literature is discussed at length with examples of the text included

Shrimali, Tejash R(2015) conducted a study of effectiveness of vedic maths on expansion unit of maths subject of std 8.

Dhara R. Joshi (2017) conducted a study to find out the relevance of Vedic mathematics in present modern era. He found that vedic mathematics can be useful for fastest growing & even changing world in modern era. Vedic mathematic algorithm can be proved efficient for faster mental calculations & for competitive exams.

He said that Vedic mathematics is an ancient scheme based on 16 formulas (sutras). These are easy & simple methods for fast mental calculations. Many researcher have worked on it for its usefulness in various branches like engineering, astronomy, mathematics. Vedic mathematics helps in faster and accurate mental calculations by this 16 sutras & 13 up sutras. One can solve any difficult equation in

addition, division, multiplication, algebra, trigonometry, square, square root, cube, cube root only by mental calculations. Today's era is fastest growing & ever changing era.

In competitive exam's like UPSC, GPSC, CET, GATE, JEE & many other Vedic maths help in faster mental calculations & helps to reduce time to solve difficult mathematical equations. Vedic mathematics also solves mathematical anxiety among school children & regains interest in math by making mathematics easier. In modern time many researches carried out in many universities of India & abroad on usefulness of India & abroad on usefulness of Vedic maths. Many universities have started courses based on Vedic maths, yoga & Vedic literature which gain interest on Vedic subject of students. He further said that nationalist prime minister Shree Narendra Modiji & HRD minister Ms Smriti Irani also taking interest for Vedic formulas & yoga to become popular in world. Many school included Vedic maths & yoga in their curriculum. Which is accepted by students & parent & teachers as well?

Krishna Prasad Karani (2016) did a study and concluded that Vedic Mathematics is an Indian ancient system of mathematical calculations or operations techniques developed in the year of 1957 with 16-word formulae and some sub-formulae. In competitive examinations, students find difficult to solve the aptitude

questions effectively with very less or small time durations. Even though students are able to understand the problem, they are not able to speedup calculation process.

In this study some basic mathematical calculations, multiplication, square root, cube root and subtraction of fractional decimal numbers are distributed to a group of 25 students, whom are competitive examination writing students and told to solve questions without and with using Vedic methods techniques. The time taken to complete the calculations are taken in terms of minutes before and after adopting Vedic method's techniques and are analyzed using paired t-test. This paper could able to find that Vedic method significantly improves the speed of calculations while performing some basic mathematical operations. Wish this paper could play an active and supportive role in actual research of Vedic mathematics and techniques to improve the speed of calculations especially while writing any competitive examinations.

Syed Azman bin Syed Ismail Pumadevi a/p Sivasubramniam (2010) discussed an action research that aimed at improving pupils' performance in doing multiplication involving times tables more than five, which is the six, seven, eight and nine times tables. This study involved five Year 4 Malaysian Primary school pupils who were selected from 30 pupils who had sat for a test consisting of questions on multiplication. The study examines the use of the "Vedic Method" to do multiplication problems involving times tables more than five by making use of

times tables from zero to five. Hence, the five participants chosen were pupils who demonstrated an ability to recall their one to five times table but had difficulties recalling the six to nine times tables. The participants of the research were able to overcome their difficulties with the use of the "Vedic Method"

Sayan Dey (2019) mentioned that how science and mathematics loving people were considered 'intelligent individuals and whosoever fell in love with subjects like history, geography and/or political sciences were by default affiliated to the 'dumb-headed club.' He said this happens just because Indian did not follow their indigenous mathematics (Vedic Mathematics). He by various examples said that it is not fair to accept western mathematics a better one without comparing it with Vedic form of mathematics. He emphasized that we (Indians) should do deeper and exploratory studies to find the modern complex mathematical calculations' easy form in Indian System (Vedic Mathematics) of mathematics.

He also mentioned that how in ancient India rope trick system made mathematics easy. With this trick its very easy to change one geometrical shape into the other one eg. by changing square into circle.

C.K. Raju (2009) said that like colonization, globalization requires soft power, hence cultural entrainment. Hence, establishing hegemony through the

perceived inferiority of alternative cultural practices still remains a critical aspect of the political agenda, and this naturally creates an inequitable environment. Cultural practices should be accepted or rejected only after a critical evaluation. Here, this understanding is applied to mathematics education. Today geometry is taught using the compass box, assumed to be superior to the rope/string (rajju) that was traditionally used in the teaching of mathematics in India. A comparative evaluation of the two practices was never done, and the Western technique was blindly accepted as superior. However, the development of the "infinitesimal" calculus in India was facilitated by the use of a flexible rope as the basic geometrical instrument—used to measure the length of a curved line. This made manifest the in-principle meaning of the length of a curved line—something declared to be beyond the capacity of the human mind by Descartes who based himself on the straight line. The compass-box reinforces this difficulty by suggesting the straight line as the basis of geometry. Descartes' difficulty arose because of a cultural mismatch in the understanding of mathematics, and this difficulty continues to haunt school children today who are ironically compelled to view a simple matter from a complex Western perspective. Since the rope can perform the function of each instrument in the compass-box, the low-cost rope is suggested as a superior replacement for the currently-used compass-box.

Shahina M. Salim and S. A. Lakhotiya (2015) found that Rivest–Shamir–Adleman (RSA) is one of the most safest standard algorithm based on public key, for providing security in network. The hierarchical overlay multiplier is used in RSA

circuitry for multiplication operation. The most significant aspect is the development of division architecture based on Ancient Indian Vedic Mathematics and embedding it in RSA encryption/decryption circuitry for improved efficiency. Typically, modular-multiplication algorithm is used since no trial division is necessary, and the carry-save addition (CSA) is employed to reduce the critical path. The implementation of RSA encryption/decryption algorithm using the algorithm of Ancient Indian Vedic Mathematics that have been modified to improve performance. RSA circuitry implemented using vedic multiplication is efficient in terms of area, speed compared to its implementation using conventional multiplication. The advantage of the Vedic multiplier is that it calculates the partial products in one single step and there are no shift operations which saves the time and the hardware. As the number of message bits increases the gate delay as well as the area increase slowly. Hence it can be used effectively in all the cryptographic applications. It is found that this design is quite efficient in terms of silicon area and speed and should result in substantial savings of resources in hardware when used for crypto and security applications.

Anshul Khare, Dr. V N Yadav, Vandana Shikarwar (2014) observed that **t**he load on general processor is increasing. For Fast Operations it is an extreme importance in Arithmetic Unit. The performance of Arithmetic Unit depends greatly on it multipliers. So, researchers are continuous searching for new approaches and hardware to implement arithmetic operation in huge efficient way in the terms of speed and area. Vedic Mathematics is the old system of mathematics which has a

different technique of calculations based on total 16 Sutras. Proposed work has discussion of the quality of Urdhva Triyakbhyam Vedic approach for multiplication which uses different way than actual process of multiplication itself. It allows parallel generation of elements of products also eliminates undesired multiplication steps with zeros and mapped to higher level of bit using Karatsuba technique with processors, the compatibility to various data types. It is been observed that lot of delay is required by the conventional adders which are needed to have the partial products so in the work it is further optimized the Vedic multiplier type Urdhva Triyakbhyam by replacing the traditional adder with Carry save Adder to have more Delay Optimization. The proposed work shows improvement of speed as compare with the traditional designs. After the proposal discussion of the Vedic multiplier in the paper, It is been used for the implementation of Arithmetic unit using proposed efficient Vedic Multiplier it is not only useful for the improve efficiency the arithmetic module of ALU but also it is useful in the area of digital signal processing. The RTL entry of proposed Arithmetic unit done in VHDL it is synthesized and simulated with Xilinx ISE EDA tool. At the last the proposed Arithmetic Unit is validated on a FPGA device Vertex-IV.

Proposed work have designed the 4x4 bit Multiplier which provides better results with respect to the available Vedic multiplier or other Multiplier and as known dynamic power is proportional to the frequency (clock speed capacity) consumed to perform any operation. So, it can be said that proposed design also reduces the dynamic power indirectly. This makes efficient multiplier and very

useful for designing the delay and power optimized ALU, which can provide direct affect on the Microprocessor & microprocessor and also CPU whose performance is dependent on the efficiency of ALU. Proposed design can also be used for optimizing the MAC unit of DSP. And so the optimized designs can be made for FFT, FIR, IIR, and DFT whose performance is dependent on the speed of MAC unit.

Aruna. M, Usharani. G (2014) said that In VLSI technology speed optimization plays a vital role. So designing of high speed devices became necessary to fulfill the end user requirements. Generally the processor designing is mainly depending upon the MAC units. In that particularly multiplier architecture comes under crucial design. Vedic Mathematics is the ancient methodology of Indian mathematics which has a unique technique of calculations based on 16 Sutras (Formulae). In this paper the importance of Urdhva tiryakbhyam Sutra and Nikhilam Sutra are discussed. The design of complex multiplier designed using this sutra consists of Radix Selection Unit (RSU), Exponent Determinant (ED), Mean Determinant (MD) and Comparator. The multiplier shows the product of the provided inputs with reduced latency along with optimized power estimation. Transistor level implementation of Vedic Mathematics based 16-bit complex multiplier for high speed low power processor is reported in this paper. The functionality of these circuits was checked and performance parameters like propagation delay and dynamic power consumption were calculated by Xilinx sparten3E using standard 90nm CMOS technology for synthesis and simulation. The propagation delay of the resulting (16, 16) x (16, 16) complex multiplier was found

to be 4ns and consume 81mW power. The implementation offered significant improvement in terms of delay and power from earlier reported ones.

In this research it was reported on complex number multiplier simulation and implementation. There are various conventional and Vedic methods of multipliers available today. Many systems need complex multipliers for various applications. However, to achieve good performance in terms of speed, area occupied and minimum power consumption, appropriate algorithm must be implemented in hardware. In this paper, we have attempted for finding such an algorithm, and Vedic method is found suitable and shown that it can be implemented in hardware by obtaining synthesis results.

The computation delay for 16x16 bits Vedic multiplier was found to be 4ns. It is therefore seen that the Vedic multipliers are much faster than the conventional multipliers. The algorithms of Vedic mathematics are much more efficient than of conventional mathematics. Comparing their simulation and synthesis results, Vedic complex multiplier has found to be advantageous and is implementable. Hence "Simulation & Implementation of complex multiplier using Vedic Mathematics" is discussed and analyzed extensively in this paper. The techniques are simulated using hardware description language, Verilog and synthesized using Xilinx Sparten 3E Board.

Satnam Singh Shergill, Arvind Kumar (2015) emphasized that with ever increasing demand of speed, accuracy and space we need better hardware and software. Software can be made better by making faster algorithms. As far as arithmetic algorithms are concerned in digital hardware, division is the least used one, computers experience performance degradation if division is ignored. There are various fields in digital world which demand excessive multiplication and division. For them algorithms based on Vedic Mathematics have proved to be much faster than other algorithms and there is further room for improvement also, which attracts further attention from researchers working on these algorithms. Division implementations as compared to other algorithms which makes these algorithms more suitable for mobile application because mobile devices need to have required functionality at the least possible power and space consumption.

A. Shriki, I. Lavy (2018) Many students experience difficulties and failures in mathematics already in elementary school. Often, this has a negative impact on their mathematics self-efficacy as mathematics learners, and as a result, their motivation to study the discipline decreases. These students might reach middle school with low confidence about their ability to study mathematics and may possibly avoid its learning.

In order to provide middle school students with a corrective emotional experience, teachers need to implement uncommon approach to the teaching of

mathematics, along with the need to close the gap students have accumulated in acquiring basic skills. However, repeating familiar contents that have already been learnt in elementary school, with little success, and implementing the same approaches is ineffective. Moreover, students may feel insulted by the fact that they have to learn repetitively elementary contents. In an attempt to address this need but differently, a learning environment based on ancient Indian mathematics, the Vedic Mathematics was developed. The Vedic mathematics is dated to 2600-3000 BC and presents simple and unconventional calculation techniques and methods for solving problems in different areas of mathematics. The beauty of the Vedic methods stems from its coherence and simplicity. They are easy to understand and students enjoy practicing them. Furtheremore, students are unacquainted with the Vedic methods, and therefore may not feel a sense of repetition of something familiar. For this reason, we assumed that students who experienced an ongoing series of failures may gain pleasure and success from engagement with the Vedic methods, and in return their sense of mathematics self-efficacy and motivation to learn mathematics will strengthen.

In a pilot study, 137 students from 7 schools (73 eighth graders from 4 schools and 64 ninth graders from 3 schools) were engaged in a learning environment consisted of a series of 15 lessons, divided into 5 independent clusters of 3 lessons, dealing with various arithmetic operations using Vedic methods. All students studied mathematics at the lowest level available in their school, and were defined as 'students with learning difficulties'. The study examined the impact of

students' involvement in the learning environment on their self-efficacy as learners of mathematics. The results indicated that the experience of Vedic methods did provide students with a sense of pleasure and success, their mathematics self-efficacy increased, and many of them argued that following the experience they came to the realization that they could succeed in mathematics if they were to invest the necessary effort. The results also indicate that experiencing the Vedic methods provided students with the opportunity to succeed without giving them the feeling that they are repeating contents and techniques they have learnt in the past with a little success.

Finally, it should be noted that since the study describes a relatively short experience, presently longterm effects of this experience could not be identified. Currently researchers are conducting a follow-up study, examining the long-term effects of the increase in students' sense of self-efficacy.

Evon M. O. Abu-Taieh (2018) research work presents Mirrored Vedic Vertically and Crosswise Multiplication Technique (MVVCMT) which is an algorithm based on Vedic Vertically and Crosswise Multiplication Technique. Vedic Vertically and Crosswise Multiplication Technique is an ancient Indian technique used to shorten the process of mental multiplication especially for big numbers. In India, the multiplication technique is still taught to kids to enhance their skills in mental multiplication. The proposed algorithm in this research was inspired by this

ancient yet practical, easy to understand and apply multiplication technique. Vedic Vertically and Crosswise Multiplication Technique was rediscovered in 1965 by Swami Bharati Krishna Tirthaji in his book *Vedic Mathematics.* The proposed algorithm runs with only 100 multiplications rather than *n2* based number of multiplications. In the research report the first section explains the Vedic Vertically and Crosswise Multiplication Technique with and example and algorithm. Then it presents a hands-on example to show the simplicity of the original technique. Next, it presents the proposed algorithm name "Mirrored Vedic Vertically and Crosswise Multiplication Technique" which is dubbed (MVVCMT).

MVVCMT is inspired by a Technique taught to children to improve their mental multiplication, where children can enjoy multiplying long integer. Hence, the algorithm is simple, easy to use, needs minimum storage and utilizes only 100 multiplication operations.

MVVCMT algorithm is unlike: *Karatsuba*'s algorithm, Schönhage–Strassen algorithm, Toom- Cook algorithm and schoolboy algorithm. While such algorithms needed: preprocessing, Splitting, evaluation, pointwise multiplication, Interpolation, recompositing, nXn matrices. The MVVCMT algorithm reduced the number of multiplication operations and reduced the need for memory.

Sushma R. Huddar, Sudhir Rao Rupanagudi, Kalpana M. and Surabhi Mohan (2013) observed that with the advent of new technology in the fields of VLSI and communication, there is also an ever growing demand for high speed processing and low area design. It is also a well known fact that the multiplier unit forms an integral part of processor design. Due to this regard, high speed multiplier architectures become the need of the day. In this research, researchers introduce a novel architecture to perform high speed multiplication using ancient Vedic maths techniques. A new high speed approach utilizing 4:2 compressors and novel 7:2 compressors for addition has also been incorporated in the same and has been explored. Upon comparison, the compressor based multiplier introduced in this research, is almost two times faster than the popular methods of multiplication. With regards to area, a 1% reduction is seen. The design and experiments were carried out on a Xilinx Spartan 3e series of FPGA and the timing and area of the design, on the same have been calculated.

Upon comparison of the area occupied by the multiplier and also its speed, with two other popular multipliers, it can be concluded that the compressor based Vedic maths multiplier proves to be a better option over conventional multipliers used in several expeditious and complex VLSI circuits. As a future work, the multiplier's performance could be tested within an ALU and also compared with several other existing multipliers.

Archana V Katgeri (2017) highlighted the effectiveness of Vedic mathematics in the classrooms. The researcher concluded that there is a significant difference in the pre-test and post-test scores with respect to the students' performance in square and square root after implementation of the Vedic Mathematics technique. Thus, students could solve more number of sums accurately making lesser errors by using the Vedic Mathematics technique in comparison to the traditional factorisation method for square and square roots. There is a significant difference in the pre-test and post-test time taken by the students for solving the sums of square and square root after implementation of the Vedic Mathematics technique. Thus, students took lesser time to solve by using the Vedic Mathematics technique in comparison to the traditional of factorisation method for square and square roots.

On the basis the research some suggestions have been proposed. Teacher can use the Vedic Mathematics Techniques as it helps to:

1. Eliminate the fear for Mathematics.

2. Saves a lot of time, as calculations are much easier and faster. Definitely these techniques would be handy for the students during exams and particularly for the competitive exams which are time bound.

3. Reduces errors as they have minimum steps to solve.

4. Students are able to master the computational skills by using the mental methods and thereby reducing the dependency on devices like calculators, computers etc.

5. It sharpens the mind, increases mental ability, intelligence and develops Left & Right Sides of the brains by increasing visualization and concentration abilities. Which is one of the most important value of included the subject of mathematics in the school curriculum.

6. It helps to carry out tedious and cumbersome mathematical operations in a simple way.

7. India has a rich background of Vedic Mathematics and we need to preserve it and use it to the best of students need. Why burden and confuse the students with long and complex calculations when we have the most fascinating technique to make life much easier for the students.

Thus it is a unique technique of calculations that is based on simple principles and rules, applying which, any kind of mathematical problems can be solved orally. More and more use of Vedic Math can without any doubts generate interest in a subject that is generally dreaded by children.

Dr. Amulya Kumar Behera (2021) believed that India, the saga of sacred land, has a high cultural heritage. The findings of Rishis in ancient India can show the path to the world. The knowledge of the Vedas and other ancient texts is an

everlasting source of knowledge. Vedic Mathematics is one of such gifts of ancient India. It helps us to solve almost all mathematical problems with less time with only mental calculation. The need for paperwork is very less. In the modern competitive world, every fraction of a second is important in competitive Exams where power tests are used for mathematical and arithmetical aptitude, numerical and nonverbal reasoning. In this present study, the Vedic method of multiplication has been used as an independent variable in order to know the effect on the achievement of students in an experimental setting of 58 students of Class – VI. For the present study, 58 students (both Boys and girls) were randomly selected from the four Upper Primary schools of Raruan Block of Mayurbhanj district. The schools were selected using the purposive sampling (as the headmasters were very cooperative) method. Further, the students of each school were randomly (by blindfold method) assigned as the Control group and Experimental group. By this 28 students were selected as Control Group and 30 students were selected as Experimental group.

The following are the major findings of the study –

- The Mean scores of the Experimental and the Control were not significantly differ on the Pre-test on multiplication knowledge. So both the groups may be treated as equal on previous knowledge on multiplication.

- Vedic method of multiplication is effective over the conventional method in terms of students' achievement in the Post-test as shown on the Multiplication Test.

- Gender could not play any role in the Post-test of sixth graders on the Vedic method of multiplication. Boys and girls of Experimental had scored high in Post-test and the difference between the two means is not significant.

- This also indicates that the Vedic method of multiplication helped the experimental group to minimize their mistakes and get a better result.

- There was a significant positive modification in the result of students with Vedic method of multiplication on post-test.

It can be concluded that the teachers should encourage the students to learn Vedic Mathematics. In the school curriculum, Vedic mathematics should be included especially at the elementary level as a supplementary subject to mathematics and some period should be allotted for practice the tricks. As a result, students will actively engage in problem-solving. The artistic abilities and talents of the students can also be developed by Vedic mathematics. It can undoubtedly create interest in mathematics among the students who have generally feared mathematics.

Ajai Kumar Shukla, R.P. Shukla1 and Ajay Pratap Singh (2017) observed that Vedic mathematics is the name given to the ancient Indian system of mathematics that was rediscovered in the early twentieth century from ancient Indian scripture namely Atharvaveda. The study was intended to compare the effectiveness of teaching mathematics through conventional and Vedic mathematics

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

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

Urmila Rani (2014) found that Vedic Mathematics is the name given to the system of mathematics, which is claimed to be discovered from Vedas by Sri Bharti Krishna Tirtha. It is based on book authored by Bharti Krishna Tirtha and published in 1965 . Vedic Mathematics is based on sixteen Sutras and thirteen subsutras in Sanskrit which are claimed to have ability to solve all modern mathematica problems. These sutras help in speedy calculations in high school mathematics. Differential equations and recurring decimals can be solved with the help of these sutras. Although the application of these sutras in different fields, has not been objected to but the critics of Vedic Mathematics object to its origin and name.

Researcher on the basis of the review mentioned that Dr. J.N. Kapoor has observed that vedic mathematics is not concerned with those aspects of mathematics which do not depend on computation. However most of the applicable parts of mathematics do require computation. For non computational, thinking and logical part of mathematics vedic mathematics does not provide any help. The book deals with only a small aspect of mathematics and its claim to give one line answers to all mathematical problems is questionable. Vedic mathematics has nothing to do with mathematics in the Vedas except that it was written by a person who knew Vedas and mathematics. Dr T.M. Karade concludes that one would never find a special and separate chapter on mathematics in the Vedas. It may be scattered here and there and to discover it is a herculean task. Bharti Krishna Tirtha's work on mathematics is usually referred to as Vedic Mathematics. But it does not mean that there cannot be Vedic Mathematics other than Bharti Krishna's mathematics. Dutta and Singh have

noticed seven distinct modes of multiplication employed by Hindus viz Door junction method, gelosia method, cross multiplication method, multiplication by separation of places, zigzag method, parts multiplication method and Algennair method. Out of these the cross multiplication method is algebraic and has been compared to Tirtakgunana or Vajrabhayasa used in algebra. This method was known to the Hindu Schlors of eighth century. Bharti Krishna Tirtha's mathematical method 'Urdhvatiryaka Sutra' is a simplified version of this method.

It may be concluded that the Vedic Mathematics discovered by Bharti Krishna Tirtha can be used in High school mathematics for speedy calculations and this branch need further intensive research to give it a shape of systematic branch of knowledge..

Dr. Parwinderjit Kaur (2017) undertaken a task to study the effect of Vedic Mathematics on achievement in relation to intelligence among adolescents. For this investigation, a sample of 120 students was drawn randomly from class IX studying in two CBSE affiliated schools located in Amritsar. The students were divided into two groups. Each group was given separate treatment i.e. one group was given treatment of Vedic mathematics and other group was given treatment of conventional mathematics. In the present study pre-post experimental design was employed. Experimental group was taught through Vedic mathematics and other group was taught through conventional method. Vedic mathematics approach was

taken as independent variable and achievement in mathematics was taken as dependent variable.

The findings of the research revealed: Achievement of the students taught through Vedic mathematics was found to be higher than those taught through conventional mathematics; Achievement of the students taught through Vedic mathematics with high intelligence is higher than those with average and low intelligence; Achievement of the students taught through Vedic mathematics with average intelligence is higher than those with low intelligence.

This research work mentioned some educational implications. Vedic Mathematics is indeed a wonderful and truly less time consuming technique and should be introduced in school curriculum as is it an easy way to solve mathematical problems with the help of just sixteen sutras and can also help in developing interest in the subject. The school authorities should encourage teachers in using Vedic mathematics as it increases the concentration of students. Teachers should be given training in making the use of Vedic mathematics in their classrooms. In this regard, seminars and workshops may be conducted to provide practical training in using this method.

Sher Singh Raikhola, Dinesh Panthi, Eka Ratna Acharya, Kanhaiya Jha (2020) conducted a study which mainly focuses on Vedic Mathematics and its importance in modern era. In order to explore the importance of Vedic Mathematics, the researcher has collected literature explaining the importance of Vedic mathematics. The researchers used thematic analysis approach to analyze the available literatures to highlight the major theme of contribution of Vedic mathematics in the modern era. Researchers collected published works as its data and subjected them to a careful analysis that usually includes qualitative aspects. NVivo 12 Pro software is used for qualitative analysis for Thematic Analysis. World Cloud and Cluster Analysis is made to show the major theme of Vedic Math's importance in the modern era. Thematic analysis through word cloud gives importance of Vedic mathematics can be characterized as 1) mathematical calculations, 2) speed, 3) classic approach, 4) fun and interesting, and 5) individual confidence. Hence this is an exploratory study to generate theme.

On the basis of analysis researchers reached to the below mentioned results:

• Vedic Math provides more systematic, simplified, unified & faster than the conventional system.; • Vedic Math gives the flexibility, fun and immense satisfaction and converts a tedious subject into a playful and blissful one which anyone can learn with smiles.; • Vedic Math with its special features has the inbuilt potential to solve the psychological problem of Mathematics anxiety.; • Vedic Math increases speed and accuracy. Mathematics, derived from the Veda, provides one

line, mental and super-fast methods along with quick cross checking systems.; • Vedic mathematics provides the integrated structure of mathematics that is complementary, direct and easy.; • A significant and interesting invention which has led to various applications in all the disciplines is the development of Vedic mathematics approach.

On the basis of results it can be concluded that modern teaching of one way calculations are rigid and boring. Vedic Mathematics has general methods and also many methods that apply for special cases. These calculations can often be carried out independent of direction & orientation. Because of this flexibility, students can use their own approach which promotes creativity and intuition. In this rapidly changing world, flexibility and adaptability are indispensible for success. By using Vedic Sutras, complicated and lengthy computations can be solved with greater accuracy and lesser time as compared to calculations based on conventional mathematics. Vedic Mathematics also improves memory and creates greater mental alertness. The most significant quality of Vedic Mathematics is its consistency. Because of this quality, it creates stress-free and enjoyable environment. It inspires innovations. The beautiful coherence between arithmetic and algebra is clearly visible in the Vedic system.

Krishna Kanta Parajuli (2021) in his study mentioned that Vedic Mathematics was rediscovered and reconstructed by Sri Bharati Krishna Tirthaji

from ancient Sanskrit texts Veda early last century between 1911 – 1918 is popularly known today is Vedic Mathematics. It is an extremely refined, independent and efficient mathematical system based on his 16 formulae and some sub-formulae with simple rules and principles.

The main purpose of this research work was to communicate a new approach to Mathematics, offering simple, direct, one-line, mental solutions to mathematical problems. In the way of basic mathematical operations like addition, subtraction, multiplication and division can be done in simple ways, and results are obtained quickly and can be checked in a minute by using the Vedic techniques. In this system, for any problem, there is always one general technique and also some special pattern problems. This research work especially concentrated only on the specific pattern of elementary operation of Vedic Mathematics.

The findings of the research highlighted that there is a contrast between Vedic and Conventional Methods for calculating basic operations. Vedic Mathematics itself is the easiest, enjoyable and one-line mental form of mathematics and some of the calculations are faster than the calculator. Modern methods have just one way of doing, say, division and this is so cumbrous and tedious that the students are now encouraged to use a calculating device whereas the Vedic method can be done without devices. While calculating is adopted by the conventional method, several carry-overs in subtractions, large multiplication tables in

multiplications and many hits and trial methods are needed, which wastes time and confusion about accuracy remains, the Vedic method helps us in this regard and saves our precious time.

Some suggestions and implications of the research has also been proposed. With the knowledge of Vedic Mathematics at primary level classes, mathematics would become a favorite subject of all, as they would be able to perform calculations accurately with speedily. To realize this objective, the assimilation of Vedic Mathematics should be given prime importance. The methods and principles can be integrated into an existing school curriculum. The incorporation of Vedic Mathematics into the present issue-based approach makes the system both conceptual and calculation based. Both Vedic Mathematics and Conventional Mathematics give the same result on calculation. Students should be trained on both methods and they should be given to choosing between the methods which they find convenient.

Rashmi Kakkar (2016) aimed to study the effect of Vedic Mathematics on achievement in algebra among adolescents with respect to different levels of intelligence. For this investigation 120 students of class IX were randomly taken from Ajanta Public school and Harkrishan public school of Amritsar city. After selecting the school, the students sample was drawn randomly. The students were randomly divided into two groups. The sample consisted of total 120 students of

class IX. 60 students were taken from each school. These 60 students were further divided into two groups of 34 from ajanta public school and 26 from harkrishan public school each for the experimental group and 33 students from ajanta public school and 27 students from harkrishan public school for traditional group.

Result shows that there is significant difference between the achievement of controlled group and experimental group. As the mean score of experimental group is greater than the controlled group, which proves that Vedic mathematics is more effective than conventional method.

Vasant V Shastri, Alex Hankey, Bhawna Sharma, Sanjib Patra(2016) found in his study that The VM and Yogic breathing groups showed slight improvement in cognitive skills and slight decrease in math-anxiety compared to the Jogging group. The study shows, Vedic Mathematics workshop improved mathematical abilities by decreasing the math-anxiety which might have helped enhance their cognitive skills. The calming effect of the pranayama practices is the probable cause for YM group improvements.

Lastly the researcher suggested that Vedic Mathematics approach plays an important role to improve the achievement of students in mathematics because this technique is very helpful in competitive exam where learner have to solve lengthy

mathematical problem in short span of time. this technique remove fear about mathematics from the mind of students .this technique make the lengthy calculations of mathematics very easy this technique takes lesser time than conventional method to solve any mathematical problem .this technique can be more useful for high intelligence group and average intelligence group .this technique is successful for the students of secondary level.

Sarita Devi (2020) found that Vedic mathematics is an interesting, speedy, simple logical & integral part of our ancient Indian culture using traditional mathematics, which finds its origin in our Vedas especially "Atharva Veda" and is mainly based on 16 principles called "Sutras" & 13 Sub-Sutras. Applied to almost every branch of mathematics. The interesting part in Vedic mathematics is, you can mostly check your calculation and know whether you are right or wrong in few seconds and that makes it more enjoyable.

The researcher observed that while applying Vedic mathematics one can versatility in solving problems and at the same time, this helps to decide on the best method possible in solving a particular type of problem. The beauty of Vedic mathematics is in its inventiveness, which one experiences while applying. As one can see in the methods applied in the research work that with good practice of the Vedic mathematics one can do time consuming complex Problems far more easily and faster.

S.P. Pohokar; R.S. Sisal; K.M. Gaikwad; M.M. Patil; Rushikesh Borse (2015) mentioned that their research work describes the Urdhva-Tiryagbhyam Sutra of vedic mathematics and they have designed multiplier based on the sutra. Vedic Mathematics is the ancient system of mathematics which has a unique technique of calculations based on 16 Sutras which are discovered by Sri Bharti Krishna Tirthaji. In this era of digitalization, it is required to increase the speed of the digital circuits while reducing the on chip area and memory consumption. In various applications of digital signal processing, multiplication is one of the key component. Vedic technique eliminates the unwanted multiplication steps thus reducing the propagation delay in processor and hence reducing the hardware complexity in terms of area and memory requirement. We implement the basic building block: 16 × 16 Vedic multiplier based on Urdhva-Tiryagbhyam Sutra. This Vedic multiplier is coded in VHDL and synthesized and simulated by using Xilinx ISE 10.1. Further the design of array multiplier in VHDL is compared with proposed multiplier in terms of speed and memory.

Deepika Vyas and Neha Jain (2015) found that Digital signal processing (DIP) is the technology that is omnipresent in almost every engineering discipline. It is also the fastest growing technology this century and, therefore it poses tremendous challenges to the engineering community. Faster additions and multiplications are of extreme importance in DSP for convolution, discrete Fourier transforms digital filters etc. The core computing process is always is multiplication routine; therefore, DSP engineers are constantly looking for new algorithms and

hardware to implement them. Vedic Mathematics is the name given to the ancient system of mathematics, which was rediscovered, from the Vedas between 1911 and 1918 by Shri Bharti Krishna Tirthaji. The whole of Vedic mathematics is based on 16 sutras (word formulae) and manifests a unified structure of mathematics. As such the methods are complementary, discrete and easy, as compare to other calculation.

Fast filtering process is one of the most critical issues to any filter. Fast computation of any filter processor consumes less A Review on Vedic Mathematics Used in Digital Signal Processing time to filter the input response. Multiplication technique is the deciding factor which decides the speed of processor or how fast the computation or filtering process taking place. The use of faster multiplier will do the faster filtering process. Since the concept of Vedic multiplication technique depends on mental calculation with the help of simple rules and principles. Thus Vedic mathematics plays vital role in the fast filtering process of FIR filter.

Sujata Ramteke and Rajshree Vaishnav (2019) aimed to study the effectiveness of the Vedic mathematics in terms of achievement for teaching mathematics. Vedic mathematics is the name given to the ancient system of Indian mathematics mentioned in ancient Vedic literature. Present study was experimental in nature. Pre-test post-test non equivalent group design was used for the study. Random sampling techniques were used for the selection of the sample. 200 students studying in two different schools namely Mahatma Gandhi Centennial Sindhu high

school and Omkarlal Sindhu high school, Nagpur were selected randomly and divided in to two groups namely experimental and control group. The students of experimental group were taught through Vedic mathematics where as the control group were taught through traditional method of teaching. The number of student in each group was 100. The concept of roots and square roots was used. Self prepared criterion reference test for the subject mathematics was used as pre and post test for both the groups.

Results indicated that Vedic mathematics is more effective method .there was a considerable positive change in the results of students through Vedic method of teaching .students have shown the positive attitude and interest towards the subject when taught through Vedic method .The teaching of Vedic math's is beneficial for the students in improving their achievement in mathematics it save calculation time during examination. It has also been found that Vedic method of teaching is more effective than the traditional method for teaching mathematics. Students of experimental group were performed better than that of students of control group in subject of mathematics. The students taught through Vedic mathematics performed significantly better than the students taught through traditional method for subject mathematics.

Vedic mathematics emphasizes, meaningful learning than mechanical learning. Finding answer through Vedic mathematics may help to reduce the

student's anxiety level. It increases concentration, as it encourages the metal calculations. This method develops better understanding among students and teachers. Vedic mathematics endures creativity among intelligent pupil, while helping the slow, learners to grasp the basic concepts of mathematics. Students can be motivated to the learn mathematics interestingly if the Vedic system of mathematics will be included into our curriculum. Mathematics can be learnt and mastered with minimum effort in a very short span of time and can be translated into a playful and a blissful subject with the help of Vedic mathematics.

G.Ganesh Kumar, V.Charishma (2012) proposed the design of high speed Vedic Multiplier using the techniques of Ancient Indian Vedic Mathematics that have been modified to improve performance. Vedic Mathematics is the ancient system of mathematics which has a unique technique of calculations based on 16 Sutras. The work has proved the efficiency of Urdhva Triyagbhyam– Vedic method for multiplication which strikes a difference in the actual process of multiplication itself. It enables parallel generation of intermediate products, eliminates unwanted multiplication steps with zeros and scaled to higher bit levels using Karatsuba algorithm with the compatibility to different data types. Urdhva tiryakbhyam Sutra is most efficient Sutra (Algorithm), giving minimum delay for multiplication of all types of numbers, either small or large. Further, the Verilog HDL coding of Urdhva tiryakbhyam Sutra for 32x32 bits multiplication and their FPGA implementation by Xilinx Synthesis Tool on Spartan 3E kit have been done and output has been

displayed on LCD of Spartan 3E kit. The synthesis results show that the computation time for calculating the product of 32x32 bits is 31.526 ns.

The designs of 32x32 bits Vedic multiplier have been implemented on Spartan XC3S500-5-FG320. The design is based on Vedic method of multiplication [3]. The worst case propagation delay in the Optimized Vedic multiplier case is 31.526ns. It is therefore seen that the Vedic multipliers are much more faster than the conventional multipliers. This gives us method for hierarchical multiplier design. So the design complexity gets reduced for inputs of large no of bits and modularity gets increased. Urdhva tiryakbhyam, Nikhilam and Anurupye sutras are such algorithms which can reduce the delay, power and hardware requirements for multiplication of numbers. FPGA implementation of this multiplier shows that hardware realization of the Vedic mathematics algorithms is easily possible. The high speed multiplier algorithm exhibits improved efficiency in terms of speed.

Divykant Maheshbhai Parmar (2020) used a method of Vedic mathematics for find a roots of numbers. The researcher mentioned that Vedic Mathematics can definitely solve mathematical numerical calculations in faster way. Some Vedic Math Scholars mentioned that Using Vedic Math tricks you can do calculations 10-15 times faster than our usual methods. Researcher agreed this to some extent because some methods in Vedic Mathematics are really very fast. But

some of this methods are dependent on the specific numbers which are to be calculated. They are called specific methods.

On the basis of research activity of the researcher he mentioned the following benefits of using vedic method of mathematics ;

- Easy Way to Learn.Vedic Mathis a simpler and interesting way of learning theMathtricks than the usualMath.
- Helps in Cross-Checking.
- Enhance Logical Thinking.
- Improve Confidence.
- MoreSystematic Way of Learning.
- Improves the performancein CompetitiveLevelExams.
- The most existing Benefits of Vedic Maths is its simplicity and integration of rule which is some time looks like magic to the student, and its create interest in student to learn math.
- The many tedious or cumbersome problem can be solved through the Vedic mathematics in mind, so don't need to write too much.

- The Very Most Benefits of Vedic Mathis It gives You the 10-15 times faster result as compared to the Western way of calculation.

- Vedic Mathematics Tricks is very useful in the aptitude section of the competitive exam.

- No need toremember any formula anddependency on the calculator will become almost zero.

- By applying the concept of Vedic mathematics,one problem has many solutions.

- Most of the Vedic Mathematics Tricks apply to many types of problem.

- It makes you creative to find the most efficient or fast Tricks to solve your problem Quick. It encourages the student to see his unique way to solve the problem.

- Vedic Mathematics helps to Develop the Intuition ability of the student.

- Through the concept of digital roots, everybody can check the validity of answer to the question.

- A most cumbersome problem like Square, cube, Square root or Cubic root of the larger number can be solved through mentally if you know Vedic mathematics.

Suyash Bhardwaj, Seema kashyap and Anju Shukla (2012) said that Vedic Mathematics is the name given to the ancient system of mathematics, or to be precise, a unique technique of calculations based on simple rules and principles with which any mathematical problem can be solved – be it arithmetic, algebra, geometry or trigonometry. The system is based on 16 Vedic sutras or aphorisms, which are actually word formulae describing natural ways of solving a whole range of mathematical problems. In this paper we will be taking a few Vedic sutras. Akadhiken Purven (By one more than the one before), Nikhilam Navtashcharam Dashat (All from 9 and the last from 10) are two of them. NASA have adopted it fully in the realms of advanced robotics. Calculations that can be solved as quick as lightning are a great tool to adopt, but you wouldn't want to teach it worldwide in the fear that you may churn out a generation of child geniuses that may threaten the intellectual status quo.

The gift that the Hindus gave to world, thousands of years ago, and that which is currently responsible for global silicon chip technology, was none other than the invention of zero and the use of the decimal point. We call our common numbers "Arabic Numerals" but really they extend back to the Hindu concept of creation and were known as "Bindu" or Unity. All Vedic Maths is based on the understanding of Unity Consciousness which means they utilize processes or Number Bases that correspond to: 0, 10, 100, 1000, 10000 etc all of which add to 1. In light of the fact that the Vedas, literally "the illimitable storehouse of All Knowledge" came under 4 headings or categories like the Rig Veda, the Yajur

Veda, the Sama Veda and the Atharva Veda. Thus a Vedic Mathematician was also an astronomer, healer and poet. It was a total system, if you are out in the field and you need to tile a square floor that is, say 108 units square. How do you do it with mental ease? I think only of the excess "8", saying how much is 108 more than my Base of 100. It is "8". So merely adding this "8" to the number in question "108" and tag on the squaring of this excess: 108 Squared = 108 + 8 / 8×8 = 116 / 64 = 11,664. Vedic mathematical methods are derived from ancient systems of computations, Compared to conventional mathematical methods, these are computationally faster and easier to perform. An application of Vedic mathematics can be effectively increased if it can made available to the beginners in various fields of study.

Dr. Smitha S (2017) conducted the study among members of prospective teachers. The present study was undertaken with the following objectives:

1. To test the effectiveness of the Supreme power of Vedic Mathematics in strengthening Computational Speed and Critical Thinking Ability of prospective teachers

2. To equip the prospective teachers with self-confidence by attaining skills of Computational Speed and Critical Thinking Ability through Indian intellectual tradition of Vedic Mathematics

In this research work the researcher made an attempt to strengthen the Computational Speed and Critical Thinking Ability of prospective teachers. The sample selected were 100 B.Ed.students from various disciplines of Sree Narayana Training College, Nedunganda of Thiruvananthapuram District of Kerala State, India. The samples were selected using random sampling technique. Study was undertaken for a period of one week.

The Research Team intended to test the effectiveness of the prepared Modules on Vedic Mathematics. Thus an experimental study was designed. Hence, selected the Non-equivalent Pre test-Post test Control Group Design, which is one of the strongest of the Quasi Experimental Designs. It was decided to conduct the experiment in the casual classroom groups and to equate the group statistically by applying the technique of analysis of covariance. Experimental and Control Groups were divided with 50 trainees in each group. Both groups shared the same Team Member as the mathematics teacher. Before the intervention, a pre-test was conducted among the sample. The Control group was given the existing instructional system of Mathematics and the Experimental Group, Vedic Mathematics instructional system. At the end, Post-Test was administered and the scores were collected. After an interval of 1 month, a retention test was given without any notice. The same tools were used for administering the retention test. Analysis of Co – Variance was applied (ANCOVA) to compare Pre Test-Post Test Scores.

Finding of the study were: 1.Vedic Mathematics applications are very much effective in strengthening Computational Speed and Critical Thinking Ability of prospective teachers; 2. Acquisition of the skills of Vedic Mathematics applications is a true solution in equipping prospective teachers with adequate skills.

Shikha Singh, Akshmeet Kaur, Anandita Gautam (2017) focused on in highlighting the significance and the vast usage of Vedic branch of mathematics. Mathematics referred to as the queen of sciences reflects the "the active will and the reason for aesthetic perfection". Logic and mathematics are commutual. As per the reports, India is facing a huge Maths Crisis in which 26.1 per cent of children in Class V know division and only 44.1 per cent in Class VIII could solve a three digit by one digit division problem. In other words, abstract and logical reasoning is their hurdle. To overcome this, scholars have revived interest in Vedic Mathematics which was born in the Vedic Age, deciphered towards the beginning of the 20th century, by Swami Bharati Krishna Tirthaji. The Sanskrit word Veda is derived from the root Vid indicating deep acquaintance. The Sutras apply to almost every branch of Mathematics making calculations of large numbers easier that was nearly impossible in systems like those of the Greeks, Romans etc. In the vedic system complex problem or difficult sum or lengthy equations can often be solved immediately. It has striking and beautiful methods which beautifies and systematise mathematics. The Vedic system invented the zero, Aryabhata was followed by Brahmagupta who developed the use of zero, followed by Pythagoras' theorem which was discovered in India and gravity was explained in the Rig Veda, 2,400

years before Newton's apple injury. The debate has raised an uncomfortable question for Hindu nationalists on how India lost its mathematical advantages over the millennia.

With a presentation of the various views on the topic, reserachers have reached to the conclusion that the methods of Vedic mathematics are quite simple and easy to understand but the views of various authors regarding the fact that there is no solid evidence to prove that these actually form a part of the Vedas. But, certainly, this method has gained popularity not only in solving high school mathematics problems but has emerged immense growth leading to the formation of actual multipliers and various other real life applications.

E. Dhivyadeepa (2014) did the study which enlightens the effectiveness of Vedic Mathematics in learning Subtraction at standard IV. Objectives of the study: [i] To find out the significant difference in achievement mean score between Pretest of Controlled group and Posttest of Controlled group. [ii] To find out the significant difference in achievement mean score between Pretest of Experimental group and Posttest of Experimental group. [iii] To find out the significant difference in achievement mean score between Posttest of Controlled group and Posttest of Experimental group. Methodology: Parallel group experimental method. Samples: Twenty four pupils studying in standard IV from Government Primary School, Kalveerampalayam, Coimbatore. Twelve students were considered as Controlled

group and another twelve students were considered as Experimental group. Tool: Researcher's selfmade Achievement test. Reliability of the tool: The reliability of the tool was calculated by splithalf method and the calculated reliability value was 0.72. Procedure of the study: [i] Identification of the problem by administrating a Pretest for both the group [ii] Teaching and learning activities through Vedic method and Conventional method. [iii] Administrating Posttest. Findings: [i] There is no significant difference in achievement mean score between the Pretest of Controlled group and Posttest of Controlled group. [ii] There is a significant difference in achievement mean score between the Pretest of Experimental group and Posttest of Experimental group. [iii] There is a significant difference in achievement mean score between the Posttest of Controlled group and Posttest of Experimental group.

The result of the study reveals that learning through Vedic method helped to improve the achievement of students in the Subtraction. Vedic Mathematics is certainly more integrated, more efficient and more fun than Conventional Mathematics. Hence it is important that introducing Vedic method in teaching of Arithmetic at primary level. These types of innovative methodss may overcome the difficulties faced by the learners in Mathematics and on future the Mathematics class may become an attractive one. Further research is needed to scientifically compare the effects of Vedic method in teaching other three basic operations such as Addition, Multiplication and Division.

Gurinder Kaur (2017) tried to find that Vedic method significantly improves the speed of calculations while performing some basic mathematical operations. Vedic Mathematics is an Indian ancient system of mathematical calculations or operations techniques developed in the year of 1957 with 16 Sutra's (formulae) and 13 sub-Sutra's (subformulae). In competitive examinations, students find difficult to solve the aptitude questions effectively with very less or small time durations. Even though students are able to understand the problem, they are not able to speedup calculation process. In this research work some basic mathematical calculations, multiplication, square root, cube root and subtraction of fractional decimal numbers are distributed to a group of 26 students, whom are competitive examination writing students and told to solve questions without and with using Vedic methods techniques. The time taken to complete the calculations are taken in terms of minutes before and after adopting Vedic method's techniques and are analyzed using paired t-test. Researcher believed that this research work could play an active and supportive role in actual research of Vedic mathematics and techniques to improve the speed of calculations especially while writing any competitive examinations.

Research findings suggests that in order to become expert in Vedic mathematics techniques a person requires continuous practice and a very good interest. This research work found that Vedic mathematics techniques significantly reduce the time required for completing some basic mathematical calculations. The Vedic mathematics techniques can reduce the burden and overhead of students in

competitive examinations while Solving quantitative aptitude and reasoning problems. It is considered as one of the short cut method for solving basic mathematical operations.

In this research work, a set of mathematical operations are considered, which includes square root, cube root, multiplication of 4 digit numbers, multiplication of numbers near to base, subtraction using the rule all from nine and last from ten. The paper statistical proved that Vedic mathematics techniques significantly reduce the time duration while solving some basic mathematical problems. All the respondents found that in worst case at least one minute can be saved, if we adopt Vedic mathematics techniques for solving problems of basic mathematical operations. Null hypothesis is disproved and alternative hypothesis are selected based on paired t-test.

Poonam Bajpai (2019) conducted a study with the aims: 1. To preserve our traditions through awareness programs. 2. To reduce Maths phobia completely and lead students to be self- dependent, 3. To increase accuracy, aptitude, speed, innovative ideas and logical thinking, 4. To reduce more dependency on devices like calculators, computers etc. 5. To increase mental ability and intelligence.

The study will be helpful for those who designs the curriculum to bring the necessary changes to equip the teachers for being more competent in Vedic Mathematics. This research statistically proved effectiveness of Vedic mathematics

techniques significantly for completing basic mathematical problems for any competitive examinations. More and more use of Vedic Mathematics, cultivates an interest for numbers without any doubts, sharpens the mind, increases mental ability, intelligence and develops the brains by increasing visualization and concentration abilities. By continuous practice of Vedic mathematics techniques, one can reduce the fear of maths and become expert to solve tedious and cumbersome mathematical operations in a simple way. Thus, Vedic Mathematics is a unique technique of calculations that is based on simple principles and rules, applying which, any kind of mathematical problems can be solved orally.

The above discussed research work helped the researcher to have a belief that Vedic Mathematics can bring a drastic change in approach of teaching and learning process of mathematics. Almost each and every research mentioned and highlighted the fact that Vedic mathematical operations are magically faster than conventional method of mathematical operations.

The studies done in the field of computer science proved that applying vedic mathematics in various operations can speed up the processing and increase the speed of computer. Almost every researcher of the field appreciated the role of Vedic Mathematics in the field of computer sciences.

The studies done in the field of mathematics also proved that this method helps students to carry out complex calculation faster than the conventional method.

They also emphasized that more emphasis should be given to the promotion of Vedic mathematics in the curriculum.

Thus overall studies gave importance to the Vedic mathematics over conventional mathematics. It has also been proved that operations of Vedic mathematics can be applied to the classes of higher education.

Though many studies have highlighted the fact that Vedic mathematics can play a vital role in the field of mathematics, but no research tried find out that if use of Vedic mathematics can bring any change in the thought processing of the learner. Thus the researcher decided to undertake a study to identify and establish a fact that Vedic mathematical operations can also make human mind sharper.

Research Methodology

Research is actually a voyage of discovery. We all possess the vital instinct of inquisitiveness for, when the unknown confronts us, we wonder and our inquisitiveness makes us probe and attain full and fuller understanding of the unknown. This inquisitiveness is the mother of all knowledge and the method, which man employs for obtaining the knowledge of whatever the unknown, can be termed as research.

The process of deciding how to systematically design research and conduct it is called Research Methodology. A research methodology is an outline of how a given piece of research is carried out. It defines the techniques or procedures that are used to identify and analyse information regarding a specific research topic. The research methodology, therefore, has to do with how a researcher designs their study in a way that allows them to obtain valid and reliable results and meet their research objectives.

Research methodology is the overall strategy or approach used by researchers to conduct research. It encompasses the theoretical and philosophical underpinnings of the research, the research design, data collection methods, data

analysis techniques, and the overall framework within which the research is conducted.

Methodology of research is an essential aspect of researching to ensure that the research process is systematic, rigorous, reliable, and valid. Here are some reasons why methodology in research is important:

1. Clarity and precision:

It provides a framework and guidelines for researchers to clearly define their research questions, objectives, and hypotheses. It helps researchers identify the most appropriate research design, sampling techniques, data collection methods, and data analysis procedures to ensure that the research is conducted with precision and clarity.

2. Validity and reliability:

Research methodology helps researchers ensure that their research findings are valid and reliable. Validity helps identify accuracy and truthfulness of research results, while reliability refers to the consistency and stability of research findings over time. Proper methodology helps in minimizing biases, errors, and confounding factors that may affect the validity and reliability of research results.

3. Ethical Considerations:

It provides ethical guidelines and principles that researchers must follow while conducting research involving human subjects, animals, or sensitive data. It helps researchers ensure that their research is conducted ethically, respecting the rights and dignity of research participants, and following appropriate ethical standards and regulations.

4. Replicability:

Research methodology emphasizes the importance of replicability of research findings. Replicability means that other researchers should be able to repeat the research study using the same methods and obtain similar results.

5. Representative:

This means that research findings can be applied to a broader population or context. Proper research methodology helps in designing research studies that are replicable and generalizable, enhancing the credibility and robustness of research findings.

6. Efficiency and resource utilization:

It helps researchers in planning and organizing their research study efficiently, optimizing the use of time, resources, and efforts. It ensures that

researchers use appropriate data collection methods, sample sizes, and statistical techniques to obtain meaningful results while minimizing unnecessary costs and efforts.

Research is a scientific investigation. Investigation means a search for new facts and ideas in any branch of knowledge. Thus, we can say that research is a search for knowledge. Research may be considered as a movement, a movement from the unknown to the known. It is actually a voyage of discovery.

Research is carried out for two purposes; one is the discovery of new facts and the second, verification of the old ones. The object of every research, of course, is the discovery of new facts, new relationship, and new laws governing the phenomena. But constant verification of the old concepts is also needed especially in dynamic world.

Common sense knowledge, based on the accumulated experiences, prejudices and beliefs of the people is often contradictory and inconsistent. On the other hand, scientific observations are based on verifiable evidence or systematic body of proof that can be cited. For example, some common sense statements are: man is more intelligent than woman; married men remain happier than single people; rural people are more hardworking than urban people etc. Contrary to this,

the scientific research or scientific inquiry finds that woman is as intelligent as man; there is no association in happiness and marriage; hard work is not related to environment alone. Thus, a statement based on common sense is just a guess or prejudice or mistaken interpretation, though at times it may be true, wise and a useful bit of knowledge. But it is not based on any scientific evidence. A scientific statement is based on accumulated systematic knowledge through research.

The word research is derived from the Latin word meaning to know. It is a systematic and a replicable process, which identifies and defines problems, within specified boundaries. It employs well-designed method to collect the data and analyses the results. It disseminates the findings to contribute to generalizeable knowledge.

A research study plays a very vital role in studying, understanding and solving a problem related to any field. Research is a process of obtaining dependable solutions through systematic and scientific investigations. In the modern environment where operational problems are of complex nature, research provides a solution oriented carefully designed procedures. Research helps us to discover the functional relationships among various phenomena that exist in any field of life. Decision-making under uncertainty is a fact in every sphere of a life. Research provides us inferences and generalizations that help in forecasting the future happenings in any field.

Types of Research

Research is a multidimensional activity. It comes in various forms and is used in all social, behavioral, educational, economical and management sciences. According to the approach and method involved in a research, one can classify the following types of research.

1. Descriptive v/s Analytical (Experimental) research

Descriptive research basically describes what is. It mainly involves collection, recording, describing and analyzing the facts related to the study. It tries to find the existing status, trend and state of affairs in a phenomenon. Descriptive research involves surveys, but they are not merely data collection as they also involve measurement, classification, analysis, comparison and interpretation. In this type of research the variable under study are uncontrollable. One can only observe and report what is happening in a situation. Analytical research, on the other hand deals with what will be. In this type of research, the variables involved are carefully and scientifically controlled and manipulated. Analytical research is also known as experimental research and is a very sophisticated technique. This kind of research is based on four important characteristics namely; control, manipulation, observation and replication.

2. Applied v/s Fundamental research

Applied research is action oriented or solution oriented. The main goal of an applied research is to obtain an immediate, specific and practical solution of a problem that a business or educational organization is facing right now. It gives here and now solutions in actual problem situations. It involves scientific investigations but the methods are not so rigorous as in fundamental research. It finds solutions to be applied in local environment and they may not be universally acceptable. Applied research does not promise to add new knowledge to the discipline. Fundamental research is carried out to scientifically enhance the organized body of knowledge of a discipline. Also know as basic research, it is concerned with formulation of theory and generalizations of principles. To evaluate and expand a formulated theory it may use empirical data. Basic research involves systematic, highly sophisticated scientific techniques. Fundamental research may not suggest the solutions of immediate problems, it rather draws long term conclusions.

3. Quantitative v/s Qualitative research

Quantitative research is based on quantitative variables, which can be measured in appropriate units. These involve objects and individuals that vary in size, quantity, amount, scale or degree. For example, prices of commodity can be measured in rupees, weight of a product is measured in kilograms and the mileage of vehicle is measured in kilometers per liter. Qualitative research, on the other hand, is based on qualitative variables, which vary in quality of type. These variables cannot

be measured on a scale or in any units. Social scientists use qualitative research for studying human behaviour. In market research surveys qualitative research is carried out to investigate the likes and dislikes of customers. It helps in understanding the current pattern of demand of a company's products.

4. Conceptual v/s Empirical research

Conceptual research involves the development of new theories, abstract ideas, and generalized principles. Philosophers, intellectuals and thinkers carry out this kind of research. On the basis of their conceptual knowledge they build theoretical models. Conceptual research is an intellectual process to develop and verify knowledge. Empirical research is based on observation and experimentation. The information collected in the form of facts develops the conclusions and theories about a phenomenon. The models, so developed, can again be verified by a replication of data collection. To test a given hypothesis empirical research is most popular and powerful tool in the modern world.

5. Other types of research:

Any research study is derivation of one or the other of above four types of research. One can further classify a research on the basis of its purpose, time taken and the discipline of knowledge it relates to. For example, Historical research is the study of past events, historical documents, remains and relics. Clinical research is

employed to study the effects of a new drug. Market research is performed to forecast the potential demand of a product. One- time research is carried out on a small scale in short period with a specific purpose. Educational research is directed towards the study and development of educational system. Social research is concerned with the social problems of the society. Field research is done by going out in the field or market, where as Laboratory research is carried out with in four walls of a laboratory.

The present interdisciplinary research work is a blend of Analytical and experimental research. Half part of this research work is analytical in nature where as half part is experimental in nature. In this research work there has been comparison of mathematical process of traditional (contemporary) method and vedic method of mathematics, in this way it is analytical. After this a sample of students was selected and they were divided into two groups. One group was taught with vedic mathematics pattern and the other group was taught with traditional mathematics pattern, in this way it becomes a part of experimental research. After this teaching process both the groups were compared to study the difference in logical reasoning ability and mental calculation ability of both the groups.

Thus the researcher followed the basics of both types of research in carrying out the research work. A very clear distinction between both types of research can be seen in this work.

Once the type of research work is decided related literature review is done.

Related Literature Review:

Related literature review is the process of collecting, selecting, and reading books, periodicals, reports, abstracts, and other reference materials. The following information may be collected while conducting review :

1. Background knowledge of the problem and related concepts.

2. Theories that explain the existence of a problem and the possible relationship between certain factors and the problem

3. Data that confirms the existence and severity of the problem

4. General and specific findings of the study related to the problem

5. Recommendations for further study given in related studies

Reason for Review Literature

Review of related literature is essential in research. Following are some obvious reasons-

1. It helps the researcher to identify and define a research problem

2. It helps to justify the need for study of a problem

3. It prevents unnecessary duplication of a study

4. It can be the source of the theoretical basis of the study

5. It enables the researcher to learn how to conceptualize a research problem and properly identify and operationally define study variables

6. It helps in creating and refining research equipment

7. It provides guidance for analysis and interpretation of data.

While the research problem is still being conceptualized, the researcher should start reviewing the literature in advance. In identifying and defining a research problem, the researcher must be able to show evidence that the problem actually exists and is worth investigating.

It is important that the researcher knows what is already known about the problem or what earlier researchers have found about it and what questions need to be answered before finalizing the research questions or objectives.

The theories that researchers use to explain the existence of a research problem and are used as a basis in the analysis of relationships between variables can be derived from references, books on theories, or from related studies.

Therefore, the researcher should read enough literature already at the beginning of the research activity.

Sources to review

1. General Reference

Examples are indexes, reviews and abstracts.

2. Primary Source

Examples are research found on published journals.

3. Secondary Source

It is a publication where, authors cite the works of others. Examples are books, encyclopedias. Secondary sources are good references for an overview of the problem.

The function of the review is to provide an insight into the trend to be followed in the area in which the research is to be carried out - it also helps to avoid inadvertent duplication of well-established finding and to provide a path through which research can be conducted effectively; It also helps to delineate and helps to define the problem.

The review gives an understanding of the research methodology which refers to the way the study is conducted. It helps to know about the tools and related tools that have been shown to be useful and promising in previous studies.

The main objective of this chapter is to provide a systematic survey of the current study area / past research carried out in the relevant area.

Reviewing the literature means that it is able to identify the following points:

- ✓ What is established, rejected and accepted in your area'
- ✓ areas of conflict or conflict between different theories of thought
- ✓ Problems or issues that remain unresolved
- ✓ Emerging trends and new perspectives
- ✓ How your research builds on and differs from previous research.

Literature review offers much more than a summary of relevant sources. The task of review involves evaluating individual sources as well as synthesizing these sources to obtain a comprehensive view of the field. At this 'field level', a literature review discusses common and emerging perspectives, notable patterns and trends, areas of conflict and controversy, and gaps within the relevant literature. When you

can see these things clearly, you will be able to set up your own research and contribute to the ongoing debate within the field.

In other words, when reviewing literature not only do you need to engage with a set of literature, you also need to be able to compare, contrast, synthesize and argue against that literature to make a contribution, indicate readiness.

Literature review exists within a variety of scholarly works with varying focus and importance. Short or short literature reviews may be presented in journal articles, book chapters or research work to set the background for the research work and provide a general understanding of the research topic.

However, the focus of a literature review in a research thesis is to identify gaps and argue for the need for further research. Depending on the author's purpose and the context in which the literature review will be presented, a selective or comprehensive approach may be taken.

In the selective approach, one or a limited number of sources are reviewed (for example an annotated bibliographic assignment, or the introduction of a journal article).

A comprehensive approach requires the review of multiple books and articles (such as in a review article), which can be submitted as a key chapter in a research thesis or self-published as a scholarly review article. can be done.

Reviewing literature is a continuous, non-linear and iterative process. Your literature review will help your questions, theories, and methods determine the parameters of your literature review - it is a cyclical process.

It is usually one of the first tasks that the research student undertakes and also one of the last that must be done before the research work can be completed. A literature review written in the early stages of research is prone to change because you need to review and revise it from time to time and make sure it is up to date. You will probably find yourself engaging with related literature in different ways at different stages of your research.

Review of related literature of the present study has also been done. Review from various sources including offline and online sources were investigated and relevant reviews were presented and discussed in chapter-2 of the thesis work. These reviews gave an insight to the researcher which helped in carrying out this research work successfully.

Research Procedure

The research procedure for the present research work may be described under five major headings. These are - (i) Sampling Procedure, (ii) Study material for both the groups of students (iii) Teaching two groups of students, (iv) Construction of logical reasoning test & Test for mental calculation (v) Scheme of data Collection & (v) Program for processing & analysis of data.

1. Sampling Procedure

Population:

Regardless of the technique to be used in selecting a sample, the first step in sampling is definition of the population. In research terminology the Population can be explain as a comprehensive group of individuals, institutions, objects and so forth with have a common characteristics that are the interest of a researcher. The common characteristics of the groups distinguish them from other individual, institutions, objects and so forth. The term universe is also used as synonyms to population.

In a research study once the problem is defined and a research design is prepared, the next step is to collect data on items or individuals related to the study. Collecting information on all the items, objects, individuals or organizations is a huge task involving a lot of money, time and staff. It is a therefore, sounds reasonable to study a portion of these items and try to draw conclusions on all of them. This is called Sampling.

A population is defined as the totality of all possible values (measurements or counts) of a particular characteristic of interest for a specified group of objects or persons. This specified group of objects is also called a 'universe'.

A population is called finite if it consists of a finite and fixed number of individuals or elementary units. A population will be called infinite if this number is infinite or statistically very large. For example, students in your university in a particular year constitute a finite population, whereas the number of leaves on a big tree will constitute an infinite population. As mentioned above it is not always possible, or very expensive and time consuming to study the whole population. We therefore, take out a representative portion of the population, called a sample, and investigate all the items in the sample thoroughly. It results in saving time, money and staff and leads to more accuracy in observation.

For the study in hand Students studying in class VIII of Lucknow city have been taken as the realistic/ accessible population.

Sampling Techniques:

After identifying and defining the research problem and determining specific information required to solve the problem, the task is to look for the type and sources of data which may yield the desired results.

There are two types of sources of data (i) Primary data and (ii) Secondary data, available for the research. Primary data generated when a particular problem at hand is investigated employing mail questionnaires, telephone surveys, personal interviews, observations and experiments. Secondary data include those data which are collected for some earlier research work and are applicable or usable in the study, presently undertaken.

Regardless of the method used to obtain the primary data, it has to be, decided whether the information is to be obtained from every unit of the population under study or only a portion of the population will be used. The first approach, that is, collecting data about each and every unit of the population is called "census method" the latter approach, where only few units of population under study considered for analysis, is called sampling method/technique.

Sometimes it is difficult/not necessary/not required (as per the need of the study) to collect information about each of the population units as is done under complete method. *As per the need of the study undertaken by the researcher, the sampling approach was used.*

The process of selection or the drawing of the accurate representation of a unit, group or sample from a population of interest is called as sampling. Sampling can be done through various sampling techniques in accordance with the nature of the sample as well as the subject matter of the study. It is the Sampling procedure, which will decide the accurate representation of the sample selected for the study as well as the relevance of generalization made from the research.

There are two main categories of sampling (i) Probability Sampling (ii) Non-Probability Sampling, under which various sampling methods/techniques are included.

(i) Probability Sampling

A probability sample is chosen in such a way that each member of the universe/population has a known chance of being selected. It is this condition known

chance-that enables statistical procedures to be used on the result to estimate sample errors. The most frequently used probability samplings are:

(a) Simple Random Sampling

(b) Systematic Sampling

(c) Stratified Sampling &

(d) Cluster Sampling

(ii) Non- Probability Sampling

In this the chance of any particular unit of population being selected is unknown. Since randomness is not involved in the selection process, an estimate of the sampling error cannot be made. But this does not mean that the findings obtained from non-probability sampling are of questionable value. If properly conducted, findings can be as accurate as those obtained from probability sampling. The three most frequently used non-probability sampling designs are:

(a) Purposive/Judgement Sampling

(b) Convenience Sampling

(c) Quota Sampling

As the nature of the method picked for the research it was decided to go for the probability sampling method. Here arose the question of selection of type of probability sampling method. The researcher decided to go for Simple Random Sampling.

The sample selection procedure involved two stage sampling. In the first stage six English medium schools (in the same vicinity) of almost same status in academics of Lucknow City were selected.

Then in second stage class VIII students, who were top 10 (Top-5 boys and Top-5 Girls) in the class on the basis of their academic achievement, were selected, then they were divided into two groups of 30-30 (each group having 15 boys and 15 girls) students. This group was divided on the basis of their academic achievement in previous class i.e. Class VII. Both the groups were quite similar on the basis of their academic achievement.

1.3 Sample Size

Sample size refers to the number of participants or observations included in a study.

The sample size is a term used in research for defining the number of subjects included in a sample size. By sample size, we understand a group of subjects that are selected from the general population and are considered a representative of the real population for that specific study. Sample size of the population plays a vital role in making a study more precise.

For the research purpose (Keeping in view the objective of the study) total 60 students from 6 different schools have been selected. The sample size is given in the table given below:

	For Teaching Mathematics with traditional methods		For Teaching Mathematics with Vedic methods		**Total**
	Male	Female	Male	Female	
No. of Students	15	15	15	15	60
Total	30		30		60

2. Study Material for both the groups

Tools are used for measurement of various variables included in the study. Tools are very important aspect of research work. Tools have the various methods to reach the respondent for collecting primary data. Primary data can be collected by three basic methods, viz. surveys, observations and experiments.

As per the need of the research work it was decided to prepare study material which can be taught to students by both traditional method and vedic method of Mathematics.

Keeping in view the objectives of the study and the focus area of the study first of all it was decided that only multiplication and division would be taught to both the groups. This would help in speedy calculation.

Study material was selected from their text book. Fundamental basis of multiplication and division was taught to both the groups. After that the same content was taught to both the group by different methods (mentioned previously).

3. Teaching two groups of students

Once the study material was finalized, a request was made to the schools to provide one hour for teaching the selected students after schools timings so that their regular schedule not get disturbed. On the request the students were gathered in one school where both the groups were taught by different method i.e. traditional method and vedic method. They were taught for 20 days.

(4) Preparation of logical reasoning test & Test for mental calculation

A non verbal logical reasoning test was prepared. This test contained 20 questions of non verbal logical reasoning. These questions were selected from the previous papers of Jawahar Navodaya Vidyalaya Selection Test so that difficulty level of the paper remains in the reach of the students. Time frame for this test was 20 minutes. Each correct answer carries 2 marks. Maximum marks for the test is 40.

Test for Mental Calculation was also prepared. This test contained 20 questions. There was no separate sheet provided for calculations work. This test contained the questions of multiplications and division based on the content taught to them. Each correct answer carries 2 marks. Maximum marks for the test is 40.

5. Scheme of Data Collection

The data was collected personally. Principal of the selected sample schools was requested for the required support for data collection. They were also convinced of the utility and outcome of the study and his consent for data collection from students was sought.

Before administering the test a brief introduction was given to the students regarding replying the statements, given in the tests.

The data was collected from the selected students of the selected schools. First, response sheet to collect background information of students was given to fill in and then the first test for Non verbal logical reasoning was administered. The administration time for this test was 20 minutes.

After the first test a break of 20 minutes was given to the students. Students were handed over the second test for mental calculation after the break. The administration time for this test was 20 minutes.

This procedure was followed in all the six selected schools one by one.

6. Program for Processing & Analysis of Data.

First of all on the basis of scores on both the test Mean and Sd. Value were computed as per whole group and gender of both the groups. In the second stage to study the significant difference for each of the group 't' values were computed. The significance of 't' value was tested at .05 and .01 level of significance.

Comparison of different mathematical operations pattern in Vedic System and Present System.

Comparative Presentation of Present System of Mathematical Operations and Vedic Mathematical Operations:

As discussed in chapter-1 (Introduction) there is difference in Present System of Mathematical Operations and Vedic system of Mathematical Operations**.** Vedic system of Mathematical Operations are based on 16 Sutras (formulas) mentioned previously. This chapter deals with the presentation of application of these Sutras and its comparison with the present system of mathematical operations. This is expected that this comparison will certainly exhibit the clear distinction between both the systems of mathematical operations.

This comparison will help one to reach to the conclusion that which system seems better; which system is easier; which system is interesting; which system will generate more interest among the learners and lastly which system should be promoted for the better outcome of learners.

Sutra 1.

1. ***Ekadhikina Purvena***

Meaning: By one more than the previous one

Now we relate the sutra to the ‘squaring of numbers ending in 5’. Consider the example 25^2.

Here the number is 25. We have to find out the square of the number. For the number 25, the last digit is 5 and the 'previous' digit is 2. Hence, 'one more than the previous one', that is, 2+1=3. The Sutra, in this context, gives the procedure to multiply the previous digit 2 by one more than itself, that is, by 3'. It becomes the L.H.S (left hand side) of the result, that is, 2 X 3 = 6. The R.H.S (right hand side) of the result is 5^2 , that is, 25.

Thus $25^2 = 2 \text{ X } 3 / 25 = 625$.

In the same way,

$35^2 = 3 \text{ X } (3+1) /25 = 3 \text{ X } 4/ 25 = 1225$;

$65^2 = 6 \text{ X } 7 / 25 = 4225$;

$105^2 = 10 \text{ X } 11/25 = 11025$;

$135^2 = 13 \text{ X } 14/25 = 18225$

In Present System

25^2 is solved like this

$$\begin{array}{r} 25 \\ \times \quad 25 \\ \hline 125 \\ 50X \\ \hline \mathbf{625} \end{array}$$

65^2 is solved like this

$$\begin{array}{r} 65 \\ \times \quad 65 \\ \hline 325 \\ 390X \\ \hline \mathbf{4225} \end{array}$$

105^2 is solved like this

$$\begin{array}{r} 105 \\ \times \quad 105 \\ \hline 525 \\ 000X \\ 105XX \\ \hline \mathbf{11025} \end{array}$$

So it is evident by above example that application of Sutra 1 is easier than the present system of mathematical operations.

Sutra 2.

Nikhilam Navatashcaramam Dashatah

Meaning: All from 9 and the last from 10

The formula can be very effectively applied in multiplication of numbers, which are nearer to bases like 10, 100, 1000i.e., to the powers of 10 . The procedure of multiplication using the Nikhilam involves minimum number of steps, space, time saving and only mental calculation. The numbers taken can be either less or more than the base considered.

The difference between the number and the base is termed as deviation. Deviation may be positive or negative. Positive deviation is written without the positive sign and the negative deviation, is written using Rekhank (a bar on the number). Now observe the following table.

Number	Base	Number – Base	Deviation
14	10	14 - 10	4
8	10	8 - 10	-2 or $\overline{2}$
97	100	97 - 100	-03 or $\overline{03}$
112	100	112 - 100	12
993	1000	993 - 1000	-007 or $\overline{007}$
1011	1000	1011 - 1000	011

Eg : Multiply 7 by 8 Base 10.

Now the base is 10. Since it is near to both the numbers, 7 we write the numbers one below the other. ----- Take the deviations of both the numbers from the base and represent

		-
	7	3
x	8	2
(7-2)		3X2
(8-3)		
5		6
	56 **Ans**	

Eg. 96X94 Base is 100

		-
	96	4
x	94	6
(96-6)		4X6
(94-4)		
90		24
	9024 **Ans**	

Eg. 986X984 Base is 1000

		-
	96	14
x	94	16
(986-16)		14X16
(984-14)		
970		224
	970224 **Ans**	

In the present system these multiplications are solved like this

Eg. 96X94

```
   96
x  94
----
  384
 864x
----
9024 Ans
```

Eg. 986X984

```
   986
x  984
-----
  3944
 7888x
8874xx
------
970224 Ans
```

It is evident from the examples that the Sutra 2 is also based on easy mathematical operation than the present system of mathematical operation

Nikhilam in Division

Consider some two digit numbers (dividends) and same divisor 9.

Observe the following example solution with present system of mathematical operation

Eg.. 1) 13 ÷ 9 The quotient (Q) is 1, Remainder (R) is 4.

Since

9) 13 (1
-9
4

Eg.. 2) 80 ÷ 9 The quotient (Q) is 8, Remainder (R) is 8.

Since

9) 80 (8
-72
08

Now with Vedic System of mathematical operation

i) Split each dividend into a left hand part for the Quotient and

right - hand part for the remainder by a slant line or slash.

Eg. 13 as 1 / 3, 34 as 3 / 4 , 80 as 8 / 0.

ii) Leave some space below such representation, draw a horizontal line.

Eg. 1 / 3 8 / 0

_____ , _____

iii) Put the first digit of the dividend as it is under the horizontal line.

Put the same digit under the right hand part for the remainder,

add the two and place the sum i.e., sum of the digits of the numbers as the remainder.

Eg. 1 / 3 8 / 0

1 8

_____ , _____

1 / 4 8 / 8

Now the problem is over.

i.e., 13 ÷ 9 gives Q = 1, R = 4

80 ÷ 9 gives Q = 8, R = 8

For the three digit division by 9

Note that the remainder is the sum of the digits of the dividend. The first digit of the dividend from left is added mechanically to the second digit of the dividend to obtain the second digit of the quotient. This digit added to the third digit sets the remainder. The first digit of the dividend remains as the first digit of the quotient.

Eg. 9) 212 (23

21 / 2

2 / 3

---

23 / 5

Q= 23, R= 5

Eg. Consider 511 ÷ 9

Add the first digit 5 to second digit 1 getting 5 + 1 = 6. Hence Quotient is 56. Now second digit of 56 i.e., 6 is added to third digit 1 of dividend to get the remainder i.e., 1 + 6 = 7

Thus 51 / 1

5 / 6

---

56 / 7 Q is 56, R is 7.

Thus in this way Nikhilam Sutra is suitable for multiplication and Division.

Sutra 3

Urdhva-Tiryagbyham

Meaning: Vertically and crosswise

Urdhva – tiryagbhyam is the general formula applicable to all cases of multiplication and also in the division of a large number by another large number.

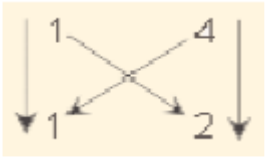
(a) Multiplication of two 2 digit numbers.

Ex.1: Find the product 14 X 12

i) The right hand most digit of the multiplicand, the first number (14) i.e.,4 is multiplied by the right hand most digit of the multiplier, the second number (12) i.e., 2. The product 4 X 2 = 8 forms the right hand most part of the answer.

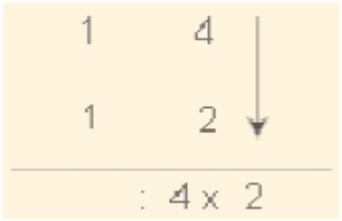
ii) Now, diagonally multiply the first digit of the multiplicand (14) i.e., 4 and second digit of the multiplier (12)i.e., 1 (answer 4 X 1=4); then multiply the second digit of the multiplicand i.e.,1 and first digit of the multiplier i.e., 2 (answer 1 X 2 = 2); add these two i.e.,4 + 2 = 6. It gives the next, i.e., second digit of the answer. Hence second digit of the answer is 6.

iii) Now, multiply the second digit of the multiplicand i.e., 1 and second digit of the multiplier i.e., 1 vertically, i.e., 1 X 1 = 1. It gives the left hand most part of the answer. Thus the answer is 168.

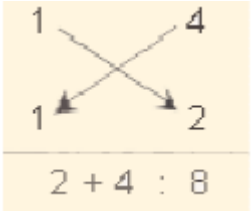


The symbols are operated from right to left .

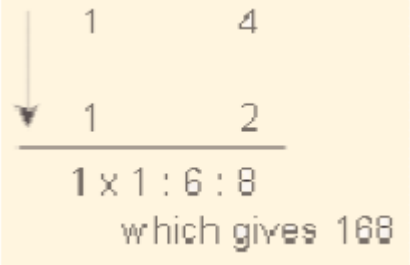
Step i) :



Step ii) :



Step iii) :



Next Example:

Ex.4: 32 X 24

Step (i) : 2 X 4 = 8

Step (ii) : 3 X 4 = 12; 2 X 2 = 4; 12 + 4 = 16.

Here 6 is to be retained. 1 is to be carried out to left side.

Step (iii) : 3 X 2 = 6. Now the carried over digit 1 of 16 is to be added.

i.e., 6 + 1 = 7.

Thus 32 X 24 = 768

Another Example:

Ex.5 28 X 35.

Step (i) : 8 X 5 = 40. 0 is retained as the first digit of the answer and 4 is carried over.

Step (ii) : 2 X 5 = 10; 8 X 3 = 24; 10 + 24 = 34; add the carried over 4 to 34. Now the result is 34 + 4 = 38. Now 8 is retained as the second digit of the answer and3 is carried over.

Step (iii) : 2 X 3 = 6; add the carried over 3 to 6. The result 6 + 3 = 9 is the third or final digit from right to left of the answer.

Thus 28 X 35 = 980.

Another Example of multiplication of three digit number with three digit number:

Eg. **124 X 132.**

i) Proceeding from right to left i) 4 X 2 = 8. First digit = 8

ii) (2 X 2) + (3 X 4) = 4 + 12 = 16. The digit 6 is retained and 1 is carried over to left side. Second digit = 6.

iii) (1 X 2) + (2 X 3) + (1 X 4) = 2 + 6 + 4 =12. The carried over 1 of above step is added i.e., 12 + 1 = 13. Now 3 is retained and 1 is carried over to left 38 side. Thus third digit = 3.

iv) (1 X 3) + (2 X 1) = 3 + 2 = 5. the carried over 1 of above step is added i.e., 5 + 1 = 6 . It is retained. Thus fourth digit = 6

v) (1 X 1) = 1. As there is no carried over number from the previous step it is retained. Thus fifth digit = 1

Ans = 124 X 132 = 16368.

Sutra 4.

Ekanyunena Purvena

Meaning: By one less than the previous one

Method :

a) The left hand side digit (digits) is (are) obtained by applying the ekanyunena purvena i.e. by deduction 1 from the left side digit (digits) .

e.g. (i) 7 x 9;

7 – 1 = 6 (L.H.S. digit)

b) The right hand side digit is the complement or difference between the multiplier and the left hand side digit (digits) .

i.e. 7 X 9 R.H.S is 9 - 6 = 3.

c) The two numbers give the answer; i.e. 7 X 9 = 63.

Example 1: 8 x 9

Step (a) gives 8 – 1 = 7 (L.H.S. Digit)

Step (b) gives 9 – 7 = 2 (R.H.S. Digit)

Step (c) gives the answer 72

Example 2: 15 x 99 Step

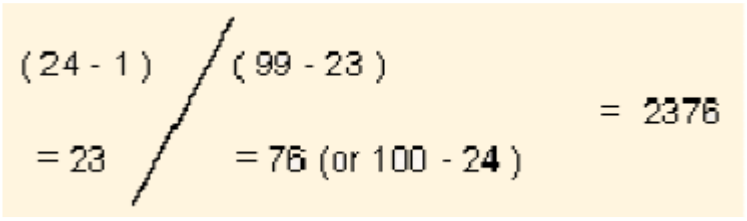
(a) : 15 – 1 = 14

Step (b) : 99 – 14 = 85

Step (c) : 15 x 99 = 1485

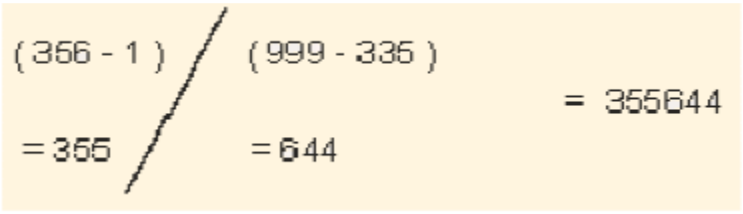
Example 3: **24 x 99**

Answer :



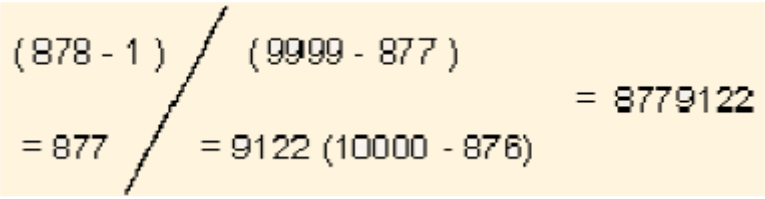
Example: **356X999**

Answer:



Example: **356X999**

Answer:



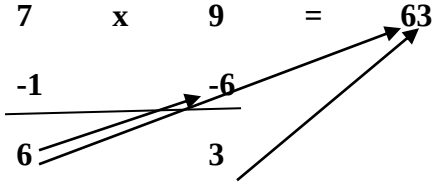
After sufficient practice, one will feel no necessity of writing in this way and simply operate or perform mentally.

Present System of Mathematical Operation has already been described earlier for multiplication and division.

The calculation pattern of Vedic system of mathematical operations is based on simple calculations, one who has simple command over addition, subtraction and tables upto 10 can do calculations of multiplication and division of even larger number without facing any problem. These calculations are based on logical connection that's why Vedic system of Mathematical operation is supposed to increase the logical reasoning ability among the learners.

An effort has been made to add something new to this vedic education system a following method of multiplication has been tried :

eg.1. 7 x 9 = 63

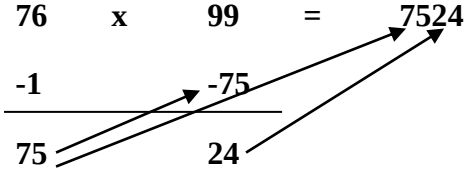


Step-1 **-1 from first digit of the multiplication**

Step-2 **Subtract the outcome of the subtraction from step-1 from the second digit of the multiplication**

Step-3 **The digit of result of step-1 and step-2 is the answer of the multiplication**

eg. 2. 76 x 99 = 7524



But this multiplication can be done one of the number of the multiplication is 9, 99, 999, 9999 or so on.

Result Analysis, Discussion & Interpretation

Keeping in mind the objectives of the research this chapter deals with the analysis and interpretation of data. In order to arrive at certain conclusions and to achieve the objective of the study a systematic treatment of data is needed which consists of three stages namely tabulation of the data, testing of the hypothesis using appropriate statistical techniques and discussion of the results. This chapter if not presented in a proper the whole hard work of doing research work and preparing thesis report goes in vain.

To get the answer of the two hypothesis, data has been presented in the tabular form and to further analyse these hypothesis 4 sub hypothesis have been formulated for each of the hypothesis keeping in view the objective of the research. Related data is represented in the tables giving N, Mean, S.D. and t values. These tables represent both Pre-Test and Post-Test results. Rejection or Acceptance of hypothesis is based on Post-Test. If Post-Test has been found significant at .01 or .05 level of significance hypothesis is rejected, and if not found significant at both level it is accepted.

Objective 3.

To study the effect of Vedic System of Mathematical operations on Logical Reasoning of the Learners.

Hypothesis for Objective- 3.

There will be no significant difference in the ability of Logical Reasoning between the students learning Mathematical Operations from Vedic System and Present System.

Table-1 (Pre-Test)

For T-test

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Pre-Test of Students taught with Vedic System	30	12.7	1.49	.75 p>.05
Post-Test of Students taught with Present System	30	12.8	1.51	

For F-Test

Logical Reasoning Ability	**N**	**M**	**Sd**	**F**
Pre-Test of Students taught with Vedic System	30	12.7	1.49	
Post-Test of Students taught with Present System	30	12.8	1.51	**. 0.9737** p>.05

For Z-Test

Logical Reasoning Ability	**N**	**M**	**Sd**	**Z**
Pre-Test of Students taught with Vedic System	30	12.7	1.49	
Post-Test of Students taught with Present System	30	12.8	1.51	**0.796258** p>.05

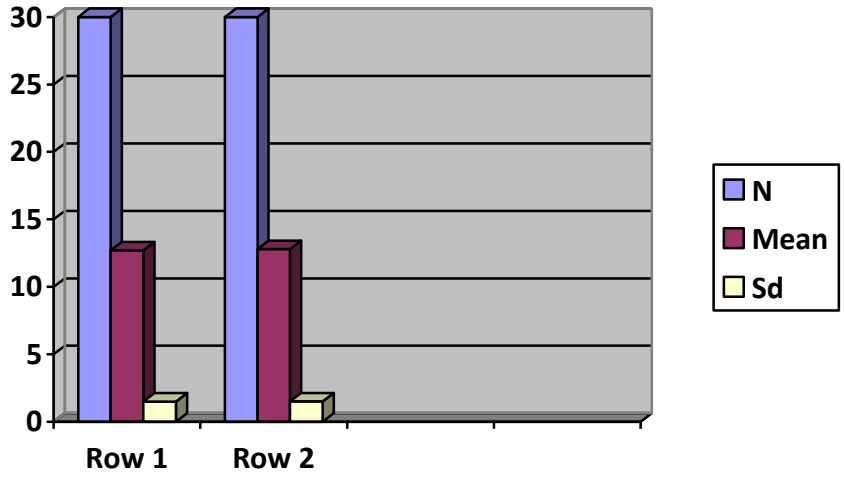


Figure-1

Result:

Table 1(Pre-Test) shows that the mean values of scores of test on Logical Reasoning Ability of students taught with Vedic System and Students taught with Present System are 12.7 and 12.8 respectively, with S.D. value of 1.49 and 1.51 respectively. 't' value between two means is .75, which is statistically not significant ($p>.05$). F-test and Z-test results also found not significant.

Table-1 (Post-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Post-Test of Students taught with Vedic System	20	35.1	3.01	4.23 p<.01
Post-Test of Students taught with Present System	20	28.1	3.32	

Logical Reasoning Ability	**N**	**M**	**Sd**	**F**
Pre-Test of Students taught with Vedic System	30	35.1	3.01	.822 p>.05
Post-Test of Students taught with Present System	30	28.1	3.32	

Logical Reasoning Ability	**N**	**M**	**Sd**	**Z**
Pre-Test of Students taught with Vedic System	30	35.1	3.01	**18.073521** p<.05
Post-Test of Students taught with Present System	30	28.1	3.32	

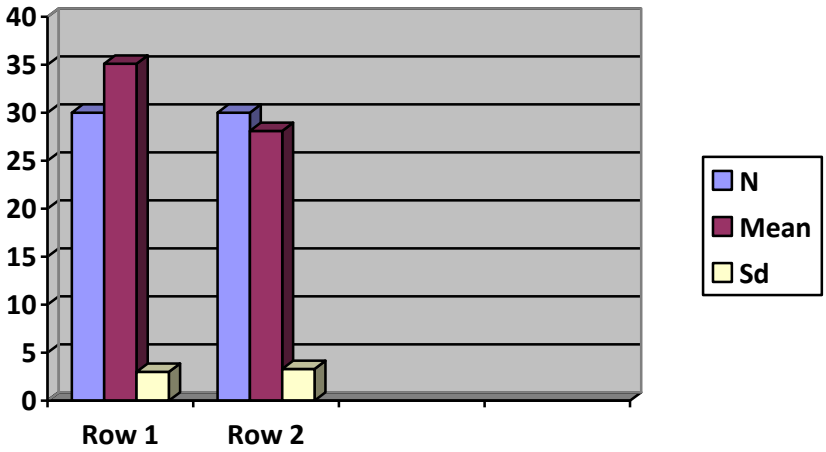


Figure-2

Result:

Table 1 (Post-Test) shows that the mean values of scores of test on Logical Reasoning Ability of students taught with Vedic System and Students taught with

Present System are 35.1 and 28.1 respectively, with S.D. value of 3.01 and 3.32 respectively. 't' value between two means is 4.23, which is statistically significant ($p<.01$). Thus the Hypothesis for objective 3 is rejected. The Mean value of the score of students taught with Vedic System is higher than the Students taught with Present System, it means that students taught with Vedic System shows marked improvement in Logical Reasoning Ability. Though F-test not found significant whereas Z-test found significant.

Sub-Hypothesis-1.1

There will be no significant difference in the ability of Logical Reasoning between the male and female students learning Mathematical Operations from Vedic System.

(Table on next Page)

Table-1.1 (Pre-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**t**
Pre-Test of Male Students taught with Vedic System	15	12.6	1.35	.77 p>.05
Pre-Test of Female Students taught with Vedic System	15	12.8	1.68	

Result:

Table 1.1 (Pre-Test) shows that the mean values of scores of test on Logical Reasoning Ability of male students taught with Vedic System and female students taught with Vedic System are 12.6 and 12.8 respectively, with S.D. value of 1.35 and 1.68 respectively. 't' value between two means is .77, which is statistically not significant (p>.05).

Table-1.1(Post-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Post-Test of Male Students taught with Vedic System	10	35	3.56	.88 p>.05
Post-Test of Female Students taught with Vedic System	10	35.2	2.53	

Result:

Table 1.1 (Post-Test) shows that the mean values of scores of test on Logical Reasoning Ability of male students taught with Vedic System and female students taught with Present System are 35 and 35.2 respectively, with S.D. value of 3.56 and 2.53 respectively. 't' value between two means is .88, which is statistically not significant (p>.05). Thus the Sub-Hypothesis 1.1 for objective 3 is accepted.

The mean score of pre-test and post-test shows that there is marked improvement in male female students who were taught with Vedic System but there is no significant on the basis of gender.

Sub-Hypothesis-1.2

There will be no significant difference in the ability of Logical Reasoning between the male and female students learning Mathematical Operations from Present System.

Table-1.2 (Pre-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Pre-Test of Male Students taught with Present System	15	12.8	1.39	1.00 p>.05
Pre-Test of Female Students taught with Present System	15	12.8	1.68	

Result:

Table 1.2 (Pre-Test) shows that the mean values of scores of test on Logical Reasoning Ability of male students taught with Present System and female students taught with Present System are 12.8 and 12.8 respectively, with S.D. value of 1.39 and 1.68 respectively. 't' value between two means is 1.00, which is statistically not significant (p>.05).

Table-1.2 (Post-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Post-Test of Male Students taught with Present System	15	28.4	3.58	.71 p>.05
Post-Test of Female Students taught with Present System	15	27.8	3.32	

Result:

Table 1.2 (Post-Test) shows that the mean values of scores of test on Logical Reasoning Ability of male students taught with Present System and female students taught with Present System are 28.4 and 27.4 respectively, with S.D. value of 3.58 and 3.32 respectively. 't' value between two means is .71, which is statistically significant (p>.05). Thus the Sub-Hypothesis 1.2 for objective 3 is accepted.

Sub-Hypothesis-1.3

There will be no significant difference in the ability of Logical Reasoning between the male students learning Mathematical Operations from Vedic System and Present System.

(Table 1.3 Next Page)

Table-1.3 (Pre-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**t**
Pre-Test of Male Students taught with Vedic System	15	12.6	1.35	.75 p>.05
Pre-Test of Male Students taught with Present System	15	12.8	1.39	

Result:

Table 1.3 (Pre-Test) shows that the mean values of scores of test on Logical Reasoning Ability of male students taught with Vedic System and male students taught with Present System are 12.6 and 12.8 respectively, with S.D. value of 1.35 and 1.39 respectively. 't' value between two means is .75, which is statistically not significant (p>.05).

Table-1.3 (Post-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Post-Test of Male Students taught with Vedic System	15	35	3.56	1.98 p<.05
Post-Test of Male Students taught with Present System	15	28.4	3.58	

Result:

Table 1.3 (Post-Test) shows that the mean values of scores of test on Logical Reasoning Ability of male students taught with Vedic System and male Students taught with Present System are 35 and 28.4 respectively, with S.D. value of 3.56 and 3.58 respectively. 't' value between two means is 1.98, which is statistically significant ($p<.05$). Thus the Sub-Hypothesis 1.3 for objective 3 is rejected. The Mean value of the score of male students taught with Vedic System is higher than the male Students taught with Present System, it means that male students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

Sub-Hypothesis-1.4

There will be no significant difference in the ability of Logical Reasoning between the female students learning Mathematical Operations from Vedic System and Present System.

Table-1.4 (Pre-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Pre-Test of Female Students taught with Vedic System	15	12.8	1.68	1.00 p>.05
Pre-Test of Female Students taught with Present System	15	12.8	1.68	

Result:

Table 1.4 (Pre-Test) shows that the mean values of scores of test on Logical Reasoning Ability of female students taught with Vedic System and female Students

taught with Present System are 12.8 and 12.8 respectively, with S.D. value of 1.68 and 1.68 respectively. 't' value between two means is 1.00, which is statistically not significant (p>.05).

Table-1.4 (Post-Test)

Logical Reasoning Ability	**N**	**M**	**Sd**	**T**
Post-Test of Female Students taught with Vedic System	15	35.2	2.53	2.58 p<.01
Post-Test of Female Students taught with Present System	15	27.8	3.32	

Result:

Table 1.4 (Post-Test) shows that the mean values of scores of test on Logical Reasoning Ability of female students taught with Vedic System and female Students taught with Present System are 35.2 and 27.8 respectively, with S.D. value of 2.53

and 3.32 respectively. ‘t’ value between two means is 2.58, which is statistically significant ($p<.01$). Thus the Sub-Hypothesis 1.4 for objective 3 is rejected. The Mean value of the score of female students taught with Vedic System is higher than the Female Students taught with Present System, it means that female students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

Objective 4.

To study the effect of Vedic System of Mathematical operations on mental calculations of the Learners.

Hypothesis for Objective-4.

There will be no significant difference in the ability of mental calculations between the students learning Mathematical Operations from Vedic System and Present System

Table 2 (Pre-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**T**
Pre-Test of Students taught with Vedic System	30	16.3	1.97	.74 p>.05
Pre-Test of Students taught with Present System	30	16.5	1.93	

Mental Calculation Ability	**N**	**M**	**Sd**	**F**
Pre-Test of Students taught with Vedic System	30	16.3	1.97	**0.9598** p>.05
Pre-Test of Students taught with Present System	30	16.5	1.93	

Mental Calculation Ability	**N**	**M**	**Sd**	**Z**
Pre-Test of Students taught with Vedic System	30	16.3	1.97	**0.516386** p>.05
Pre-Test of Students taught with Present System	30	16.5	1.93	

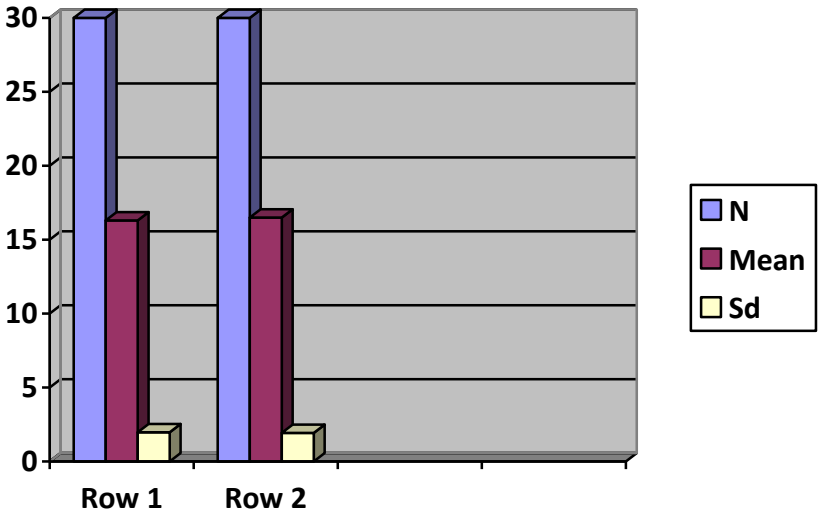


Figure-3

Result:

Table 2 (Pre-Test) shows that the mean values of scores of test on Mental Calculation Ability of students taught with Vedic System and Students taught with Present System are 16.3 and 16.5 respectively, with S.D. value of 1.97 and 1.93 respectively. 't' value between two means is .74, which is statistically not significant (p>.05). F-test and Z-test also not found significant.

Table 2 (Post-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**T**
Post-Test of Students taught with Vedic System	30	36.8	2.46	3.86 p<.01
Students taught with Present System	30	23.4	2.52	

Mental Calculation Ability	**N**	**M**	**Sd**	**F**
Post-Test of Students taught with Vedic System	30	36.8	2.46	**0.9529** p>.01
Students taught with Present System	30	23.4	2.52	

Mental Calculation Ability	**N**	**M**	**Sd**	**Z**
Post-Test of Students taught with Vedic System	30	36.8	2.46	**34.597882** p<.01
Students taught with Present System	30	23.4	2.52	

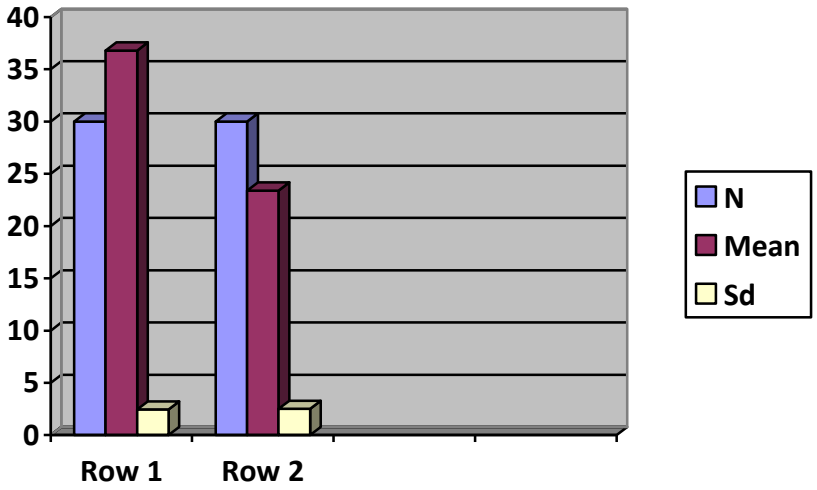


Figure-4

Result:

Table 2(Post-Test) shows that the mean values of scores of test on Mental Calculation Ability of students taught with Vedic System and Students taught with Present System are 36.8 and 23.4 respectively, with S.D. value of 2.46 and 2.52 respectively. 't' value between two means is 3.86, which is statistically significant ($p<.01$). Thus the Hypothesis for objective 4 is rejected. The Mean value of the score of students taught with Vedic System is higher than the Students taught with Present System, it means that students taught with Vedic System shows marked improvement in Mental Calculations Ability. F-test not found significant whereas Z-test found significant at .01 level.

Sub-Hypothesis-2.1

There will be no significant difference in the ability of mental calculations between the male and female students learning Mathematical Operations from Vedic System.

Table 2.1 (Pre-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**T**
Pre-Test of Male Students taught with Vedic System	15	16.6	1,89	.51 p>.05
Pre-Test of Female Students taught with Vedic System	15	16	2.10	

Result:

Table 2.1 (Pre-Test) shows that the mean values of scores of test on Mental Calculation Ability of male students taught with Vedic System and female students

taught with Present System are 16.6 and 16 respectively, with S.D. value of 1.89 and 2.10respectively. 't' value between two means is .51, which is statistically not significant (p>.05).

Table2.1 (Post-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Post-Test of Male Students taught with Vedic System	30	37.2	2.7	1.02 p>.05
Post-Test of Female Students taught with Vedic System	30	36.4	2.27	

Result:

Table 2.1 (Post-Test) shows that the mean values of scores of test on Mental Calculation Ability of male students taught with Vedic System and female students taught with Vedic System are 37.2 and 36.4 respectively, with S.D. value of 2.7 and

2.27 respectively. 't' value between two means is 1.02, which is statistically not significant (p>.05). Thus the Sub-Hypothesis 2.1 for objective 4 is accepted.

Though score of post test is much better than pre test the students taught with vedic system but there is no gender difference

Sub-Hypothesis-2.2

There will be no significant difference in the ability of mental calculations between the male and female students learning Mathematical Operations from Present System.

Table 2.2 (Pre-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Pre-Test of Male Students taught with Present System	15	16.4	2.06	.82 p>.05
Pre-Test of Female Students taught with Present System	15	16.6	1.89	

Result:

Table 2.2 (Pre-Test) shows that the mean values of scores of test on Mental Calculation Ability of male students taught with Present System and female students taught with Present System are 16.4 and 16.6 respectively, with S.D. value of 2.06 and 1.89 respectively. 't' value between two means is .82, which is statistically not significant (p>.05).

Table2.2 (Post-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Post-Test of Male Students taught with Present System	15	24.2	2.74	.86 p>.05
Post-Test of Female Students taught with Present System	15	22.6	2.11	

Result:

Table 2.2 (Post-Test) shows that the mean values of scores of test on Mental Calculation Ability of students taught with Vedic System and Students taught with Present System are 24.2.1 and 22.6 respectively, with S.D. value of 2.74 and 2.11 respectively. 't' value between two means is .86, which is statistically not significant ($p<.01$). Thus the Sub-Hypothesis 2.2 for objective 4 is rejected.

Sub-Hypothesis-2.3

There will be no significant difference in the ability of mental calculations between the male students learning Mathematical Operations from Vedic System and Present System.

Table 2.3 Next page

Table-2.3 (Pre-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Pre-Test of Male Students taught with Vedic System	15	16.6	1.89	.82 p>.05
Pre-Test of Male Students taught with Present System	15	16.4	2.06	

Result:

Table 2.3 (Pre-Test) shows that the mean values of scores of test on Mental Calculation Ability of male students taught with Vedic System and male students taught with Present System are 16.6 and 16.4 respectively, with S.D. value of 1.89 and 2.06 respectively. 't' value between two means is .82, which is statistically not significant (p>.05).

Table2.3 (Post-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Post-Test of Male Students taught with Vedic System	15	37.2	2.7	3.18 p<.01
Post-Test of Male Students taught with Present System	15	24.2	2.74	

Result:

Table 2.3 (Post-Test) shows that the mean values of scores of test on Mental Calculation Ability of male students taught with Vedic System and male students taught with Present System are 37.2 and 24.2 respectively, with S.D. value of 2.7 and 2.74 respectively. 't' value between two means is 3.18, which is statistically significant (p<.01). Thus the Sub-Hypothesis 2.3 for objective 4 is rejected. The Mean value of the score of male students taught with Vedic System is higher than the male students taught with Present System, it means that male students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

Sub-Hypothesis-2.4

There will be no significant difference in the ability of mental calculations between the female students learning Mathematical Operations from Vedic System and Present System.

Table 2.4 (Pre-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Pre-Test of Female Students taught with Vedic System	15	16	2.10	.51 p>.05
Pre-Test of Female Students taught with Present System	15	16.6	1.89	

Result:

Table 2.4 (Pre-Test) shows that the mean values of scores of test on Mental Calculation Ability of female students taught with Vedic System and female

students taught with Present System are 16.6 and 16 respectively, with S.D. value of 2.10 and 1.89 respectively. 't' value between two means is .51, which is statistically not significant (p>.05).

Table2.4 (Post-Test)

Mental Calculation Ability	**N**	**M**	**Sd**	**t**
Post-Test of Female Students taught with Vedic System	15	36.4	2.27	3.82 p<.01
Post-Test of Female Students taught with Present System	15	22.6	2.11	

Result:

Table 2.4 (Post-Test) shows that the mean values of scores of test on Mental Calculation Ability of female students taught with Vedic System and female

students taught with Present System are 36.4 and 22.6 respectively, with S.D. value of 2.27 and 2.11 respectively. 't' value between two means is 3.82, which is statistically significant ($p<.01$). Thus the Sub-Hypothesis 2.4 for objective 4 is rejected. The Mean value of the score of female students taught with Vedic System is higher than the female students taught with Present System, it means that female students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

On the basis of viewing the above result and discussion it can be said easily said that Learning mathematical operations from Vedic System help in acquiring mental calculation ability and Logical Reasoning Ability.

Summary, Findings, Suggestions and Implications

In the present chapter Summary, Findings, Suggestions and Educational Implications are discussed in detail.

Summary :

The present venture is concerned with the study of comparison of Vedic System of Mathematical Operations and Present System of Mathematical Operations.

The present investigation which is entitled, "**A Comparative Study of Vedic System of Mathematical Operations and Present System of Mathematical Operations"** tried to identify difference in logical reasoning ability and mental calculation ability of two group of Class VIII Students out of which one group was taught with Vedic System of Mathematical Operations and the other group was taught with the present system of Mathematical Operations. There were four objectives of this study. On the basis of review of related literature and objectives of the study two research Hypotheses were formulated. Later on to analyse further the research hypotheses, 4 sub-hypotheses were formulated for each of the research hypothesis.

For the purpose of this research a 40 students of class VIII of 4 schools were divided into two groups of 20 each. One group was taught with Vedic System of Mathematical Operations and the other group was taught with present system of Mathematical Operations. A pre-test was conducted to test the entry level of the students and post-test was conducted to test the hypothesis. After teaching, a logical reasoning test and mental calculation test was given to both the groups. Then the scores were computed and then Mean, SD and 't' value was computed. Significance Level of 't' value became the basis of acceptance/ rejection of Hypothesis. This acceptance/rejection of the hypothesis decided the effect of Vedic System of Mathematical Operations on the students.

Findings :

For Objective-1 & 2

Analysis and comparison presented in chapter-1 and Chapter-4 shows clearly that Vedic System of Mathematical has upper hand over present system of mathematical operations. Vedic System is able to make students sharper and much quicker than the students studying through present system.

If there is clarity of understanding of the basic concepts of Vedic System of Mathematical operations and it's 16 Sutras and UP Sutras then learner can achieve more than it is expected from them.

Hypothesis wise wise findings of the present study are given here:

Hypothesis-3

There will be no significant difference in the ability of Logical Reasoning between the students learning Mathematical Operations from Vedic System and Present System.

- There is significant difference in the Logical Reasoning Ability of students taught with Vedic System and Students taught with Present System. 't' value between two means is 4.23, which is statistically significant ($p<.01$).

- Students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

- **Note: In Pre-Test hypothesis was accepted.**

To further analyse Result of Hypothesis-3 some sub-hypothesis were also tested.

Sub-Hypothesis-1.1

There will be no significant difference in the ability of Logical Reasoning between the male and female students learning Mathematical Operations from Vedic System.

- There is no significant difference in the Logical Reasoning Ability of male students taught with Vedic System and female students taught with Present System . 't' value between two means is.88, which is statistically not significant (p>.05).

Sub-Hypothesis-1.2

There will be no significant difference in the ability of Logical Reasoning between the male and female students learning Mathematical Operations from Present System.

- There is no significant difference in Logical Reasoning Ability of male students taught with Present System and female students taught with Present System. 't' value between two means is .77, which is statistically not significant (p>.05).

Note: Both hypothesis were accepted in Pre-test and Post-test result , which shows that before teaching and after teaching result of both groups are similar in their logical reasoning ability.

Sub-Hypothesis-1.3

There will be no significant difference in the ability of Logical Reasoning between the male students learning Mathematical Operations from Vedic System and Present System.

- There is significant difference in Logical Reasoning Ability of male students taught with Vedic System and male Students taught with Present System. 't' value between two means is 1.98, which is statistically significant ($p<.05$).

- Male students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

Sub-Hypothesis-1.4

There will be no significant difference in the ability of Logical Reasoning between the female students learning Mathematical Operations from Vedic System and Present System.

- There is significant difference in Logical Reasoning Ability of female students taught with Vedic System and female Students taught with Present System. 't' value between two means is 2.58, which is statistically significant ($p<.0$).

- Female students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

Hypothesis-4

There will be no significant difference in the ability of mental calculations between the students learning Mathematical Operations from Vedic System and Present System.

- There is significant difference in the Mental Calculation Ability of students taught with Vedic System and Students taught with Present System. 't' value between two means is 3.86, which is statistically significant ($p<.01$).

- Students taught with Vedic System shows marked improvement in Mental Calculations Ability.

- **Note: In Pre-Test hypothesis was accepted.**

Sub-Hypothesis-2.1

There will be no significant difference in the ability of mental calculations between the male and female students learning Mathematical Operations from Vedic System.

- There is no significant difference in Mental Calculation Ability of male students taught with Vedic System and female students taught with Vedic

System. ‘t’ value between two means is 1.02, which is statistically not significant (p>.05).

Sub-Hypothesis-2.2

There will be no significant difference in the ability of mental calculations between the male and female students learning Mathematical Operations from Present System.

- There is no significant difference in Mental Calculation Ability of male students taught with Present System and female students taught with Present System. ‘t’ value between two means is .82, which is statistically not significant (p>.05).

- **Note: Pre-test result for both the sub-hypothesis were also not significant.**

Sub-Hypothesis-2.3

There will be no significant difference in the ability of mental calculations between the male students learning Mathematical Operations from Vedic System and Present System.

- There is significant difference in Mental Calculation Ability of male students taught with Vedic System and male students taught with Present System. 't' value between two means is 3.18, which is statistically significant ($p<.01$)

- Male students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

Sub-Hypothesis-2.4

- **There will be no significant difference in the ability of mental calculations between the female students learning Mathematical Operations from Vedic System and Present System.**

- There is significant difference in Mental Calculation Ability of female students taught with Vedic System and female students taught with Present System. 't' value between two means is 3.82, which is statistically significant ($p<.01$)

- Female students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

- **Note: In Pre-test both the groups of sub-hypothesis 2.3 & 2.4 were not significantly different.**

Suggestions:

In the light of the finding of the study it seems worthwhile to offer some suggestions. These may be for different people of society viz. Policy makers, School Authorities, Community leaders and other stakeholders of the society and the future researchers.

Suggestion for the Policy-makers:

- Policy makers and planners have an important role in deciding the path to ensure availability of quality content in the field of education of mathematics. Policy makers must remember that students and the young generation especially growing children and teenagers are the future of the nation and world nation. Thus Vedic system of mathematics must be given its due place.

Suggestion for Schools:

- Schools should also introduce Vedic mathematics as an additional subject (Till it is officially introduce in the curriculum) for the betterment of students.

Suggestion for Community:

- Community should also join hands to uplift our age old mathematics system and demand the introduction of vedic mathematics system in Indian Education System.

Thus it can be suggested in a holistic manner that every one should join hands together to make this world a better place where there would be content for the people of every walk of society. If promoted judiciously and used in a right manner it may prove an effective powerful tool for making people more reasoned and quick. Besides it can also become a strong source of learning for everyone. It may attract learners to take up mathematics as a subject in above highschool level studies.

Suggestions for the further research:

(1) Researchers may take up studies for case studies of institutions which runs Vedic Mathematics Classes.

(2) Researchers may take up studies of colleges of other cities. .

(3) A detailed study of some other role of Vedic system of Mathematical operations can be done

(4) Use of more sophisticated statistical techniques may be used for more systematic analysis of the data.

(5) Present investigation involves Class VIII level students, it can be done for primary, secondary, senior secondary and degree level also.

(6) The research can be done involving different cities with a large sample. Even rural areas can also be included.

(7) This research is being done on schools of different national and state boards.

(8) A detailed study for demographic aspect of students and its impact can also be done.

Implications:

(1) The present study reflects that Vedic System of Mathematical Operations can be useful in development of Logical Reasoning ability of upper primary students.

(2) In order to get teenangers more benefitted of the Vedic Mathematics, they must be guided in a friendly manner.

(3) Teenagers and other members of society may give a boost to their Learning by using Vedic Mathematics 16 Sutras in effective manner

(4) Parental support and elderly guidance can play a vital role.

(5) Opportunity to explore effect of Vedic Mathematics on various aspect of studies need clean and clear policies.

(6) To ensure availability of quality content on Vedic Mathematics, experts will also have to take responsibility.

(7) Vedic Mathematics can speed the mental calculation ability give more confidence to the beginners and advance learners.

(8) Proper motivation/reward should be given to the learners for their good deeds/performance while learning Vedic Mathematics so that others may also follow the same path..

(9) Government control should be there to manage and control. It is required that it should not be rigid but flexible keeping in view the basic needs and requirements of the society.

Vedic Mathematics in India needs qualitative revamping especially for future students and generations as they are getting largely escaping from taking mathematics at higher level of education due to fear and poor understanding of basic calculations. Parents and schools are the main system that can guide the young generation to learn through Vedic Mathematics that may give them more confidence. The progressive trend and increasing use of Vedic Mathematics in education sector is an indication that in future Vedic Mathematics can play a vital role in everybody's life and also in every domain of life.

In the concluding remark of this thesis work it can be said that Vedic Mathematics can play an important role in development of logical reasoning ability and mental calculation (with speed) ability of teenagers and young generation. They way it is growing one day it may affect every aspect of human life.

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Logical Reasoning Test

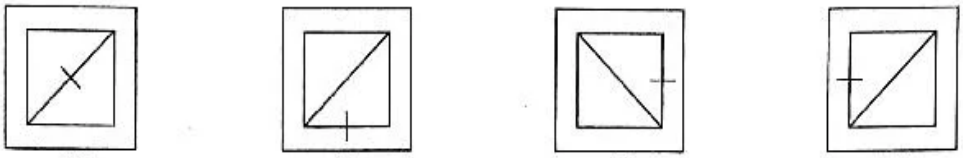
Instructions:

1. This Test contains 20 questions.

2. Try to attempt all questions in 20 minutes time.

Directions : In Question Nos. 1 to 6, four figures (A), (B), (C) and (D) have been given in each question. Of these four figures, three figures are similar in some way and one figure is different. Select the figure which is different. Darken the circle for answer in the OMR Answer Sheet against the number corresponding to the question.

1.

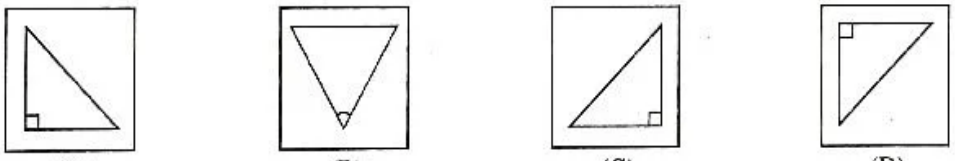


(A) (B) (C) (D)

2.

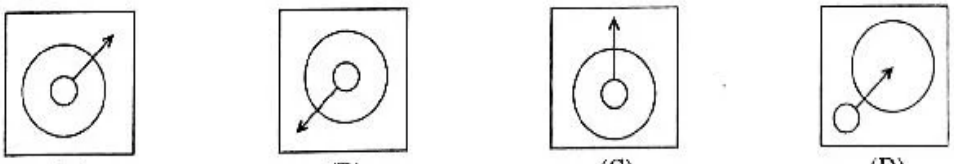
(A) (B) (C) (D)

3.

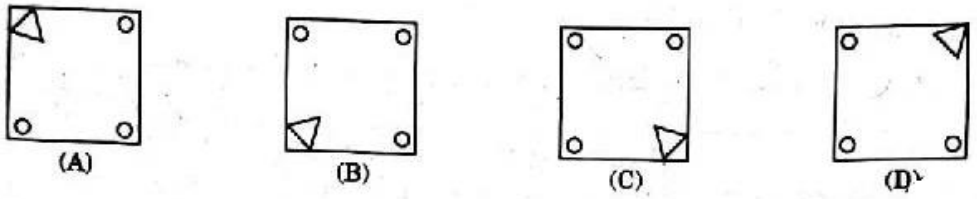


(A) (B) (C) (D)

4.



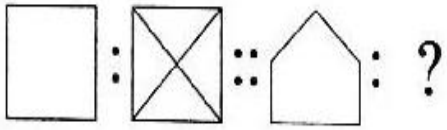
(A) (B) (C) (D)

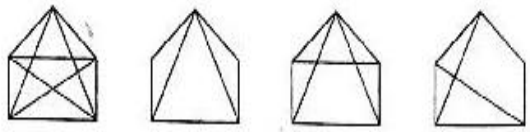
5. 

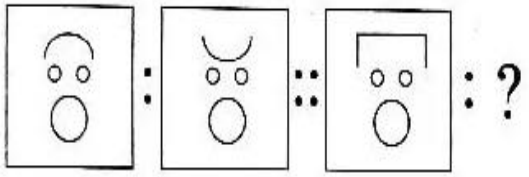
6. TIC (A) CTI (B) TEC (C) ITC (D)

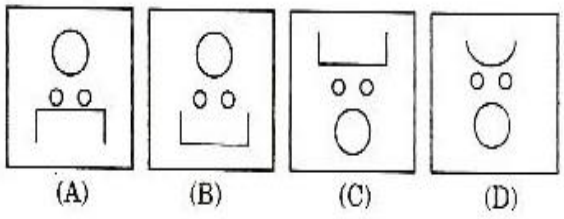
Directions : In Question Nos. 7 to 12, there are two sets of two question figures each. The second set has an interrogation mark (?). There exists a relationship between the first two question figures. Similar relationship should exist between the third and the fourth question figure. Select one of the answer figures which replaces the mark of interrogation. Darken the circle in the OMR Answer Sheet against the number corresponding to the question.

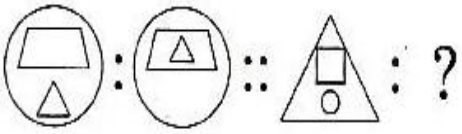
Question Figures | **Answer Figures**

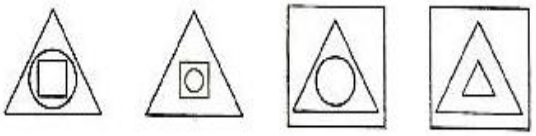
7. 



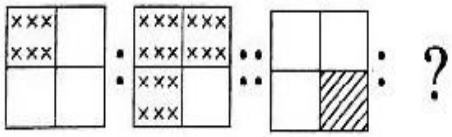
8. 

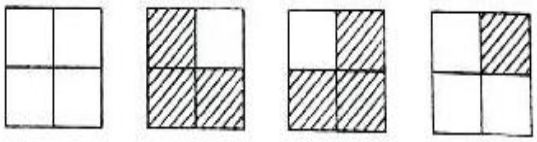


9. 

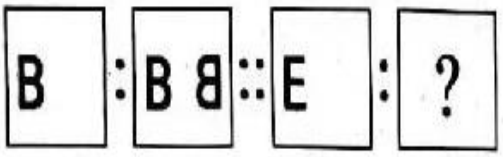


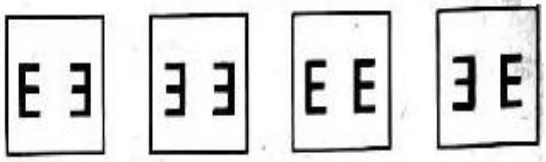
(A) (B) (C) (D)

10. 

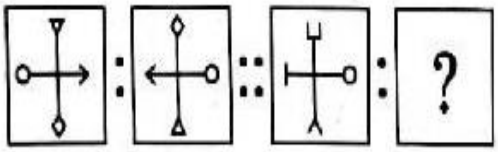


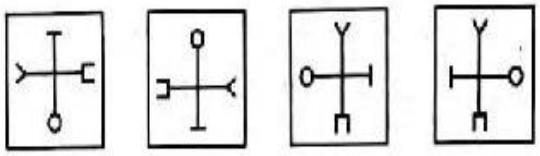
(A) (B) (C) (D)

11. 



(A) (B) (C) (D)

12. 

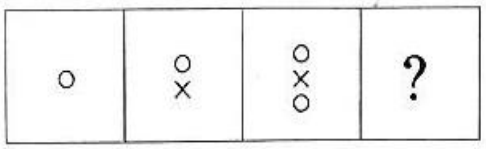


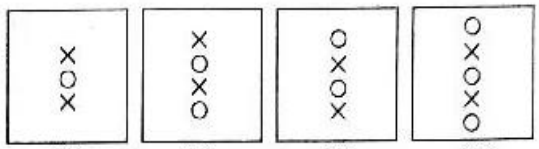
(A) (B) (C) (D)

Directions : In Question Nos. **13** to **20**, there are three question figures on the left side and the space for the fourth figure is left blank. The question figures are in a series. Find out one figure from among the answer figures given on the right side which occupies the blank space for the fourth figure on the left side and completes the series. Indicate your answer by darkening the circle in the OMR Answer Sheet against the number corresponding to the question.

Question Figures | **Answer Figures**

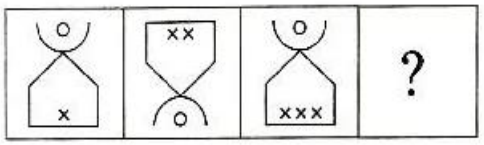
13.

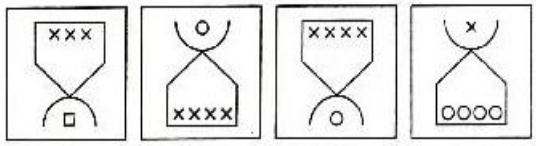




(A) (B) (C) (D)

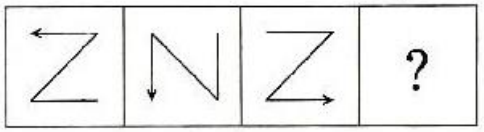
14.

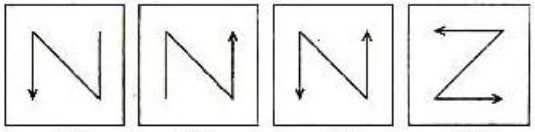




(A) (B) (C) (D)

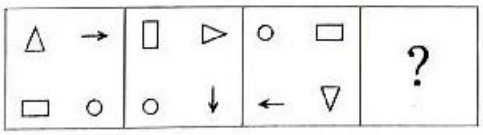
15.

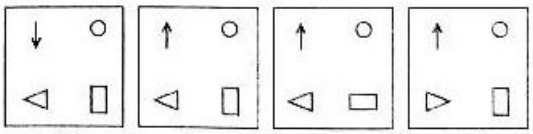




(A) (B) (C) (D)

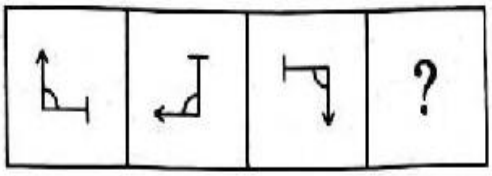
16.





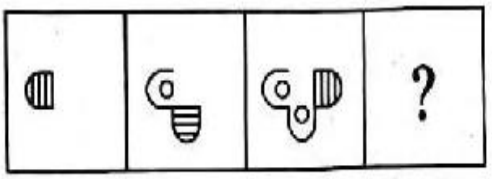
(A) (B) (C) (D)

17.



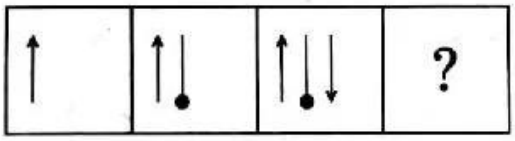
(A) (B) (C) (D)

18.



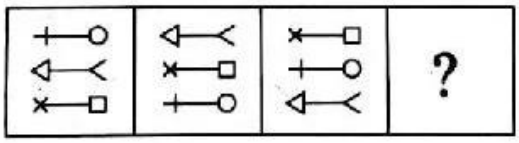
(A) (B) (C) (D)

19.



(A) (B) (C) (D)

20.



(A) (B) (C) (D)

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Mental Calculation Test (20 Question) Multiplication and Division

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"THE EFFECT OF VEDIC SYSTEM OF MATHEMATICAL OPERATIONS ON LOGICAL REASONING OF THE LEARNER"

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[2] *Ph.D. Scholar, P.K. University, Vill. Thanara (P.O. Dinara), Shivpuri, M.P.*

ABSTRACT

This research paper tries to go through the Vedic mathematics system to understand its process. Mathematical operations of Vedic mathematics are quite simple and easy to comprehend and apply. These mathematical operations are based on some sutras and once you understand its system you find the difference in speed of your calculation work. Its very interesting and useful system based on Indian mathematics system.

Keyword*: Vedic Mathematics, Sutras, Mathematical operations.*

I. INTRODUCTION

Mathematics is a study of measurements, numbers, and space, which is one of the first sciences that humans work to develop because of its great importance and benefit.
Mathematics reveals hidden patterns that help us to understand the world around us. Now, much more than arithmetic and geometry, mathematics today is a diverse discipline that deals with data, measurements and observations from science, with inference, deduction, and proof; and with mathematical models of natural phenomena, of human behavior, and of social systems. The literal meaning of mathematics is "things which can be counted" now you can think that counting has vital role in our daily life; just imagine that there were no mathematics at all, how would it be possible for us to count members of the family, number of students in the class, rupees in the pocket, runs in a cricket match, days in a week or in a months or years? On a basic level you need to be able to count, add, subtract, multiply, and divide.
As for mathematical inventions, they are numerous throughout the ages. Some of them were tangible, such as counting and measuring devices. Some of them are not as tangible as methods of thinking and solving. The symbols that express numbers are also one of the most important mathematical inventions.
Math encourages logical reasoning, critical thinking, creative thinking, abstract or spatial thinking, problem-solving ability, and even effective communication skills.

II. VEDIC MATHEMATICS

Vedic mathematics is the name given to the ancient Indian system of mathematics that was rediscovered in the early twentieth century from ancient Indian scripture namely Atharvaveda. We use mathematics in our all endeavors; therefore it becomes a part of our life. Our imaginations do involve mathematics

Atharvaveda – supposedly contains a set of sixteen sutras that describe all of mathematics. Sutra is often translated word formula and is short and easily memorized and recited. Vedic Mathematics is a system of mathematics based on

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these sixteen sutras. These sixteen sutras are given below.

III. THE 16 SUTRAS OF VEDIC MATH

1. *Ekadhikina Purvena*
   (Corollary: Anurupyena)
   Meaning: By one more than the previous one
2. *Nikhilam Navatashcaramam Dashatah*
   (Corollary: Sisyate Sesasamjnah)
   Meaning: All from 9 and the last from 10
3. *Urdhva-Tiryagbyham*
   (Corollary: Adyamadyenantyamantyena)
   Meaning: Vertically and crosswise
4. *Paraavartya Yojayet*
   (Corollary: Kevalaih Saptakam Gunyat)
   Meaning: Transpose and adjust
5. *Shunyam Saamyasamuccaye*
   (Corollary: Vestanam)
   Meaning: When the sum is the same that sum is zero
6. *(Anurupye) Shunyamanyat*
   (Corollary: Yavadunam Tavadunam)
   Meaning: If one is in ratio, the other is zero
7. *Sankalana-vyavakalanabhyam*
   (Corollary: Yavadunam Tavadunikritya Varga Yojayet)
   Meaning: By addition and by subtraction
8. *Puranapuranabyham*
   (Corollary: Antyayordashake'pi)
   Meaning: By the completion or non-completion
9. *Chalana-Kalanabyham*
   (Corollary: Antyayoreva)
   Meaning: Differences and Similarities
10. *Yaavadunam*
    (Corollary: Samuccayagunitah)
    Meaning: Whatever the extent of its deficiency
11. *Vyashtisamanstih*
    (Corollary: Lopanasthapanabhyam)
    Meaning: Part and Whole
12. *Shesanyankena Charamena*
    (Corollary: Vilokanam)
    Meaning: The remainders by the last digit
13. *Sopaantyadvayamantyam*
    (Corollary: Gunitasamuccayah Samuccayagunitah)
    Meaning: The ultimate and twice the penultimate
14. *Ekanyunena Purvena*
    (Corollary: Dhvajanka)
    Meaning: By one less than the previous one
15. *Gunitasamuchyah*
    (Corollary: Dwandwa Yoga)
    Meaning: The product of the sum is equal to the sum of the product

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16. *Gunakasamuchyah*
(Corollary: Adyam Antyam Madhyam)
Meaning: The factors of the sum is equal to the sum of the factors

Here is an example to show how fast the results can be achieved using Vedic mathematical operations-

Example-1:

Present/ Conventional System: Find 109^2=

```
  109
x 109
-----
  981
 000x
109xx
-----
11881
```

Vedic Mathematical Operation:

Find 109^2 = (109+9)/9x9 = (118)/81 = 11881

First step: 109 is added by 9 and 118 is put as one part of the answer.
Second step: 9 is multiplied by 9, other part of the answer comes as 81. The product thus comes 11881.

This calculation is based on *Nikhilam Sutra (Corollary)* which means "whatever the extent of its deficiency, lessen it still further to that very extent, and also set up the square (of that deficiency)".

But for numbers above 10 We work exactly as before; but, instead of reducing still further by the deficit, we increase the number still further by the surplus. In above example 9 is surplus from 100 then 9 is added to 109 and becomes 118. After that that surplus 9 is squared and becomes 81. Putting 81 after 118 we get the answer 11881 which is the square of 109.

IV. Vedic Mathematics And Logical Reasoning

Mathematics teaching is very important for intellectual developments there is no other subject in the curriculum likes mathematics which makes students' brain active. Problem solving help in the development of mental faculties.
Mental work is needed to solve mathematical problems. If a child, has a mathematical problem her/his brain becomes active in solving that problem. Each problem of mathematics posses such sequence which is necessary for constructive and creative process. In this way, all-mental abilities of child are developed through mathematics.
Historically, learning mathematics and teaching it to all students at the school stage has been motivated by the belief that a study of mathematics helps students to learn to reason and apply such reasoning to everyday problems.
Vedic Mathematics is based on more logical basis than present system of Mathematics.

V. Review of Related Literature

Archana V Katgeri (2017) highlighted the effectiveness of Vedic mathematics in the classrooms. The researcher concluded that there is a significant difference in the pre-test and post-test scores with respect to the students' performance in square and square root after implementation of the Vedic Mathematics technique. Thus, students could solve more number of sums accurately making lesser errors by using the Vedic Mathematics technique in comparison to the traditional factorisation method for square and square roots. There is a significant difference in the pre-test and post-test time taken by the students for solving the sums of square and square root after implementation of the Vedic Mathematics technique. Thus, students took lesser time to solve by using the Vedic Mathematics technique in comparison to the traditional of factorisation method for square and square roots.

Evon M. O. Abu-Taieh (2018) research work presents Mirrored Vedic Vertically and Crosswise Multiplication Technique (MVVCMT) which is an algorithm based on Vedic Vertically and Crosswise Multiplication Technique. Vedic Vertically and Crosswise Multiplication Technique is an ancient Indian technique used to shorten the process of

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mental multiplication especially for big numbers. In India, the multiplication technique is still taught to kids to enhance their skills in mental multiplication. The proposed algorithm in this research was inspired by this ancient yet practical, easy to understand and apply multiplication technique.

Dr. Amulya Kumar Behera (2021) believed that India, the saga of sacred land, has a high cultural heritage. The findings of Rishis in ancient India can show the path to the world. The knowledge of the Vedas and other ancient texts is an everlasting source of knowledge. Vedic Mathematics is one of such gifts of ancient India. It helps us to solve almost all mathematical problems with less time with only mental calculation. The need for paperwork is very less. In the modern competitive world, every fraction of a second is important in competitive Exams where power tests are used for mathematical and arithmetical aptitude, numerical and nonverbal reasoning. In this present study, the Vedic method of multiplication has been used as an independent variable in order to know the effect on the achievement of students in an experimental setting of 58 students of Class – VI. For the present study, 58 students (both Boys and girls) were randomly selected from the four Upper Primary schools of Raruan Block of Mayurbhanj district.

It has been concluded that the teachers should encourage the students to learn Vedic Mathematics. In the school curriculum, Vedic mathematics should be included especially at the elementary level as a supplementary subject to mathematics and some period should be allotted for practice the tricks. As a result, students will actively engage in problem-solving. The artistic abilities and talents of the students can also be developed by Vedic mathematics. It can undoubtedly create interest in mathematics among the students who have generally feared mathematics

VI. NEED FOR THE STUDY

The present world is changing rapidly, every sphere of human life is getting affected by this change. Growing young generation is required to cope-up with this change. They need to be quicker and sharper in every field of life. As it has been discussed above, that effective knowledge of mathematics can play a vital role in making a student more reasoned, seasoned and sharper.

It has been observed recently that students are not taking interest in mathematics subject at primary and upper primary level and thus the enrollment in class IX in science stream especially maths stream is reducing markedly. Government is serious to bring change in this scenario because if this scenario doesn't change India will lag behind in the field of science and technology.

Going through the review of related literature and looking at the fact that students' interest is reducing in mathematics, the researcher thought that if mathematics is made interesting and easier for learners there interest can be regenerated. Besides, the researcher found that dependency on calculator is also affecting the calculation ability of the students especially at primary and upper primary level. The researcher also found that it appears that vedic mathematical pattern can be easily understandable for the students. It also appears that if students find it easy to do arithmetical calculations their interest in mathematics can also be regenerated. Thus the researcher decided to undertake a research work on the below given topic.

VII. STATEMENT OF THE TOPIC

"The effect of Vedic System of Mathematical operations on Logical Reasoning of the Learners."

VIII. OBJECTIVE

To study the effect of Vedic System of Mathematical operations on Logical Reasoning of the Learners.

IX. HYPOTHESIS

There will be no significant difference in the ability of Logical Reasoning between the students learning Mathematical Operations from Vedic System and Present System.

Research Type: The present study is Descriptive research.

Population: Class VIII Students of the Lucknow city have been the population of the study

Sampling & Sample Size: Simple Random Sampling has been done in the proposed research.

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Tool: 1. A standardized non verbal logical reasoning test.
Statistics: t-test has been applied.

X. RESULT AND DISCUSSION

Objective
To study the effect of Vedic System of Mathematical operations on Logical Reasoning of the Learners.
Hypothesis.
There will be no significant difference in the ability of Logical Reasoning between the students learning Mathematical Operations from Vedic System and Present System.

Table-1 (Pre-Test)

Logical Reasoning Ability	N	M	Sd	t
Pre-Test of Students taught with Vedic System	20	12.7	1.49	.75 p>.05
Post-Test of Students taught with Present System	20	12.8	1.51	

Result:
Table 1(Pre-Test) shows that the mean values of scores of test on Logical Reasoning Ability of students taught with Vedic System and Students taught with Present System are 12.7 and 12.8 respectively, with S.D. value of 1.49 and 1.51 respectively. 't' value between two means is .75, which is statistically not significant (p>.05).

Table-1 (Post-Test)

Logical Reasoning Ability	N	M	Sd	t
Post-Test of Students taught with Vedic System	20	35.1	3.01	4.23 p<.01
Post-Test of Students taught with Present System	20	28.1	3.32	

Result:
Table 1 (Post-Test) shows that the mean values of scores of test on Logical Reasoning Ability of students taught with Vedic System and Students taught with Present System are 35.1 and 28.1 respectively, with S.D. value of 3.01 and 3.32 respectively. 't' value between two means is 4.23, which is statistically significant (p<.01). Thus the Hypothesis is rejected. The Mean value of the score of students taught with Vedic System is higher than the Students taught with Present System, it means that students taught with Vedic System shows marked improvement in Logical Reasoning Ability.

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XI. CONCLUSION

The result shows that the students taught with Vedic System of mathematical operations showed marked improvement in Logical Reasoning Ability than the students taught with present system of mathematical operations.

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"VEDIC MATHEMATICS: A BRIEF OVERVIEW"

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ABSTRACT

This research paper tries to go through the Vedic mathematics system to understand its process. Mathematical operations of Vedic mathematics are quite simple and easy to comprehend and apply. These mathematical operations are based on some sutras and once you understand its system you find the difference in speed of your calculation work. Its very interesting and useful system based on Indian mathematics system.

Keyword*: Vedic Mathematics, Sutras, Mathematical operations.*

I. INTRODUCTION

Mathematics is a fundamental part of human thought and logic, and integral to attempts at understanding the world and ourselves. Mathematics provides an effective way of building mental discipline and encourages logical reasoning and mental rigor. In addition, mathematical knowledge plays a crucial role in understanding the contents of other school subjects such as science, social studies, and even music and art.

Mathematical literacy is a crucial attribute of individuals living more effective lives as constructive, concerned and reflective citizens. Mathematical literacy is taken to include basic computational skills, quantitative reasoning, spatial ability etc.

Mathematics is applied in various fields and disciplines, i.e., mathematical concepts and procedures are used to solve problems in science, engineering, economics. (For example, the understanding of complex numbers is a prerequisite to learn many concepts in electronics.) The complexity of those problems often requires relatively sophisticated mathematical concepts and procedures when compared to the mathematical literacy aforementioned.

The origin of the word "mathematics" is in Greek, which means tendencies to learn, and there are many branches of mathematics in science, that are related to numbers, including geometric forms, algebra, and others.

II. VEDIC MATHEMATICS

Vedic mathematics is the name given to the ancient Indian system of mathematics that was rediscovered in the early twentieth century from ancient Indian scripture namely Atharvaveda. We use mathematics in our all endeavors; therefore it becomes a part of our life. Our imaginations do involve mathematics. From beggar to businessman, everyone uses mathematics in their life. The education commission (1964-1966) recommended mathematics as a compulsory subject for students at all school level. The National Policy on Education (1986) has also considered the importance of mathematics in general education and suggests that mathematics should be visualized as the vehicle to

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train a child to think, reason, analysis and articulate logically apart from being a specific subject. But due to lack of understanding its essence and technique of teaching, mathematics is now considered as a dry subject by many learners. Now a learner shows no interest in learning mathematics, teacher is teaching and students are learning just for the sake of obtaining marks. Most of the problems in Mathematics have magic and mysteries. Our ancient scholars understood all these mysteries and developed some simple ways and techniques to solve mathematical problems. One such technique is Vedic mathematics as it helps to solve mathematical problems very much faster than the traditional methods of solving problems. The National Policy of Education (NPE-1986) stated "Mathematics could be considered as a medium to train a child to develop his thinking capacity, to develop his reasoning power, and to coherent logically". So mathematics should be shown as a way of thinking, an art or form of beauty, and as human achievement and it can be achieved easily through Vedic mathematics as it not only helps in generating interest and concept clarity in students but also stabilizing the knowledge for longer duration too.

Mathematics is the study of numbers, quantity, space, structure and change. It is a branch of science that uses numbers and symbols which are arranged using systematic mathematics rules. It can create moment of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more efficient solution, or notice hidden connection. But the essence and nature of teaching of mathematics is degrading day by day which creates a fear and phobia among students. Due to excessive use of electronic gadgets and internet software, student and teacher both are diverting their path from efficient and effective teaching learning process. Now a student is laying less stress on mental calculation and is more dependent on the gadgets and software for the solution. Vedic mathematics is a unique method of solving problems by the use of fast calculations. It is unique system as it helps to solve all kinds of mathematical problems easily and efficiently. Tiwari, Gankhuyag, Kim & Cho (2008) found that the proposed Vedic multiplier circuit seems to have better performance in terms of speed. The goal of teaching mathematics is not just academic achievement but its personal and professional growth also. Vedic mathematics not only helps in understanding the concept efficiently but also brings interest while learning mathematics through magical techniques.

Atharvaveda – supposedly contains a set of sixteen sutras that describe all of mathematics. Sutra is often translated word formula and is short and easily memorized and recited. Vedic Mathematics is a system of mathematics based on these sixteen sutras. These sixteen sutras are given below.

III. THE 16 SUTRAS OF VEDIC MATH

1. *Ekadhikina Purvena*
   (Corollary: Anurupyena)
   Meaning: By one more than the previous one
2. *Nikhilam Navatashcaramam Dashatah*
   (Corollary: Sisyate Sesasamjnah)
   Meaning: All from 9 and the last from 10
3. *Urdhva-Tiryagbyham*
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   Meaning: Vertically and crosswise
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   Meaning: Transpose and adjust
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   Meaning: When the sum is the same that sum is zero
6. *(Anurupye) Shunyamanyat*
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   Meaning: If one is in ratio, the other is zero

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7. *Sankalana-vyavakalanabhyam*
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   Meaning: By addition and by subtraction
8. *Puranapuranabyham*
   (Corollary: Antyayordashake'pi)
   Meaning: By the completion or non-completion
9. *Chalana-Kalanabyham*
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    (Corollary: Samuccayagunitah)
    Meaning: Whatever the extent of its deficiency
11. *Vyashtisamanstih*
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12. *Shesanyankena Charamena*
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    Meaning: The remainders by the last digit
13. *Sopaantyadvayamantyam*
    (Corollary: Gunitasamuccayah Samuccayagunitah)
    Meaning: The ultimate and twice the penultimate
14. *Ekanyunena Purvena*
    (Corollary: Dhvajanka)
    Meaning: By one less than the previous one
15. *Gunitasamuchyah*
    (Corollary: Dwandwa Yoga)
    Meaning: The product of the sum is equal to the sum of the product
16. *Gunakasamuchyah*
    (Corollary: Adyam Antyam Madhyam)
    Meaning: The factors of the sum is equal to the sum of the factors

Here is an example to show how fast the results can be achieved using Vedic mathematical operations-

Example-1:

Present/ Conventional System: Find 109^2=

```
   109
 x 109
-----
   981
  000x
 109xx
-----
 11881
-----
```

Vedic Mathematical Operation:
Find 109^2 = (109+9)/9x9 = (118)/81 = 11881

First step: 109 is added by 9 and 118 is put as one part of the answer.
Second step: 9 is multiplied by 9, other part of the answer comes as 81. The product thus comes 11881.

This calculation is based on *Nikhilam Sutra (Corollary)* which means “whatever the extent of its deficiency, lessen it still further to that very extent, and also set up the square (of that deficiency)".

But for numbers above 10 We work exactly as before; but, instead of reducing still further by the deficit, we increase the number still further by the surplus. In above example 9 is surplus from 100 then 9 is added to 109 and becomes 118.

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After that that surplus 9 is squared and becomes 81. Putting 81 after 118 we get the answer 11881 which is the square of 109.

17. Thus from above example it can be observed very easily that vedic mathematical operations are much easier than the present system of mathematical operations. This system speeds up your calculation ability and thus reducing the time taken to solve the mathematical problems. Researches are showing that application of Vedic Mathematical operations is increasing in every field of mathematics.

IV. STUDIES SUPPORTING VEDIC MATHEMATICAL OPERATIONS BETTER THAN PRESENT MATHEMATICAL OPERATIONS

Babajee, Dr D. K. R. (2015), studied the various applications of Vedic Mathematics and found that the excess of the sum of the smaller sides of a right angled triangle over the hypotenuse is always even and using this property he derived the old two-fraction method for generating Pythagorean Triples. He also developed a general method for squaring and extended Tirthaji cross-multiplication method for solving systems of linear equations.

Krishna Prasad Karani (2016) did a study and concluded that Vedic Mathematics is an Indian ancient system of mathematical calculations or operations techniques developed in the year of 1957 with 16-word formulae and some sub-formulae. In competitive examinations, students find difficult to solve the aptitude questions effectively with very less or small time durations. Even though students are able to understand the problem, they are not able to speedup calculation process.

Dhara R. Joshi (2017) conducted a study to find out the relevance of Vedic mathematics in present modern era. He found that vedic mathematics can be useful for fastest growing & even changing world in modern era. Vedic mathematic algorithm can be proved efficient for faster mental calculations & for competitive exams.

He said that Vedic mathematics is an ancient scheme based on 16 formulas (sutras). These are easy & simple methods for fast mental calculations. Many researcher have worked on it for its usefulness in various branches like engineering, astronomy, mathematics. Vedic mathematics helps in faster and accurate mental calculations by this 16 sutras & 13 up sutras. One can solve any difficult equation in addition, division, multiplication, algebra, trigonometry, square, square root, cube, cube root only by mental calculations. Today's era is fastest growing & ever changing era.

Eason, Rod (2018) did a study which includes a discussion of the evolution of modern science and a comparative view of Maharishi Vedic Science, the combination of which represents a new paradigm for the advancement of scientific knowledge. Research in consciousness is discussed from several points of view and also includes a connection with the physiology. The structure of the Veda and Vedic Literature is discussed at length with examples of the text included.

V. CONCLUSION

In a nutshell it can be said on the basis of above discussion that Vedic Mathematical Operations can prove a game changer in the field of Mathematics. It is the need of the hour that Government of India and Mathematicians should give this Indian system of mathematical operation its due place.

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He/She presented the paper (Oral/Poster) entitled .....

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