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An Analysis of Global Contribution in the History of Mathematics

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AN INTRODUCTION

The study of Mathematics as a subject in its own right begins in the 6th century BC with the Pythagoreans, who coined the term "Mathematics" from the ancient Greek "Mathema", meaning "subject of instruction".

Greek Mathematics greatly refined the methods and expanded the subject matter of Mathematics. Chinese Mathematics made early contributions, including a place value system. The Hindu-Arabic numeral system and the rules for the use of its operations, in use throughout the world today, likely evolved over the course of the first millennium AD in India and was transmitted to the west via Islamic Mathematics. Islamic Mathematics, in turn, developed and expanded the Mathematics known to these civilizations. Many Greek and Arabic texts on Mathematics were then translated into Latin, which led to further development of Mathematics in medieval Europe.

From ancient times through the Middle Ages, bursts of Mathematical creativity were often followed by centuries of stagnation. Beginning in Renaissance Italy in the 16th century, new Mathematical developments, interacting with new scientific discoveries, were made at an increasing pace that continues through the present day.

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Prehistoric Mathematics

The oldest known possibly Mathematical object is the Lebombo bone, discovered in the Lebombo mountains of Swaziland and dated to approximately 35,000 BC. It consists of 29 distinct notches cut into a baboon's fibula. Also prehistoric artifacts discovered in Africa and France, dated between 35,000 and 20,000 years old, suggest early attempts to quantify time.

The Ishango bone, found near the headwaters of the Nile river (northeastern Congo), may be as much as 20,000 years old and consists of a series of tally marks carved in three columns running the length of the bone. Common interpretations are that the Ishango bone shows either the earliest known demonstration of sequences of prime numbers or a six-month lunar calendar.

Babylonian Mathematics

Babylonian Mathematics refers to any Mathematics of the people of Mesopotamia (modern Iraq) from the days of the early Sumerians through the Hellenistic period almost to the dawn of Christianity. It is named Babylonian Mathematics due to the central role of Babylon as a place of study. Later under the Arab Empire, Mesopotamia, especially Baghdad, once again became an important center of study for Islamic Mathematics.

In contrast to the sparsity of sources in Egyptian Mathematics, our knowledge of Babylonian Mathematics is derived from more than 400 clay tablets unearthed since the 1850s. Written in Cuneiform script, tablets were inscribed whilst the clay was moist, and baked hard in an oven or by the heat of the sun. Some of these appear to be graded homework.

The earliest evidence of written Mathematics dates back to the ancient Sumerians, who built the earliest civilization in Mesopotamia. They developed a complex system of metrology from 3000 BC. From around 2500 BC onwards, the Sumerians wrote multiplication tables on clay tablets and dealt with geometrical exercises and division problems. The earliest traces of the Babylonian numerals also date back to this period.

The majority of recovered clay tablets date from 1800 to 1600 BC, and cover topics which include fractions, algebra, quadratic and cubic equations, and the calculation of regular reciprocal pairs. The tablets also include multiplication tables and methods for solving linear and quadratic equations. The Babylonian tablet YBC 7289 gives an approximation of $\sqrt{2}$ accurate to five decimal places.

Babylonian Mathematics were written using a sexagesimal (base-60) numeral system. From this derives the modern day usage of 60 seconds in a minute, 60 minutes in an hour, and 360 (60 x 6) degrees in a circle, as well as the use of seconds and minutes of arc to denote fractions of a degree. Babylonian advances in Mathematics were facilitated by the fact that 60 has many divisors.

Egyptian Mathematics

Egyptian Mathematics refers to Mathematics written in the Egyptian language. From the Hellenistic period, Greek replaced Egyptian as the written language of Egyptian scholars. Mathematical study in Egypt later continued under the Arab Empire as part of Islamic Mathematics, when Arabic became the written language of Egyptian scholars.

The most extensive Egyptian Mathematical text is the “Rhind Papyrus” (sometimes also called the Ahmes Papyrus after its author), dated to c. 1650 BC but likely a copy of an older document from the Middle Kingdom of about 2000-1800 BC. It is an instruction manual for students in arithmetic and geometry. In addition to giving area formulas and methods for multiplication, division and working with unit fractions, it also contains evidence of other Mathematical knowledge, including composite and prime numbers; arithmetic, geometric and harmonic means; and simplistic understandings of both the Sieve of Eratosthenes and perfect number theory (namely, that of the number 6). It also shows how to solve first order linear equations as well as arithmetic and geometric series.

Greek Mathematics

Greek Mathematics refers to the Mathematics written in the Greek language from the time of Thales of Miletus (~600 BC) to the closure of the Academy of Athens in 529 AD. Greek mathematicians lived in cities spread over the entire Eastern Mediterranean, from Italy to North Africa, but were united by culture and language. Greek Mathematics of the period following Alexander the Great is sometimes called Hellenistic Mathematics.

Greek Mathematics was much more sophisticated than the Mathematics that had been developed by earlier cultures. All surviving records of pre-Greek Mathematics show the use of inductive reasoning, that is, repeated observations used to establish rules of thumb. Greek mathematicians, by contrast, used deductive reasoning. The Greeks used logic to derive conclusions from definitions and axioms, and used Mathematical rigor to prove them.

Greek Mathematics is thought to have begun with Thales of Miletus (c. 624–c.546 BC) and Pythagoras of Samos (c. 582–c. 507 BC). Although the extent of the influence is disputed, they were probably inspired by Egyptian and Babylonian Mathematics. According to legend, Pythagoras traveled to Egypt to learn Mathematics, geometry, and astronomy from Egyptian priests.

Thales used geometry to solve problems such as calculating the height of pyramids and the distance of ships from the shore. He is credited with the first use of deductive reasoning applied to geometry, by deriving four corollaries to Thales' Theorem. As a result, he has been hailed as the first true mathematician and the first known individual to whom a Mathematical discovery has been attributed.

Pythagoras established the Pythagorean School, whose doctrine was that Mathematics ruled the universe and whose motto was "All is number". It was the Pythagoreans who coined the term "Mathematics", and with whom the study of Mathematics for its own sake begins. The Pythagoreans are credited with the first proof of the Pythagorean theorem, though the statement of the theorem has a long history, and with the proof of the existence of irrational numbers.

Plato (428/427 BC – 348/347 BC) is important in the history of Mathematics for inspiring and guiding others. His Platonic Academy, in Athens, became the Mathematical center of the world in the 4th century BC, and it was from this school that the leading mathematicians of the day, such as Eudoxus of Cnidus, came. Plato also discussed the foundations of Mathematics, clarified some of the definitions (e.g. that of a line as "breadthless length"), and reorganized the assumptions. The analytic method is ascribed to Plato, while a formula for obtaining Pythagorean triples bears his name.

Chinese Mathematics

Early Chinese Mathematics is so different from that of other parts of the world that it is reasonable to assume independent development. The oldest extant Mathematical text from China is the Chou Pei Suan Ching, variously dated to between 1200 BC and 100 BC, though a date of about 300 BC appears reasonable.

Of particular note is the use in Chinese Mathematics of a decimal positional notation system, the so-called "rod numerals" in which distinct ciphers were used for numbers between 1 and 10, and additional ciphers for powers of ten. Thus, the number 123 would be written using the symbol for "1", followed by the symbol for "100", then the symbol for "2" followed by the symbol for "10", followed by the symbol for "3". This was the most advanced number system in the world at the time, apparently in use several centuries before the Common Era and well before the development of the Indian numeral system. Rod numerals allowed the representation of numbers as large as desired and allowed calculations to be carried out on the suan pan, or Chinese abacus. The date of the invention of the suan pan is not certain, but the earliest written mention dates from AD 190, in Xu Yue's Supplementary Notes on the Art of Figures.

The oldest existent work on geometry in China comes from the philosophical Mohist canon c. 330 BC, compiled by the followers of Mozi (470–390 BC). The Mo Jing described various aspects of many fields associated with physical science, and provided a small number of geometrical theorems as well.

Indian Mathematics

The earliest civilization on the Indian subcontinent is the Indus Valley Civilization that flourished between 2600 and 1900 BC in the Indus river basin. Their cities were laid out with geometric regularity, but no known Mathematical documents survive from this civilization.

The oldest extant Mathematical records from India are the Sulba Sutras (dated variously between the 8th century BC and the 2nd century AD), appendices to religious texts which give simple rules for constructing altars of various shapes, such as squares, rectangles, parallelograms, and others. As with Egypt, the preoccupation with temple functions points to an origin of Mathematics in religious ritual. The Sulba Sutras give methods for constructing a circle with approximately the same area as a given square, which imply several different approximations of the value of π. In addition, they compute the square root of 2 to several decimal places, list Pythagorean triples, and give a statement of the Pythagorean theorem. It is not known to what extent the Sulba Sutras influenced later Indian mathematicians. As in China, there is a lack of continuity in Indian Mathematics; significant advances are separated by long periods of inactivity.

Pāṇini (c. 5th century BC) formulated the rules for Sanskrit grammar. His notation was similar to modern Mathematical notation, and used metarules, transformations, and recursion. Pingala (roughly 3rd-1st centuries BC) in his treatise of prosody uses a device corresponding to a binary numeral system. His discussion of the combinatorics of meters corresponds to an elementary version of the binomial theorem. Pingala's work also contains the basic ideas of Fibonacci numbers (called mātrāmeru)

The next significant Mathematical documents from India after the Sulba Sutras are the Siddhantas, astronomical treatises from the 4th and 5th centuries AD (Gupta period) showing strong Hellenistic influence. They are significant in that they contain the first instance of trigonometric relations based on the half-chord, as is the case in modern trigonometry, rather than the full chord, as was the case in Ptolemaic trigonometry. Through a series of translation errors, the words "sine" and "cosine" derived from the Sanskrit "jiya" and "kojiya".

In the 5th century AD, Aryabhata wrote the Aryabhatiya, a slim volume, written in verse, intended to supplement the rules of calculation used in astronomy and Mathematical mensuration. It is in the Aryabhatiya that the decimal place-value system first appears. Several centuries later, the Muslim mathematician Abu Rayhan Biruni described the Aryabhatiya as a "mix of common pebbles and costly crystals".

In the 7th century, Brahmagupta identified the Brahmagupta theorem, Brahmagupta's identity and Brahmagupta's formula, and for the first time, in Brahma-sphuta-siddhanta, he lucidly explained the use of zero as both a placeholder and decimal digit, and explained the Hindu-Arabic numeral system. It was from a translation of this Indian text on Mathematics (c. 770) that Islamic mathematicians were introduced to this numeral system, which they adapted as Arabic numerals. Islamic scholars carried knowledge of this number system to Europe by the 12th century, and it has now displaced all older number systems throughout the world. In the 10th century, Halayudha's commentary on Pingala's work contains a study of the Fibonacci sequence and Pascal's triangle, and describes the formation of a matrix.

In the 12th century, Bhāskara II lived in southern India and wrote extensively on all then known branches of Mathematics. His work contains Mathematical objects equivalent or approximately equivalent to infinitesimals, derivatives, the mean value theorem and the derivative of the sine function. To what extent he anticipated the invention of calculus is a controversial subject among historians of Mathematics.

In the 14th century, Madhava of Sangamagrama, the founder of the so-called Kerala School of Mathematics, found the Madhava–Leibniz series, and, using 21 terms, computed the value of π as 3.14159265359. Madhava also found the Madhava-Gregory series to determine the arctangent, the

Madhava-Newton power series to determine sine and cosine and the Taylor approximation for sine and cosine functions. In the 16th century, Jyesthadeva consolidated many of the Kerala School's developments and theorems in the Yukti-bhāṣā.

Islamic Mathematics

The Islamic Empire established across Persia, the Middle East, Central Asia, North Africa, Iberia, and in parts of India in the 8th century made significant contributions towards Mathematics. Although most Islamic texts on Mathematics were written in Arabic, most of them were not written by Arabs, since much like the status of Greek in the Hellenistic world, Arabic was used as the written language of non-Arab scholars throughout the Islamic world at the time. Persians contributed to the world of Mathematics alongside Arabs.

In the 9th century, the Persian mathematician Muḥammad ibn Mūsā al-Khwārizmī wrote several important books on the Hindu-Arabic numerals and on methods for solving equations. His book On the Calculation with Hindu Numerals, written about 825, along with the work of Al-Kindi, were instrumental in spreading Indian Mathematics and Indian numerals to the West. The word algorithm is derived from the Latinization of his name, Algoritmi, and the word algebra from the title of one of his works, Al-Kitāb al-mukhtaṣar fī hīsāb al-ğabr wa'l-muqābala (The Compendious Book on Calculation by Completion and Balancing). He gave an exhaustive explanation for the algebraic solution of quadratic equations with positive roots, and he was the first to teach algebra in an elementary form and for its own sake. He also discussed the fundamental method of "reduction" and "balancing", referring to the transposition of subtracted terms to the other side of an equation, that is, the cancellation of like terms on opposite sides of the equation. This is the operation which al-Khwārizmī originally described as al-jabr. His algebra was also no longer concerned "with a series of problems to be resolved, but an exposition which starts with primitive terms in which the combinations must give all possible prototypes for equations, which henceforward explicitly constitute the true object of study." He also studied an equation for its own sake and "in a generic manner, insofar as it does not simply emerge in the course of solving a problem, but is specifically called on to define an infinite class of problems."

Medieval European Mathematics

Medieval European interest in Mathematics was driven by concerns quite different from those of modern mathematicians. One driving element was the belief that Mathematics provided the key to understanding the created order of nature, frequently justified by Plato's Timaeus and the biblical passage (in the Book of Wisdom) that God had ordered all things in measure, and number, and weight.

Boethius provided a place for Mathematics in the curriculum in the 6th century when he coined the term quadrivium to describe the study of arithmetic, geometry, astronomy, and music. He wrote De institutione arithmetica, a free translation from the Greek of Nicomachus's Introduction to Arithmetic; De institutione musica, also derived from Greek sources; and a series of excerpts from Euclid's Elements. His works were theoretical, rather than practical, and were the basis of Mathematical study until the recovery of Greek and Arabic Mathematical works.

In the 12th century, European scholars traveled to Spain and Sicily seeking scientific Arabic texts, including al-Khwārizmī's The Compendious Book on Calculation by Completion and Balancing, translated into Latin by Robert of Chester, and the complete text of Euclid's Elements, translated in various versions by Adelard of Bath, Herman of Carinthia, and Gerard of Cremona.

These new sources sparked a renewal of Mathematics. Fibonacci, writing in the Liber Abaci, in 1202 and updated in 1254, produced the first significant Mathematics in Europe since the time of Eratosthenes, a gap of more than a thousand years. The work introduced Hindu-Arabic numerals to Europe, and discussed many other Mathematical problems.

Renaissance Mathematics

During the Renaissance, the development of Mathematics and of accounting was intertwined. While there is no direct relationship between algebra and accounting, the teaching of the subjects and the books published often intended for the children of merchants who were sent to reckoning schools (in Flanders and Germany) or abacus schools (known as abbaco in Italy), where they learned the skills useful for trade and commerce. There is probably no need for algebra in performing bookkeeping operations, but for complex bartering operations or the calculation of compound interest, a basic knowledge of arithmetic was mandatory and knowledge of algebra was very useful.

Luca Pacioli's "Summa de Arithmetica, Geometria, Proportioni et Proportionalità" (Italian: "Review of Arithmetic, Geometry, Ratio and Proportion") was first printed and published in Venice in 1494. It included a 27-page treatise on bookkeeping, "Particularis de Computis et Scripturis" (Italian: "Details of Calculation and Recording"). It was written primarily for, and sold mainly to, merchants who used the book as a reference text, as a source of pleasure from the Mathematical puzzles it contained, and to aid the education of their sons. In Summa Arithmetica, Pacioli introduced symbols for plus and minus for the first time in a printed book, symbols that became standard notation in Italian Renaissance Mathematics. Summa Arithmetica was also the first known book printed in Italy to contain algebra. It is important to note that Pacioli himself had borrowed much of the work of Piero Della Francesca whom he plagiarized.

In Italy, during the first half of the 16th century, Scipione del Ferro and Niccolò Fontana Tartaglia discovered solutions for cubic equations. Gerolamo Cardano published them in his 1545 book Ars Magna, together with a solution for the quartic equations, discovered by his student Lodovico Ferrari. In 1572 Rafael Bombelli published his L'Algebra in which he showed how to deal with the imaginary quantities that could appear in Cardano's formula for solving cubic equations.

Mathematics during the Scientific Revolution

The 17th century saw an unprecedented explosion of Mathematical and scientific ideas across Europe. Galileo observed the moons of Jupiter in orbit about that planet, using a telescope based on a toy imported from Holland. Tycho Brahe had gathered an enormous quantity of Mathematical data describing the positions of the planets in the sky. Through his position as Brahe's assistant, Johannes Kepler was first exposed to and seriously interacted with the topic of planetary motion. Kepler's calculations were made simpler by the contemporaneous invention of logarithms by John Napier and Jost Bürgi. Kepler succeeded in formulating Mathematical laws of planetary motion. The analytic geometry developed by René Descartes (1596–1650) allowed those orbits to be plotted on a graph, in Cartesian coordinates. Simon Stevin (1585) created the basis for modern decimal notation capable of describing all numbers, whether rational or irrational.

Building on earlier work by many predecessors, Isaac Newton discovered the laws of physics explaining Kepler's Laws, and brought together the concepts now known as infinitesimal calculus. Independently, Gottfried Wilhelm Leibniz, who is arguably one of the most important mathematicians of the 17th century, developed calculus and much of the calculus notation still in use today. Science and Mathematics had become an international endeavor, which would soon spread over the entire world.

In addition to the application of Mathematics to the studies of the heavens, applied Mathematics began to expand into new areas, with the correspondence of Pierre de Fermat and Blaise Pascal. Pascal and Fermat set the groundwork for the investigations of probability theory and the corresponding rules of combinatorics in their discussions over a game of gambling. Pascal, with his wager, attempted to use the newly developing probability theory to argue for a life devoted to religion, on the grounds that even if the probability of success was small, the rewards were infinite. In some sense, this foreshadowed the development of utility theory in the 18th–19th century.

Modern Mathematics

Throughout the 19th century Mathematics became increasingly abstract. In the 19th century lived Carl Friedrich Gauss (1777–1855). Leaving aside his many contributions to science, in pure Mathematics he did revolutionary work on functions of complex variables, in geometry, and on the convergence of series. He gave the first satisfactory proofs of the fundamental theorem of algebra and of the quadratic reciprocity law.

This century saw the development of the two forms of non-Euclidean geometry, where the parallel postulate of Euclidean geometry no longer holds. The Russian mathematician Nikolai Ivanovich Lobachevsky and his rival, the Hungarian mathematician János Bolyai, independently defined and studied hyperbolic geometry, where uniqueness of parallels no longer holds. In this geometry the sum of angles in a triangle add up to less than 180°. Elliptic geometry was developed later in the 19th century by the German mathematician Bernhard Riemann; here no parallel can be found and the angles in a triangle add up to more than 180°. Riemann also developed Riemannian geometry, which unifies and vastly generalizes the three types of geometry, and he defined the concept of a manifold, which generalizes the ideas of curves and surfaces.

The 20th century saw Mathematics become a major profession. Every year, thousands of new Ph.D.s in Mathematics were awarded, and jobs were available in both teaching and industry. An effort to catalogue the areas and applications of Mathematics was undertaken in Klein's encyclopedia.

In a 1900 speech to the International Congress of Mathematicians, David Hilbert set out a list of 23 unsolved problems in Mathematics. These problems, spanning many areas of Mathematics, formed a central focus for much of 20th-century Mathematics. Today, 10 have been solved, 7 are partially solved, and 2 are still open. The remaining 4 are too loosely formulated to be stated as solved or not.

One of the more colorful figures in 20th-century Mathematics was Srinivasa Aiyangar Ramanujan (1887–1920), an Indian autodidact who conjectured or proved over 3000 theorems, including properties of highly composite numbers, the partition function and its asymptotics, and mock theta functions. He also made major investigations in the areas of gamma functions, modular forms, divergent series, hypergeometric series and prime number theory.

Contribution of Non Western Mathematicians in the Development of Mathematics

It is now widely accepted that many scientific ideas flowed from one civilization to another across the Eurasian landmass over the millennia. Classical Indian astronomy took the idea of epicycles from the Greeks; pre-modern Europe took the idea of the present system of numerals from India (through the Arabs); ideas on trigonometry have moved back and forth; India was in close contact with Babylonia since around 2000 BCE and acquired the sexagesimal system, still in use for measuring angles and some other quantities all over the world. (Narasimha, R., 2007)

Of all the school subjects which were imposed on indigenous pupils in the colonial schools, arguably the one which could have been considered the least culturally-loaded was mathematics. Even today, that belief prevails. The conventional wisdom was that mathematics was culture-free knowledge. After all, the popular argument went, two twos are four, a negative number times a negative number gives a positive number, and all triangles have angles which add up to 180 degrees. These are true statements the world over. They have universal validity. Surely, therefore, it follows that mathematics must be free from the influence of any culture? There is no doubt that mathematical truths like those are universal. They are valid everywhere, because of their intentionally abstract and general nature. So, it doesn’t matter where you are, if you draw a flat triangle, measure all the angles with a protractor, and add the degrees together, the total will always be approximately 180 degrees. Because mathematical truths like these are abstractions from the real world, they are necessarily context-free and universal. But where do ’degrees’ come from? Why is the total 180? Why not 200, or 100? Indeed, why are we interested in triangles and their properties at all? The answer to all these questions is, essentially, ’because some people determined that it should be that way’. Mathematical ideas, like any other ideas, are humanly constructed. They have a cultural history. The anthropological literature demonstrates for all who wish to see it that the mathematics which most people learn in contemporary schools is not the only mathematics that exists. (Bishop, A.J., 1990)

To a typical historian of mathematics today, if there is one certainty, it is that Isaac Newton (1642–1727) and Gottfried Leibniz (1646–1716) were the first to 'invent' a generalised system of infinitesimal calculus, an essential prelude to modern mathematics. However, at least two hundred years earlier, the astronomer-mathematicians of Kerala, notably Madhava of Sangamagrama and his disciples, had discovered elements of that calculus, the forerunners of modern techniques used in mathematical analysis. Given the existence of a corridor of communication between Kerala and Europe, especially from the sixteenth century onwards, and the crucial importance of calculus in the growth of modern mathematics, one would have expected that the possibility of the transmission of the Kerala mathematics westwards would be high on the agenda for historical investigation. That such an investigation has not yet been carried out may reflect, in our view, the strength and the pervasive nature of Eurocentrism in the history of science. (Almeida, D.F. & Joseph, G.G., 2004)

Eurocentricism in the Development of Mathematics

It is without doubt that mathematics today owes a huge debt to the outstanding contributions made by Indian mathematicians over many hundreds of years. What is quite surprising is that there has been a reluctance to recognise this and one has to conclude that many famous historians of mathematics found what they expected to find, or perhaps even what they hoped to find, rather than to realise what was so clear in front of them. (O'Connor, J.J. & Robertson, E.F., 2000)

Philosophy and religion are closely related. Both deal with metaphysical reality. Perhaps surprising to the contemporary reader is that mathematics and religion have also been closely related throughout history in many cultures. Even in Western Europe where science and religion are often considered antithetical, the Vatican has maintained an astronomical observatory that was founded in the sixteenth century and is still today an important center for scientific research. In South Asia, sophisticated mathematics grew from the attempt to predict celestial phenomena. It was the priests who had the time and the intellectual training that enabled them to pursue this study. And the priests had an incentive: To understand the workings of the heavens is to come closer to understanding the nature of transcendent reality. (Bressoud, D. & Laine, J., 2003)

Several books have been written on the history of Indian tradition in mathematics. In addition, many books on history of mathematics devote a section, sometimes even a chapter, to the discussion of Indian mathematics. Many of the results and algorithms discovered by the Indian mathematicians have been studied in some detail. But, little attention has been paid to the methodology and foundations of Indian mathematics. There is hardly any discussion of the processes by which Indian mathematicians arrive at and justify their results and procedures. And, almost no attention is paid to the philosophical foundations of Indian mathematics, and the Indian understanding of the nature of mathematical objects, and validation of mathematical results and procedures. (Centre for Policy Studies, 1990)

India has a rich tradition of intellectual inquiry and a textual heritage that goes back to several hundreds of years. India was magnificently advanced in knowledge traditions and practices during the ancient and medieval times. The intellectual achievements of Indian thought are found across several fields of study in ancient Indian texts ranging from the Vedas and the Upanishads to a whole range of scriptural, philosophical, scientific, technical and artistic sources. However, the knowledge of India's traditions and practices has become restricted to a few erudite scholars who have worked in isolation. (Singh, J., 2012)

While Western scholars have been studying traditional Indian mathematics since the late eighteenth century and Indian scholars have been working hard to assemble and republish surviving Sanskrit manuscripts, a widespread appreciation of the greatest achievements and the unique characteristics of the Indian approach to mathematics has been lacking in the West. Standard surveys of the history of mathematics hardly scratch the surface in telling this story. Today, there is a resurgence of activity in this area both in India and the West. The prosperity and success of India has created support for a new generation of Sanskrit scholars to dig deeper into the huge literature still hidden in Indian libraries. Meanwhile the shift in the West toward a multicultural perspective has allowed Westerners to shake off old biases and look more clearly at other traditions. (Plofker, K., 2008)

Mathematics, in its early stages, developed mainly along two broad overlapping traditions: (i) the geometric and (ii) the arithmetical and algebraic. Among the pre-Greek ancient civilizations, it is in India that we see a strong emphasis on both these great streams of mathematics. Other ancient civilizations like the Egyptian and the Babylonian had progressed essentially along the computational tradition. A Seidenberg, an eminent algebraist and historian of mathematics, traced the origin of sophisticated mathematics to the originators of the Rig Vedic rituals. (Dutta, A.K., 2002)

One of the major casualties in the Eurocentric view of mathematics has been the ignoring or undervaluing of the contributions to mathematics of the Indian subcontinent. Although the invention of zero by mathematicians of the Indian subcontinent has long been acknowledged, the significance of this as the lynchpin of the decimal place value system is often underestimated. The Indian development of decimal numeration together with the place value system is the most remarkable development in the history of mathematics, as well as being one of the foremost intellectual productions in the overall history of humankind. There is a misrepresentation of the intellectual significance of these developments without which the modern conceptions of number (including its computerization, with all of the applications this brings) would not be possible. (Ernest, P., 2007)

CONCLUSION

As the available literature on the issue of development of Mathematics through the centuries exhibit, the History of Mathematics cannot be traced to any specific culture, race, religion, caste, region or country. The initial developments took place in India, China, Middle East, Egypt and Greece and infact then the developments travelled throughout the world due to reasons of interaction among the societies, business relationships, spread of religions, scientific interests, etc. However, due to reasons as colonialism of the Asian world by the European countries and later on, the dominance of American countries in the economic and educational world, it appears that the development of mathematics in the Asian countries could not be later traced to them and in fact these are now presented as if the mathematical inventions and contributions have been due to research in the field of Mathematics in the Western World.

Without doubt, the present day Mathematics as it is understood and studied got its formal design only during the nineteenth and twentieth centuries in the Western World, but then as it is known, no knowledge develops in vacuum. There has to be some background work and basic knowledge on the basis of which new knowledge develops and makes the discipline easy to understand and to comprehend. Mathematics is no different.

The history of Mathematics is the history of mathematical interests and inventions in the Asian countries and finally taking the formal shape in the Western World. Not to say then, there has been strong role of cross cultural influences on the Development of Mathematics, which has been throughout neglected in the Western World and is propagated as if all the Mathematical Concepts have found their development in the Western World only. There appears to be gross non acceptance of contribution of the countries and regions outside the western world. This fallacy is now being corrected by the Mathematicians both in the Western World as also in the non-Western World.

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