

Status of Mathematics Education in India

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ABSTRACT

Mathematics teaching has always been an issue of concern across the whole globe. In India, mathematics is a compulsory subject in the curriculum from early grades, and the importance of mathematics as a school subject has been recognized at the top of the subject hierarchy in India. In Indian villages, it is commonly seen that people who are not formally educated use many modes of mental mathematics. What may be called folk algorithms exist for not only mentally performing number operations but also for measurement, estimation, and understanding of shapes and aesthetics. Appreciating the richness of these methods can enrich the child's perception of mathematics. Many children are immersed in situations where they see and learn the use of these methods, and relating such knowledge to what is formally learnt as mathematics can be inspiring and additionally motivating. It must be understood that there is a spectrum of technology use in mathematics education, and calculators or computers are at one end of the spectrum. While notebooks and blackboards are the other end, use of graph paper, geo boards, abacus, geometry boxes, etc. is crucial. Innovations in the design and use of such material must be encouraged so that their use makes school mathematics enjoyable and meaningful. The present article focuses on mathematics education in India; it highlights the scope and challenges in the field of mathematics teaching.

INTRODUCTION

Indian mathematics has its deep roots in the Vedas, different from what is known as Vedic mathematics. The Vedic age gave rise to a new era of progress in the field of science, technology, and development. The Hindu Scripture Vedas is synonymous with all kinds of original sources of knowledge and intellectual wisdom in the universe, leading to modern knowledge in modern mathematics. Indian mathematicians made tremendous contributions to the entire world of mathematics and science. The decimal number system as well as the invention of zero (0) are among the greatest contributions of Indian mathematicians. The theory of trigonometry, mathematical modeling, algebra, algorithms, modern arithmetic, sine and cosine functions leading to modern trigonometry, Diophantine equations, square roots, cube roots, and negative numbers were also developed by Indian mathematicians. In this review article, the work of some of the renowned Indian mathematicians from Indus Valley civilization and the Vedas to modern times is covered in short with the hope that it may reveal hidden fundamental mathematical ideas as basic ideal tools that may usefully motivate further research work in every domain of mathematical sciences, natural and applied sciences, engineering, and social sciences. Moreover, there are many more remarkable Indian mathematicians who contributed to the origin of mathematical sciences. They have made several general contributions to mathematics that have significantly influenced scientists and mathematicians in modern times.

India has an extraordinarily rich mathematical heritage along with a long and blessed history of mathematics. The mathematical tradition in India goes back at least to the Vedas. Apart from this, there are so many contributions of Indian mathematicians that give us a sense of the glory of mathematics in India. Over the past years, the area of mathematics education, i.e., teaching and learning of mathematics, has developed rapidly over the last decade and opened up new avenues of research and innovative teaching practices in India and across the world. In context to India, it has several differences, particularly in terms of classroom situations, as compared to other nations. We have a very rich diversity of culture in our hemisphere.

Consequently, our classes are also full of multicultural environments with different socio-economic statuses; therefore, for a teacher, it is not an easy task to exist evenly in the classrooms and connect the classroom teaching with the daily lives of the learners, which is a desirable goal of mathematics teaching as per the NCF-2005. Numerous researchers have revealed that mathematics should be taught by systematic algorithms, and following the previous knowledge of the learners, either they make use of computer-assisted instruction (CAI), programmed instructions, or any other instruction for the teaching of mathematics.

Also, there is research evidence that the use of ICT can have positive effects both on students' mathematics achievement (Li and Ma 2010) as well as on their perception of mathematics (Bakker et al. 2015; Barkatsas et al. 2009). Teaching instruction should be considered a major step of better learning; therefore, fundamental research to develop new facts of mathematics teaching is the need of the present hour.

Objectives of the Study

- To discuss the overview of mathematics education in India.
- To study the progress of mathematics education at all levels in India
- To describe the challenges and solutions to teaching mathematics

RESEARCH METHODOLOGY

The research is based on secondary data. It's exploratory and descriptive in nature, and given the nature of the present study, it was required to collect information from secondary sources. Secondary information was collected from research studies, books, journals, newspapers, and ongoing academic working papers.

The National Policy on Education 1986 went further: mathematics should be visualised as the vehicle to train a child to think, reason, analyze, and articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning. The National Curriculum Framework for School Education (NCFSE) 2000 document echoes such sentiments as well. Yet, despite this history of exhortations, mathematics education has remained pretty much the same, focused on narrow aims.

NCF 2005: The Objective of Teaching Mathematics

1. Learn and demonstrate an understanding of the concepts from the different branches of Mathematics: Algebra, Number Theory, Trigonometry and Geometry, Discrete Mathematics, and Probability and Statistics.
2. Use proper mathematical skills and concepts to solve problems in both unfamiliar and familiar situations.
3. Choose and apply correctly the general rules of problem-solving.
4. Prompting students into reasoning and thinking to visualize abstractions and solve.
5. Use different types of mathematical representation—diagrams, formulae, charts, and \emptyset tables, models, and graphs.

India has displayed its love for mathematics since the Vedic period. The Rig Veda talks about a huge number like the parardha (10^{12}); the book Lalit Vistara written on the life of the Buddha speaks about tallakshana, another large number (10^{55}); the Valmiki Ramayana speaks about yet another big number, mahaugh (10^{60}), in Yudha Kanda. The books written by Satpathi Brahmins and Sulvasutra written during the 8th century BC talk about deep geometric concepts. Mathematics was alive and thriving between the 4th and 12th centuries AD under Aryabhata, Brahmagupta, and Bhaskaracharya. India's contribution to the world of mathematics includes the discovery of zero, the decimal number system, and negative numbers, and yet today India's presence in the field of mathematics is almost negligible.

So, what went wrong with India's mathematical dreams? Why are we not producing good mathematicians? According to the 2014 Field Medal winner and member of NEP 2019, Manjula Bhargava, "The biggest mistake that happened in India after independence was the separation of teaching and research in India's higher education system. India has some fantastic research institutions like the Tata Institute of Fundamental Research, the International Centre for Theoretical Sciences, and the Indian Statistical Institute, but they are little islands of excellence. And then there is the whole teaching sector, state universities where no research happens."

The National Achievement Survey 2017, conducted by the MHRD, to assess learning outcomes among children across India in different subjects shows class 3, 4, and 5 students getting 64%, 53%, and 42%, respectively, in the mathematics test. This shows a trend of declining interest in mathematics. The situation is even more alarming at the higher level, as the Central Board of Secondary Education (CBSE) confirms that only 21% of students passing class 10 opt for mathematics at the senior secondary level. Why? From a country that had a rich mathematical tradition, how did we turn into a math-fearing nation? Have we not made efforts to bring back the popularity of math?

As early as 1968, the Kothari Commission had placed emphasis on the importance of mathematics. It said, "With a view to accelerating the growth of the national economy, science education and research should receive high priority. Science and mathematics should be an integral part of general education till the end of the school stage."

The commission had suggested the introduction of mathematics at two levels. General mathematics was made compulsory up to class 10, and advanced mathematics was introduced at the secondary level as an optional subject. General

mathematics comprises arithmetic, algebra, and geometry, whereas advanced mathematics comprises integers, quadratic equations, logarithms, and coordinate geometry. But the system failed in the implementation of this change. The government neither trained nor could recruit good teachers of the subject.

Then came the National Policy on Education of 1986. Though the NPE was a visionary educational policy, it too failed to bring about significant changes to math education in India. Unattractive classroom environment, teacher absenteeism, teacher-centred pedagogy, and low skill attainment were some of the reasons. In 1992, the NPE was modified to once again bring in the two-level mathematics (with some changes) as suggested by the Kothari Commission in 1968. The curriculum was redesigned to suit modern-day needs, and trained teachers were appointed to teach the subject. Mathematics kits were supplied under Operation Black Board. But due to a vast syllabus, the non-availability of good textbooks, and no systems in place for the professional up gradation of teachers, this policy like the ones before it failed.

In 1993, the government constituted a National Advisory Committee under Professor Yashpal to look into the issue of overburdening of schoolchildren. This committee rightly pointed out that the math taught in schools had no connection to children's lived reality and that this should be corrected if math was to become popular again. This report, followed by NCF 2005, highlighted the need to reduce the size of the curriculum, ensure quality education for all, and focus on activity-based teaching. The new syllabus proposed by NCF 2005 emphasised reason and conceptual understanding at every stage. Tackling mathematical anxiety was also addressed.

According to NCF 2005, mathematics is more than formulas and mechanical procedures, and an effort should be made to help children enjoy mathematics rather than fear it. The word mathematician was stressed upon. The policy document says, "Developing children's abilities for mathematics is the main goal of mathematics education. The narrow aim of school mathematics is to develop 'useful' capabilities, particularly those relating to numeracy—numbers, number operations, measurement, decimals, and percentages. The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusion, and to handle abstraction. It includes a way of doing things and the ability and attitude to formulate and solve problems." (NCERT, 2005, p. 42).

NCF 2005, NEP 2019, or the older NPE 1968 and 1986 were all well-thought-out policy documents prepared by learnt people, but all these policies failed miserably at one thing: seeking the views of the stakeholders—students, teachers, schools, and parents. Only when those involved in the day-to-day transaction of education are consulted will we know whether the proposals put forth can be implemented on the ground successfully or not. What is the point of saying math teaching should be made fun and innovative when we don't have quality teachers who are passionate enough to uplift the standard of mathematics, when textbooks produced are bad, and when we have not been able to link mathematics with daily life?

In the year 2012, when India was celebrating the 125th birth anniversary of Srinivasa Ramanujan, Prime Minister Manmohan Singh said, "It is a matter of concern that for a country of our size, the number of competent mathematicians we have is badly inadequate. Over more than the last three decades, many of our young men and women with natural ability in mathematics have not pursued the discipline at advanced levels. This resulted in a decline in the quality of math teachers in schools and colleges."

A systemic goal that needs to be underlined and internalised in the entire system is universal inclusion. This means acknowledging that forms of social discrimination work in the context of mathematics education as well and addressing means for redress. For instance, gendered attitudes that consider mathematics to be unimportant for girls have to be systematically challenged in school. In India, even caste-based discrimination manifests in such terms, and the system cannot afford to treat such attitudes by default. Inclusion is a fundamental principle. Children with special needs, especially children with physical and mental disabilities, have as much right as every other child to learn mathematics, and their needs (in terms of pedagogy, learning material, etc.) have to be addressed seriously. The conceptual world of mathematics can bring great joy to these children, and it is our responsibility not to deprive them of such education. One important implication of taking mathematics seriously is that even the language used in our textbooks must be sensitive to the language uses of all children.

This is critical for primary education, and this may be achievable only by a multiplicity of textbooks. While the emphasized shift towards learning environments is essential for engaging the currently nonparticipating majority in our classrooms, it does not in any way mean dilution of standards. We are not advising here that the mathematics class, rather than boring the majority, ends up boring the already motivated minority. On the other hand, a case can be made that such open problem situations offer greater gradations in challenges and hence offer more for these few children as well. It is widely acknowledged that mathematical talent can be detected early, in a way that is not observable in more complex fields such as

literature and history. That is, it is possible to present challenging tasks to highly talented youngsters. The history of the task may be ignored; the necessary machinery is minimal; and the manner in which such youngsters express their insights does not require elaboration in order to generate mathematical inquiry. All this is to say that challenging all children according to their mathematical taste is indeed possible. But this calls for systemic mechanisms, especially in textbooks. In India, few children have access to any mathematical material outside their mathematics textbooks, and hence structuring textbooks to offer such a variety of content is important. In addition, we also need to consider mechanisms for identification and nurturing of such talent, especially in rural areas, by means of support outside main school hours.

At all stages of the curriculum, an element of humanizing the curriculum is essential. The development of mathematics has many interesting stories to be told, and every student's daily life includes many experiences relevant to mathematics. Bringing these stories and accounts into the curriculum is essential for children to see mathematics in perspective. Lives of mathematicians and stories of mathematical insights are not only endearing; they can also be inspiring. A specific case can be made for highlighting the contribution made by Indian mathematicians. An appreciation of such contributions will help students see the place of mathematics in our culture. Mathematics has been an important part of Indian history and culture, and students can be greatly inspired by understanding the seminal contributions made by Indian Mathematization in early periods of history. Similarly, contributions by women mathematicians from all over the world are worth highlighting. This is important, mainly to break the prevalent myth that mathematics has been an essentially male domain and also to invite more girls to the mathematical enterprise.

In a sense, all these are steps advocated by every mathematics educator over decades. The difference here is in emphasis in achieving these actions by way of curricular choices. Perhaps the most compelling reason for the vision of mathematics education we have articulated is that our children will be better served by higher expectations, by curricula that go far beyond basic skills and include a variety of mathematical models, and by pedagogy that devotes a greater percentage of instructional time to problem solving and active learning. Many students respond to the current curriculum with boredom and discouragement, develop the perception that success in mathematics depends on some innate ability which they simply do not have, and feel that, in any case, mathematics will never be useful in their lives.

Learning environments like the one described in the vision will help students to enjoy and appreciate the value of mathematics, to develop the tools they need for varied educational and career options, and to function effectively as citizens. Our vision of excellent mathematical education is based on the twin premises that all students can learn mathematics and that all students need to learn mathematics. Curricula that assume student failure are bound to fail; we need to develop curricula that assume student success. We are at a historic juncture when we wish to guarantee education for all. It is therefore a historic imperative to offer our children the very highest quality of mathematics education possible.

Status of Mathematics education in India.

While mathematics was seen to be an essential part of any curriculum from early on, perspectives differed. The Zakir Husain committee in 1937 saw it in relation to work. The National Policy on Education in 1986 saw it as a "vehicle to train a child to think, reason, analyse, and articulate logically." However, the shape of mathematics education has remained largely the same over the last 50 years. In response to global curricular processes in India too, there has been considerable curricular acceleration in school mathematics. For instance, calculus, which was only taught in college three decades ago, is taught now at the higher secondary level. On the other hand, projective geometry has almost entirely disappeared from the school. At the undergraduate level, the core curriculum remains much the same, though the influence of computer science and other modern disciplines can be seen in the course mix on offer.

In all this, one strain that has been persistent is the experience of anxiety and failure associated with mathematics. Excessive use of procedure and the pressure of board examinations and entrance examinations for access to prestigious institutions have created a culture of highly competitive preparation among the urban elite, and this has taken a toll on meaningful mathematics. On the other hand, in almost all boards, if there are specific disciplines that record failures, mathematics is principal among them. It is often referred to as the 'killer' subject, and studies showed that a large number of children were failing or dropping out before completing elementary school because they could not cope with the demands of the curriculum.

Over the end of the last century, a perception that mathematics education was increasingly becoming burdensome and ineffective had gathered momentum. The Report 'Learning Without Burden' (Ministry of Human Resource and Development, 1993) had pointed out that children were in fact not 'dropping out' but were being 'pushed out', owing to the 'burden of non-comprehension', as a result of an irrelevant curriculum, distanced from the lives of the majority, and often rendered 'boring and uninteresting' by outdated teaching strategies. This shift from conventional 'deficit theories', which

attribute children's inability to learn to some 'deficit' in their mental abilities or their home background, led to a critical review of the curriculum and the traditional teaching and learning process based on rote memorization of facts.

The National Curriculum Framework (henceforth "NCF 2005") responded to this and guided the development of new curricula and textbooks based on how children actively construct knowledge, rooted in social and cultural practices (National Council for Educational Research and Training [NCERT], 2005). The NCF 2005 position paper on the teaching of mathematics (NCERT, 2006a) begins by stating that the primary goal of mathematics education is the "Mathematisation of the child's thought processes" and the development of the "inner resources of the growing child." It goes on to argue for a "shift from content to process," recommending a multiplicity of approaches to liberate school mathematics from the "tyranny of the one right answer obtained by applying the one algorithm that has been taught." It emphasised the need for processes such as "formal problem solving, use of heuristics, estimation and approximation, optimisation, use of patterns, visualisation, representation, reasoning and proof, making connections, and mathematical communication."

Subsequent to this, many boards of education in the states undertook a curricular review exercise, and the last few years have witnessed a churning. While the lofty goals articulated above may be hard to achieve, there have been some significant shifts visible in textbooks and pedagogic processes, especially in elementary education. However, secondary education, weighed down by the shadow of board examinations, remains hard to reform.

The end-of-school Board examinations remain landmark events in the lives of children, and as passports to economic mobility, they critically inform attitudes toward education. These exams cast long shadows and inordinately influence classroom assessment. In fact, the traditional pattern of examinations in mathematics have been a matter of serious concern and have not only intimidated children but have often dissuaded more creative teachers too, since their classroom efforts to encourage sense-making tend to get obliterated by the focus on procedural questions devoid of meaning and contextual relevance.

In this context, the pressures of a democratic society on board examination results have to be acknowledged as well. When single subject failures tended to be high in mathematics, the pressure to set exams that fail fewer pupils became strong. This has led to a situation where pass rates have increased among those who appear for board exams, but many who give up drop out much earlier. This also means that high achievement in many of these exams may not attest to high competence or mastery of the subject either.

One solution to this has been attempted in many parts of the world, that of streaming students into Basic Mathematics and Advanced Mathematics, with the former constituting mathematical literacy that the state considers essential for its citizens and the latter dictated by disciplinary objectives. But this is problematic in India since they can become yet another form of social discrimination, with the latter course simply not being offered in many schools that children from poorer sections attend. Indeed, this was the experience in many Indian states in which such streaming existed till the 1960's. In a society that is already deeply driven by many social schisms, the possibility that the rights of disadvantaged children to quality education in mathematics might be subverted presents a major problem.

The reforms we have spoken of have come about because outside the formal system the country has had a range of educational initiatives, largely experimental and small scale but nevertheless carried out by passionately committed educationists. The valuable lessons learnt from such work contributed significantly to the national reform process. Such work is still visible in India, across geographic regions, from primary schools to university education.

Higher stages

We have spoken at length about elementary education. The situation is similar in secondary and tertiary education, but the fact that India has the third largest higher education system in the world (after China and the USA) suggests that there is a great deal of mathematics around as well.

According to India 2009 Reference Annual (Ministry of Information and Broadcasting, 2009), India has 20 universities run by the Central Government and 215 run by States. In addition, there are 100 autonomous institutions deemed-to-be universities that do not get their funding directly from governments. Nearly 16000 colleges are affiliated with these universities, among them 1800 exclusively for women.

India is also home to some institutions where world-class research in mathematics is carried out. A strong group of Indian mathematicians have been contributing to the development of many areas of mathematics. The legendary genius Srinivasa Ramanujan has inspired generations of young Indians towards taking up mathematics as a calling. India boasts of institutions of technology and medicine that have been globally acclaimed for their standard of undergraduate education.

These, and the boom in the information technology industry (and its generation of jobs) in the last two decades, have led to a greater emphasis on mathematical training, and the nation seeks to expand a pool of scientifically equipped manpower.

This creates a situation in India where higher education in mathematics forms a very sharp pyramid. A few elite institutions offer excellent opportunities for mathematics research and a small number for mathematics education as a part of technology or engineering education, or in some instances, management studies. However, among the large number of universities and a vast number of affiliated colleges, which provide the bulk of tertiary mathematics education, there is an overall rigidity in curriculum, pedagogy, and modes of assessment that make mathematics education often ineffective, and this affects the prospects of building a strong pool of mathematics teachers for the future. Small innovative initiatives towards constructing a meaningful interactive pedagogy at the undergraduate level give hope for solving this problem on a larger scale in the future.

The major challenge

If one were asked to isolate and point to one single challenge as the most important among the plethora of problems that we have mentioned, it would have to be that of creating a pool of good mathematics teachers in the required numbers. At the elementary stage, the numbers exist, but not with the required understanding of mathematics, attitudes towards mathematics, or comprehension of how children learn (or fail to learn) mathematics. The social inequalities in India and the resource-poor rural schools call for greater competence on the part of teachers than in richer, more democratic societies. This calls for new modes of teacher professional development that are yet to be formulated. At higher stages, the numbers are daunting. The existing pool of teachers is woefully inadequate for meeting the requirements, especially with universalisation of school education becoming a conceivable reality within a generation. With the numbers, the problem of rigour and depth in mathematical knowledge and practice becomes more acute. Devising systemic measures to achieve quality in teacher preparation is perhaps the most urgent need in the Indian mathematics scenario today.

Research

An important agenda for mathematics education in India is research in mathematics education. University departments, while undertaking research in education, by their typical structure tend to attract largely people who are neither mathematically trained nor thus inclined. Further, the idea of research providing solutions to curricular conundrums or pedagogic trauma remains outside the framework of decision-making in education. This is not to belittle the tremendous contributions made by governmental as well as nongovernmental initiatives towards reform that have been characterised by innovation and commitment.

However, these do not rest on a scaffolding of research and rigorous critique as yet. The system needs to build a way of actively pursuing research on several fronts towards well-formulated questions and use the answers to influence policy. It should be noted here that India provides a large enough arena, with tremendous diversity, to even allow a self-contained universe for analysis and research, and international influences can only add to this richness. The agenda for such research includes not only internalist critique from the discipline of mathematics and its pedagogy and practices. Indian society and its cultural and work-based practices also offer avenues for mathematical explorations that a pedagogue could incorporate into a toolkit. However, a body of research needs to be built to make realistic use of such possibilities.

Challenges

Many students have fear in the subject of mathematics. They are unable to understand the basic concept of mathematics and their technique due to various reasons. A mathematical task is a problem when it incorporates challenges for learners.

It should (1) be motivating (2) not include readily available procedures (3) require an attempt (4) have several approaches to a solution.

The Indian mathematics education system faces numerous challenges, including:

Inadequate teacher training and support: Teachers lack sufficient training and support, leading to inadequate pedagogical practices and poor student outcomes.

Outdated curriculum and pedagogical practices: The curriculum is often outdated, and teaching methods are not aligned with modern learning approaches.

Insufficient resources and infrastructure: Schools, especially in rural areas, lack basic resources and infrastructure, hindering effective mathematics education.

Disparities in access and quality across urban and rural areas: Significant disparities exist in access to quality mathematics education, with rural areas facing additional barriers.

Inequitable distribution of opportunities for disadvantaged groups: Disadvantaged groups, such as girls and students from low-income backgrounds, face additional challenges in accessing quality mathematics education.

Solutions

Let's explore the reasons for and solutions to the unpopularity of mathematics at the mass level.

Poor quality of books: Textbooks at the primary level should have children's favorite cartoon characters explaining the mathematical concepts. The link between math and real life should be made very apparent. Mathematical games, puzzles, tidbits on the lives of mathematicians, the history of mathematics, and new research and discovery in mathematics should all be an integral part of textbooks, which should of course be updated often.

Faulty education policy: Educational policies in India are designed by people who are unaware of the ground realities—school infrastructure, student-teacher ratio, the knowledge level of teachers, etc. Any education committee formed should have practicing teachers and other stakeholders as active members.

Shortage of quality teachers: Most students in rural areas are first-generation learners. They are completely dependent on their teachers for education, but there is a shortage of well-trained teachers. We need teachers who can teach mathematics using technology and can relate mathematics to daily life. Mathematics teaching should not be monotonous. We need teachers to go beyond the textbook and not be in a hurry to complete the syllabus. It is not a teacher's job to tell her students how to score well in an exam; it is her job to show them how to apply their classroom knowledge to solve real-life problems.

Lack of research institutes: In the last 70 years of independence, we have built reputable institutions like the IIT, AIIMS, IIM, and IIIT, which produce quality engineers, doctors, and managers, but in most of our universities we hardly focus on research in mathematics. Besides TIFR, IISc, ISI, IMS, etc., we don't have any institutions that engage students in the field of research. The education system in India is inclined towards making money. A student who is good at mathematics prefers to go into engineering rather than pursue mathematical research.

Lack of awareness of careers in mathematics: In India, engineering or teaching are the two known career options for students of math. Different career options need to be explored. Actuary, data analysis, gaming, psychometry, research, operation research, financial analysis, and cryptology are a few areas where people from mathematics backgrounds are in great demand. Even Face book and Google hire people with a mathematics background.

Mathematics is not about calculations or getting jobs by cracking competitive exams; it is an integral part of our lives. The policy formed by the government for the upliftment of mathematics should be implemented with proper planning and with full knowledge of ground realities. Math is a beautiful and exciting subject, and unless we realise this, we will not be able to bring back the glorious days of math.

The biggest challenge for us is to change the attitude towards mathematics and the research approach and progress with the attitude of teachers, parents, and others to make mathematics as cognitive fun and as an intellectual game and focus on why and how it should be taught. For most people, "mathematics is still hard to handle," and they also tend to feed this into the minds of our youth." NCF [1]2005 has pointed out that 'the main goal of mathematics education in schools is the Mathematization of the child's thinking' (NCF-2005 p. 42). If we look back at current developments in mathematics education in India, some notable observations can be made. While many significant attempts have been made to improve the teaching of mathematics in various dimensions like algebra teaching, factors associated with errors, in-depth analysis of child learning in elementary grades, early algebraization, and teaching through project-based learning Despite all this, further improvement in this immersing area is always possible. Recent developments are not enough to uplift the status of teaching and learning mathematics; therefore, many more quality research studies focusing on various concern areas should be done, where special care of professional development of mathematics teachers should be taken.

Success in education is teamwork. This team consists of stakeholders: family, teachers, and the education system. Motivation and psychological wellbeing play an important role in overcoming many problems in mathematics teaching and learning. Adopting a learning approach that emphasises the cooperation of teachers, students, peers, and parents in mathematics teaching/learning will facilitate the work of teachers and increase efficiency and success in mathematics teaching.

The intensity of the achievements in the mathematics program, their suitability for the developmental characteristics of the students, the highlighting of individual differences, the revaluation of the gain/time relationship, and teachers receiving qualified in-service training suitable for changing programs can be expressed as an important requirement for an effective learning process. **“The only way to learn mathematics is to do mathematics.”**

CONCLUSION

Mathematics is embedded deeply into the life and culture of people in the Indian subcontinent, attested by a long history of engagement with mathematics in art, craft, work, and abstract disciplines of thought. This has also meant a tradition of socially embedded modes of education and learning in aspects of mathematics as well. Such a historical perspective on mathematics and its education in India. In India, traditionally the emphasis has been on the development of manipulative skills and the tendency to feed the mathematics into the minds of learners, but now constructivist approaches should be adopted to facilitate the learners and to make them democratic in nature to satisfy their curiosity. On the other hand, the role of the mathematics teacher has also changed a bit, i.e., from instructor to facilitator, to act as scaffolding for the learning attainment of the learners. We can say the role of teacher has been minimized. To act in a proper way and help the learners in their learning process, we must undertake concrete steps for putting India's children on the path of achieving their full potential, and it is desperate that we make policy and implement them to enable India to reach its national goals of mathematics learning for growth and equity.

The challenge of providing quality mathematics education for all at the school level is immense, and the country has some way to traverse to achieve this. The need for a large body of teachers with expertise in mathematics and training in pedagogy is acute. The government is the central player in Indian education, but it is not monolithic either. On the other hand, India's diversity has given rise to a range of initiatives, some small, some large, including some from the government. We have spoken of problems endemic to the Indian mathematics education system, but many of them are not unlike problems encountered in mathematics education in other societies and nations. The immense size and diversity of the Indian subcontinent, low levels of resources, and an almost ungovernable polity complicate, but the sense of hope that prevails suggests that India may yet solve these problems that force us to take a hard look at mathematics not only in terms of curricula (in diversity) and pedagogy (in a widely varied milieu), but in social context as well. When India manages to provide quality mathematics education for all, mathematics education as a discipline will have new insights and new formulations to work with.

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