

Maths Education in India: The efforts from outside the System

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The promise of school education

- Universalisation of education
- Comparable education for all
- An education which fosters democracy
- There is diversity in the way people live, the resources they have, the way they organise their lives, their experiences and their priorities
- The system has expanded manifold in the last 30-35 years

The promise of Maths Education

- The earliest statements on Maths teaching can be read in the Kothari commission and the National Policies of Education, 1968 and 1986 very briefly comment upon Maths education in the same tone as the commission.
- Maths to be an integral part of general school education.
- The purpose of Maths teaching linked to growth of physical and biological sciences and in turn to technology at the same time encourage logical thinking, reasoning and analysis
- Lack of a detailed statement which would link aims to content and pedagogy.

The promise of Maths Education

- Kothari commission(1964-66) pointed out to the need to reorganize the mathematics syllabus across all stages of schooling, conceptual understanding as against computation and promotion of logical thinking.
...in the teaching of mathematics, emphasis should be more on the understanding of basic principles than on the mechanical teaching of mathematical computations
...most desirable that the course in arithmetic and algebra be integrated and emphasis placed on the laws and principles of mathematics and logical thinking
...The emphasis on memorising of theorems and exercises in geometry should be given up. The approach to the teaching of geometry should be changed and an axiomatic and systematic treatment adopted.
- National policy of education,1968- *Science and Mathematics should be an integral part of general education till the end of the school stage*
- National policy of education,1986(as modified in 1992) *'Mathematics should be visualised as the vehicle to train a child to think, reason, analyse and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning.'*

Interventions from outside

- Institutional inputs (Examples include some colleges and university departments, Homi Bhabha Centre for Science Education (HBCSE), Vidya Bhawan etc.)
- Voluntary organisations- Eklavya, Kerala Shastra Sahitya Parishath (KSSP), Tamil Nadu Science Forum (TNSF), Digantar, Suvidhya, Rishi Valley etc...)
- Teacher associations
- Corporate social responsibility and other such initiatives
- Individual initiatives and contributions

Interventions from outside

- **Sandhan(1983) non government, non-profit entity which has worked with education of marginalized and underprivileged adolescents and children.**
- **Closely associated to two prominent programs of Rajasthan- Shiksha Karmi and Lok Jumbish and has been involved with training locally recruited educational workers as teachers and also creating teaching-learning material for children in Maths and other subjects and also training teachers and setting up support structures for them in collaboration with other organisations**

Interventions from outside

- **Centre for learning Resources, Pune(1984) non government, non-profit entity is involved in in-service training of teachers, para-teachers, teacher trainees and developing teaching-learning material for primary level Maths. It is concerned about-**
 1. **Teachers' own conceptual understanding and competence**
 2. **Building conceptual understanding, problem-solving and computational skills of learners - the place of experiential learning and concrete materials**
 3. **Relating mathematics to everyday life**
 4. **Learning assessment**

Its training programs focus on-

- **Conceptual knowledge and activity based pedagogy**
- **Using simple, low cost teaching learning material**
- **Evaluation of pupil assessment**
- **Discussions on affective aspects of the teaching-learning situation including equity in the classroom, teacher attitudes and teacher motivation**

Training material is available on print and video too.

Interventions from outside

- **Homi Bhabha Centre for Science Education(HBCSE) (1974)- a part of Tata Institute for Fundamental Research, HBCSE promotes Science and Maths education from primary school to college. It has research projects including action researches in Maths learning and teaching. Two decades of such work has also fed into its curriculum and textbooks for primary Maths. Mathematics Education group has the following broad aims:**
 1. **Develop a better understanding of how school students learn mathematics**
 2. **Develop ways of organizing the content of school mathematics for more effective learning**
 3. **Develop a better understanding of the teaching of school mathematics**
 4. **Develop materials and other resources for the teaching and learning of school mathematics**
- Supports material development at state and national level through the SCERT, NCERT, IGNOU etc.**

Interventions from outside

- Jodo Gyan(1998) is not for profit, social enterprise, whose focus of work is primary Maths. They conduct concept based workshops, mainly in-service as well as design, produce, procure and distribute low cost teaching-learning material. They also run experimental schools for first generation learners in Delhi.
- Have been holding workshops for teachers of various schools and have brought forward ideas of how to bring more concrete materials to the school
- They subscribe to Realistic Mathematics Education (RME) (Freudenthal's view of Mathematics): *Just as mathematics arose from the mathematization of reality, so must learning mathematics also originate in mathematizing reality.*

Interventions from outside

Tamil Nadu Science Forum, Pondicherry
Science Forum and KSSSP

- Engagement with new ideas of education among wide set of stake-holders
- Programmes of science and maths popularisation and for adult learning
- Sporadic activities with teachers including from secondary school
- Include refresher courses on specific areas
- Workshops on activities and problem solving

Interventions from outside

- Many others exist, many more may be there
- These are only illustrative
- Not chronological or in contribution
- Not enough documentation on any
- No good study of the work
- We would look at one in detail

The situation encountered

- Fear of Maths in students and teachers- lack of confidence in learnability
- Emphasis on short-cuts, algorithms and formulae
- Incomprehension at all levels, with the burden increasing as we to the higher classes
- Lack of conceptual clarity among teachers
- Children's lack of reading ability an impediment in Maths learning
- The 'correct answer' being all important and no heed being paid to the process
- Copy and repetition and 'dull' practice central to Maths teaching

Interventions from outside

- Prashika-Eklavya(1982)
- A comprehensive school intervention in Hoshangabad, Betul and other districts of Madhya Pradesh
- Based on Hoshangabad science teaching Programme (HSTP), A model led academically and conceptually by a voluntary organization in **collaboration** with people from the system and from other institutions including universities
- In collaboration with the State education deptt and SCERT

Interventions from Outside

Prashika.....

- Areas of work- curriculum in all dimensions including purposes, perspective, social aspects of inclusion and diversity, classroom-participation, assessment, learner engagement and exploration
- Teaching learning materials and textbooks
- The notion of training
- The material for teachers

Nature of support to Prashika

- Support as a structure from Eklvaya with a flexible agenda and space to explore
- Space and acceptance in the public education system as an informed partner
- Linkage with the university and academics and the deep commitment of some of the people from these structures
- Opportunity to act as a forum for harnessing those who want a change towards universalisation of quality with equity

The environment that made it possible

- Cross-fertilisation of ideas and struggles
- The strong environment of discourse and assessment of worthiness of ideas
- Closeness to schools, teaching community, awareness of the children and the community they came from
- Constant interaction and learning from the schools, teachers and children. The shoulders of Kishore Bharti, FRCH and HSTP
- The space to explore, think, do, reflect and try again. The ability to allow errors and also check for quality.
- IS THAT AVAILABLE NOW? DOES IT NEED TO BE SUPPORTED, EXPANDED AND ENCOURAGED?

What we have gained

- Evolved framework for Maths education- Exploring, trying alternatives, challenging the existing premises, including democratic debates leading to NCF, 2005.
Contribution to aims-content-pedagogy-assessment
- Textbooks and other teaching learning material for
- Conceptualisation of and support to teacher preparation - Pre-service teacher and In-service training
- Reading material for teachers
- Building networks for Maths awareness
- Assessment methods and possibilities
- Recognition of the agency of the teacher and the educator and the need for respecting them and giving them space.
- Respecting the learner and her effort to learn

Framework for Maths Teaching

- Maths not calculations and algorithms
- Concept development and solving new problem key to capability in maths
- The need to use the context of the child
- Faith in the capability of the child, recognition of multiple paths
- Memorisation not key to maths capability
- The role of language capability in developing learning in maths classrooms essential
- Maths learning not linear not isolated, needs spiralling of ideas
- Need to have learner articulate their understanding, build logical arguments and follow their own algorithms.

Framework for Maths Education

- Need for active participation and engagement of the students
- Time on task to be increased and peer learning and conversations encouraged
- Forming definitions and having children make their own expressions important for the classroom process
- Exercises in the book illustrative. Teachers to make more.
- Students to make questions for deepening their learning
- Teachers must be aware of and participate in the creating materials and their frame-work. Need to have some materials created regularly at clusters by groups of teachers
- Teacher must plan her own class and her own activities. She must follow her own pace according to the pace of her class.

What has happened so far

- Re-conceptualisation of the Maths program
- Greater thought on how children learn Maths
- Clarifying purposes, content load, priorities
- Support to teacher preparation
- Building networks for Maths awareness

Possible areas of participation

- The need for deepening involvement-Move from primary/ups to secondary, higher secondary
- The responsibility of society
- Reflect on what we mean by maths in context
- Reflect on children's difficulties
- Reflect on the relationship between the nature of maths and the aims of teaching it
- Capacity building of teachers, teacher educators and administrators in maths and its education
- Empowering parents and adults in the community to explore and engage with maths and with abstraction

Challenges and barriers

- Transformation of a respected set of institutions to a category called NGO's
- Increase in insularity and growth of centralization and bureaucratic dominance
- Looking at non-institutional players as interferers or as sub-contractors of work decided by the Govt
- Lack of quality check and adherence formats
- No sharing and net-working mechanisms

Challenges and barriers

The lack of resources available for such institutions to be nurtured

In-adequate number of capable and willing people to work towards improving the conditions around fellow humans