Professional Development in Math Education in India

FIRSTMATH MEETING
Georgetown University, DC

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Education System

Post Graduation (2 Yrs)

Graduation Level (3 Yrs)

Board Exam

Higher Sec / Pre-University (11,12)
SSLC / Matriculation Board Exam

Secondary Level (9, 10)

Upper Primary (6 to 8)

Lower Primary (1 to 5 )

Pre-School/ Kindergarten

Elementary
Governance and standards

There are 3 national Boards each with their own sets of standards
a) Central Board of Secondary Education – CBSE
b) Indian Certificate of Secondary Education – ICSE
c) Indira Gandhi National Open University - IGNOU

In addition, each States has its own Board for class 10\textsuperscript{th} (called the Pre-University Boards) which have their own standards.

Each board has its own text books, assessments, curriculum and examination systems and medium of instruction

A school has to get a no-objection certificate from the State Government and apply to any board it wants for affiliation.

There is no separate system for Mathematics Education.
Teacher education

Post Graduation (2 Yrs)

Graduation Level (3 Yrs)

Board Exam

Higher Sec / Pre-University (11,12)
SSLC / Matriculation Board Exam

Secondary Level (9, 10)
Upper Primary (6 to 8)
Lower Primary (1 to 5)
Pre-School/ Kindergarten

Bachelor in Education (1 Year)
Integrated Teacher Ed (4 Yrs)
Diploma in Education or equivalent

Master in Education can teach in Teacher Education Institutes

Elementary Diploma in Education or equivalent
Teacher Recruitment

- State specific
- Varying entry qualifications, common certification
  
  In some states, specific subject knowledge may be needed
- Varying age criterion
  (lower age limit: 18 - 21 years, upper age limit: 28 - 35 years, with relaxation for several categories. Can be as high as 45 years)
- Entrance Exam: Some states have written tests
- No state has interviews.
- Mostly the final authority on selection, appointments and transfers etc is at the district. The Zilla Panchayat head or members may also be involved along with educational officials
Historical Overview of Pre-Service Education

- Continuous attempt to enhance quality
- Driven by changes in school curricula
- Policies led by national commissions

Independence 1947

University Education Commission (1948)

The Secondary Education Commission (1953)

Education Commission (1964-66)

National Policy of Education (1986)

Chattopadhyay Committee Report (1983-85)

Yashpal Committee (1993)

National Council of Teacher Education (1998)

Acharya Ramamurthy Committee (1990)

National Curricular Framework for Teacher Education (2009)

National Council of Teacher Education (1998)

National Policy of Education (1986)

Chattopadhyay Committee Report (1983-85)

Yashpal Committee (1993)

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Acharya Ramamurthy Committee (1990)

National Curricular Framework for Teacher Education (2009)

National Curricular Framework (1988)

National Curricular Framework (1988)
Pre-Service Education contd.....

- Colonial hangover - insulated from the University and schools

- EC (1964-66) emphasized need for relevance to Indian school context

- Teacher Education Curriculum Framework (1978)
  - Curriculum structure conceptualized according to the stages of education
  - Emphasized urban and rural contexts, and local needs of children

- In 1983, 4 years integrated Teacher education programs was started
Pre-service Education contd...

- Curriculum Framework (1988) - also emphasized theoretical knowledge of subjects – in an effort to reduce the insularity of teacher education from University

- NCTE / curriculum framework revision 1998 – emphasized practice and use of technology

- Current Curriculum Framework 2009 – emphasizes practice and concept courses and pedagogy courses mutually reinforcing one another
National Council of Teacher Education (NCTE)

- Advises the GoI on all matters concerning teacher education, including pre-service and in-service training, evaluation of curricula for teacher education and periodical review of progress
- Advises the state government on any matters when referred to
- Reviews the programs of plan schemes, both central and state, concerning teacher education
- Advises the government on ensuring adequate standards in teacher education
Historical Overview of In-service Education

- Pre-service and in service as two ends of the continuum of Professional Development (Education Commission 1964)

- Essentially short-term courses (not of the accumulative/credited variety). Three types of courses – short term courses for untrained teachers, refresher courses for advanced teachers and advanced courses for advanced level training of teachers in their field of interests

Institutionalization of In-Service Education – 1986.
Institutions established to mandate in-service professional development for primary and secondary school teachers
In 2004 : 500 DIETS, 87 CTEs, 38 IASEs and 30 SCERTS have been established.

Different models of in-service education were developed
In-service education institutes

NCERT
(National)

SCERT
(State)

DIET
(District)
National Council of Education Research and Training (NCERT)
• Apex organization at the national level designed to undertake research and training in education at the school stage.
• Coordinates the entire work of the in-service teacher education
• Formulates syllabi for the education or training of teachers at different levels.

State Institute of Education (SCERTs)
• Provide various training courses for supervisors of elementary schools or elementary teacher educators.
• Organize conferences and seminars to senior state education officers.
• Provide conduct and supervise extensive services to training institutions for elementary teachers.
• Organize research in elementary education and provide correspondence course for teachers
Major problems in in-service education

• In consonance with the needs of school education rather than the needs of teachers.
• The methodology of training was lecture based and teachers had no opportunity for active participation. Even activity based learning and multi-grade teaching was taught through lecture method.

In response to this,

Training began to be conducted in schools in addition to off-site training. This enhanced the relevancy of teacher training.
Different models of In-service Education

<table>
<thead>
<tr>
<th>Model</th>
<th>Institution/Agency</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Conventional Campus Model, or Face-to-face Institutional Model.</td>
<td>NCERT, NIEPA, NCTE, SCERT, IASE, CTE, DIET</td>
<td>Short Duration (One week to two weeks) Longer Duration (Six weeks)</td>
</tr>
<tr>
<td>Project Based Model such as PMOST, SPOT MLL</td>
<td>NCERT, RIE SCERT IASE, CTE, DIET</td>
<td>Short Duration</td>
</tr>
<tr>
<td>School Cluster Model</td>
<td>District Primary Education Authority</td>
<td>Short Duration</td>
</tr>
<tr>
<td>Model</td>
<td>Organization(s)</td>
<td>Duration</td>
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<td>NGO Model</td>
<td>Sandhan (Jaipur, Rajasthan), Eklavya (Bhopal)</td>
<td>Short Duration</td>
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<tr>
<td>Mass Media Model</td>
<td>CIET, SIET, IGNOU, UGC</td>
<td>Short Duration (15 minutes to one hour)</td>
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<tr>
<td>Distance Education Model</td>
<td>IGNOU, UGC, University Departments</td>
<td>Longer Duration (Three months to one year)</td>
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<tr>
<td>Correspondence Type</td>
<td>University Departments</td>
<td>Longer Duration (One year)</td>
</tr>
<tr>
<td>Cascade Model</td>
<td>NCERT, NCTE, SCERT</td>
<td>Short Duration</td>
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Support for Math Teaching

Teachers’ Union
• Are very powerful and there are several teachers who are elected members of the Upper and Lower House of the Parliament.
• Mainly support issues related to employment such as better working conditions, salaries, etc.
• Do not provide specific support for subjects
Support for Math Teaching

• A few Private or Non-Governmental Organizations (NGOs).

• The Homi Babha Centre for Science Education conducts training programs on Math for teachers and students. This is a National Centre of the Tata Institute of Fundamental Research (TIFR), Mumbai. They also have a Math lab and teachers are trained in its use. They are also encouraged to bring students

• Pratham supports Math Education, particularly at the primary level. Work mainly with students through volunteers.

• The Association of Mathematics Teachers of India conducts short term training programs on specific Mathematical concepts.
OTL Math in the first Five years

• The States conduct subject-specific training programs for teachers as soon as they enter the profession. But these are not regular.

• A few States have started teaching Math through activities. These States provide training to teachers on the Activity based pedagogy.

• At the secondary levels, such trainings are few and far between.

• Currently, there is an effort to develop a community of practice by creating networks among teachers across a few schools. In these meetings, teachers develop and share resources.
6. Novice Teacher in a Math Class

- See video Clip
A Dream of a Just, Equitable, Humane and Sustainable Society

Thank You
8. Description of Math Curriculum, Tests and Learning Materials

• National Math Standards of India defines what math concepts students should have mastered at each grade level.

• The Indian standard is fairly consistent across various States and builds on knowledge gained in prior years and doesn't change.

• The list is a long one.

The Detailed description of the standards for the primary and secondary levels are given in

• The standards are presented here for only the Number concept by way of illustration about the nature of the standard.
8. Description of Math Curriculum contd...

• **Example:** **Number Concept : Primary Level**
  
  **Class 1**: Develop a sense of numberness, counting and operations of numbers 1-9 and 0

• **Class 2**
  
  ✓ Read, write, count, count in different ways, group, and expand, find the place value, compare numbers on the basis of their place value for numbers up to 99

  ✓ Add and subtract numbers without and with regrouping through pictures, objects and numbers

  ✓ Observe commutative properties of addition

  ✓ Discuss situations involving repeated Addition

  ✓ Makes equal groups
8. Description of Math Curriculum contd...

- **Class 3:**
  - ✓ Read, write, count, count in different ways, group, and expand, find the place value, compare numbers on the basis of their place value for numbers up to 999
  - ✓ Add numbers vertically and horizontally
  - ✓ Frame problems of addition and subtraction
  - ✓ See multiplication as repeated addition in pictures, with objects and numbers
  - ✓ Use Multiplication facts in situations
  - ✓ Multiply two digit numbers using standard algorithms
  - ✓ Explain division from context using equal grouping
  - ✓ Relate multiplication to division
  - ✓ Complete division of facts using grouping and multiplication tables
8. Description of Math Curriculum contd...

- **Class 4:**
  - Write tables up to 10 × 10
  - Multiply two and three digit numbers using algorithms
  - Divide a number by another number – by drawing dots, by grouping, by using multiplication facts, by repeated subtraction
  - Apply the four operations to real life.
  - Frame word problem
  - Estimate sums, differences and products of given numbers

- **Class 5:**
  - Find place value of numbers beyond 1000
  - Appreciate the role of place value in addition, subtraction and multiplication algorithm.
8. Description of Math Curriculum contd...

✓ Use informal and standard division algorithms
✓ Explain the meaning of factors and multiples.

• Class 6:
✓ Consolidate the sense of numberness up to 5 digits. And use all operations with 5 digit numbers
✓ Use symbols and brackets
✓ Observe patterns and arrives at divisibility rules
✓ Identify even odd prime / composite numbers, co-prime numbers, factorisation, every number can be written as products of prime factors,
✓ Find out HCF & LCM; prime factorisation and division methods
✓ Describe Whole numbers and its properties
✓ Formulate rules in accordance to patterns
✓ Understand, order and represent negative numbers
8. Description of Math Curriculum contd...

- **Class 7**
  - ✔ Show knowledge of Integers
  - ✔ Multiply and divide integers using patterns
  - ✔ Observe division of Zero as being meaningless
  - ✔ Look at properties of integers in all operations
  - ✔ Construct examples that are not commutative
  - ✔ Represent rational numbers as decimals
  - ✔ Solve word problems (all operations) on rational numbers
  - ✔ Describe laws of exponents
  - ✔ Differentiate Fractions and Rational Numbers
  - ✔ Multiply fractions
  - ✔ See fractions as an operator and reciprocals as fractions
  - ✔ Divide fractions
  - ✔ Solve word problems involving mixed fractions
  - ✔ Represent rational numbers on number line
  - ✔ Perform all operations on rational numbers
8. Description of Math Curriculum contd...

- **Class 8:**
  - ✓ Describe properties of rational numbers
  - ✓ Consolidate operations on rational numbers
  - ✓ Find out rational numbers that lie between two rational numbers
  - ✓ Solve word problems involving two operations
  - ✓ Look at integers as exponents
  - ✓ Describe laws of exponent with integral powers
  - ✓ Distinguish Squares and Square Roots
  - ✓ Calculate square roots using fraction and division methods for numbers within 4 digits and for numbers within two digit decimal places
  - ✓ Distinguish Cube and cube roots upto 3 digits
  - ✓ Estimate square roots and cube roots
  - ✓ Write a 2 and 3 digit number in generalized form
  - ✓ Deduce divisibility rules for 2, 3, 5, 9, and 10 for two or three digit numbers
8. Description of Math Curriculum contd...

- **Pattern of Examinations:**
  - Every School has monthly and quarterly tests and Half-yearly and Annual examinations.
  - In some States there is no separate tests for classes 1 to 4 (eg. Puducherry, Karnataka, Chhattisgarh)

- **Use of Learning Materials**
  - There is a lot of emphasis on using locally available resources for learning Math concepts.
  - Several States have their own learning resource kits for teaching Math. As a part of training, teachers are trained in the use of these kits.
  - Organizations like Suvidya, Pratham, have developed Math Kits and other learning materials.
8. Description of Math Curriculum contd...

- NCERT has come out with a Handbook, titled, “Manual for Mathematics Teaching Aids for Primary Schools” which focuses on use of gives detailed description of the concepts to be taught, materials to use and process of usage.
- Most of the resources are for primary schools and a few are for Middle schools.

- There are very few resources for use at the level of high schools.

- In Urban areas like Mumbai, and Bangalore, a few schools take students to Museums or Math labs but such trips are not frequent and these are not accessible to all students.
8. Description of Math Curriculum contd...

- At the level of middle and High Schools, teacher seminars are held in a few States (eg. Rajasthan), where experienced teachers mentor young teacher groups.

- Another informal training that is in existence at the systemic level but is currently being revitalized is that of support by cluster resource persons.

- In every State, the districts are broken up into blocks and clusters. One cluster resource person takes care of schools in 11 to 15 clusters. The cluster resource persons are expected to observe teachers while they are teaching, support teachers to reflect on their pedagogy and demonstrate to teachers a better way of teaching.