A Study of Mathematics Curriculum for School Education since Last Two Decades and its Implementation

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Abstract

The knowledge of Mathematics is very essential in our day to day life. Since ancient period early man used Mathematics in their day to day life. Beginning of counting and using symbol for estimating the number of sheep were used by shepherd from very old age period in their day to day life. The Mathematics becomes a very important and useful for every person in every respect. Therefore, in Modern Education Mathematics is a compulsory subject from the initial stage of school education and informally subject is dealt in pre-primary level also. Therefore, learning of Mathematics is important for every person which help her/him throughout her/his life. As Mathematics is a compulsory subject, receiving quality learning in Mathematics is a right to every child. And also presently school education became compulsory for every child of the age 6-18 years. Keeping this in mind tremendous change had been made in school Mathematics in our country since independence. And in last 2 decades rapid development have been made to make the Mathematics learner friendly at global, national and also at our state level though reforming school curriculum. This study investigated the place of Mathematics, the development of syllabus and textbook, teaching-learning process etc. in school curriculum since independence in general and particularly in last 2 decades.

Key words: curriculum, mathematics learning, teaching learning process.

Introduction:
Mathematics is the mother of all science. The world cannot move without Mathematics. Nature is the greatest Mathematician of all. Many Mathematical concepts, pattern, laws, etc. are observed in the nature. Mathematics fulfills most of the human needs related to different aspects of everyday life. Every person whatever he or she requires a knowledge of Mathematics in day to day life for various purposes.

It is essential for all as Mathematics is everywhere in our daily life activities from dawn to midnight. It is in our life from birth to death, from creation of universe to today’s modern world, from home to society. Hence, not only today but from past, Mathematics learning is being essential for all from childhood. From early period when civilization begins man used Mathematics for different purpose mainly for getting the answer of ‘how many’, ‘how big’, ‘how far’, ‘how much’, etc. Counting and symbol for number started from that period.

All children must learn essential Mathematics so that they can face the challenges of their day to day life as well for the newly formed technological world of today and tomorrow. Hence, Mathematics is made an essential subject from the beginning of the school education. Previously it was a misconception that Mathematics is required only for being an Engineer, Mathematician or Scientist and hence the subject was treated as a difficult subject by the society. And school student had a fear psychosis of the
subject. But since last few decades to make the elementary education a fundamental right for all children treatment of the subject was made as far as possible learner friendly and relevant to child’s real life situation. Accordingly all over the world Mathematics education in school particularly at elementary stage has made a remarkable reformation by reforming curriculum, renewing textbooks and changing teaching-learning process.

Background of Mathematics in school education:

(a) Pre-independence period- Since pre-independence period Mathematics was a major core subject in school education. Before coming of British in India there were different types of educational institutes for different category specially in our state of Assam like ‘Pathsalas’ for Hindus, ‘Muktabs’ for Muslim, ‘Tols’ for higher cast Hindus, ‘Satras’ for Vaishnavas- where education was based on the cultural religion life of the people. At that period also a little amount of Arithmetics, money transaction, a knowledge of Geometrical concepts and figures, measurements, Zamindari accounts were there in those days of school education. After coming British (in 1826) the traditional system soon made away and British system of Schooling started in three stages- primary, middle and high schools and took up measures for the promotion of the indigenous system of education in our state along with the other state for providing general education for the masses. The curriculum in that period for Mathematics was consists of following:

At LP level: (1) Arithmetic Written and mental Arithmetic (2) Bazar and Zamindari accounts and simple mensuration

At middle schools (ME/ MV) level: (1) Arithmetics (2) Theory of Surveying (3) Bazar and Zamindari accounts (4) Handling of money matters (5) Geometry and Mensuration

M.E. Madrasa and Sanskrit Middle School had a common curriculum of study for Arithmetics/ Mathematics.

(b) Post independence periods- Just after independence, Primary education act was passed in 1947 for the 2nd time to introduce free, compulsory and universal primary education in graded stage for the children upto the age 6 to 11 years. Then the Basic Education act came in 1954, the curriculum for primary level was consists of Arithmetic, Mental Arithmetic, Accounts, Jama Kharach (savings & expenditure), reading of clock.

The curriculum was almost same in the primary schools and in basic schools. The only difference was that the Basic schools followed a different method i.e. learning by doing. The school subjects were taught through craft in Basic School. For the teacher it was being difficult to teach all subjects / class through craft even for the trained teachers. Therefore, in our state Assam, like other states also, the Basic education Act 1954 failed to achieve the desired results.

The major reform in curriculum for all stages of school education came after National Policy of School Education, 1968 as per the report of the ‘Kothari’ commission. A common curriculum for class I to class X was prepared at national level for adoption by all the states in the country with adjustments according to local need. Then the 10+2+3 pattern was adopted in the country.
Mathematics and Science was made compulsory core subject at Middle and Secondary stage. Mathematics and Science were greater stressed. Accordingly General Mathematics was compulsory subject upto class X and at Secondary level an advance Mathematics was there as optional subject.

General Mathematics comprises Arithmetics, Geometry (concept and theory) a simple Algebra.

Advance Mathematics mainly consists of integers, quadratic equation, logarithm, coordinate geometry.

Meanwhile 1968 National Policy continues to serve as basis for educational development. The most important of these programmes relates to universalization of elementary education and eradication of adult illiteracy.

But the system does not work much. There was huge number of students who failed to achieve school final examination. Many dropped and failed in between the primary and middle stage. The education system was found faulty and new education policy in 1986 was undertaken by the then Prime Minister Rajiv Gandhi according to which “Education will have to be streamlined to facilitate modernization of production, services and infrastructure. Besides, to enable the young people to develop enterprisal ability, they must be exposed to challenges of new ideas. Old concepts have to be replaced by new ones in an effort to overcome the resource constrain and input dynamism.”

As per 1986 policy – upto a given level, all students irrespective of caste, creed, location or sex have access to education of comparable quality. Quality in education through quality learning was more emphasized. The policy recommended identification of Minimum Level of Learning (MLL) for all subjects at primary level.

And in 1992 MLL was identified at National level for all subjects including Mathematics at primary stages. Child-centric approach was suggested and reformation starts in curriculum and textbooks. The Mathematics curriculum for that time was –

At L.P. level:

Arithmetic consists of number, four operation, simplification, money, metric system, reading clock, basic Geometrical concept.

At U.P. level (V to VII):

- Number
- Fractions, decimal fraction
- Money, measurement
- Idea of simple Geometric term/concept/properties
- Unitary method, simple interest
- Ratio proportion
At Secondary level (VIII to X):

General Mathematics was compulsory in our state for all children. But in addition advance Mathematics was there as optional subject at secondary level.

General Mathematics curriculum was consist of:

- Number system
- Sets (basic ideas)
- Algebra- expression, equations, factors
- Geometry
- Mensuration – theorem, properties, etc.
- Discount
- Shares
- Graphs
- Compound interest
- Banking
- Introduction to Trigonometry
- Statistics

Advance Mathematics consists of:

- Sets
- Fraction
- Irrational number, complex number
- Indices and logarithm
- Inequality and inequation
- Quadratic equation
- Geometry- proofs and application

Development of Mathematics curriculum in school education since last two decades and its implementations:

After NPE 1986 and POA 1992 major reformation in school education was attempted in respect to Science and Mathematics. The curriculum was made a heavy and modernized at middle and secondary level and to handle the subject separate Science Graduate teachers were appointed at the middle and secondary stage. Science and Mathematics kits were supplied to schools under OBB scheme to learn the subject by doing. Teachers were trained under. Free textbooks were started distributed to the children by our state (like other state) at primary stage. The curriculum mentioned in that stage was found very loaded especially for middle and secondary level. And also textbooks developed at that time was not so attractive for mass children specially at elementary stage due to which both teacher as well as children were facing difficulty to learn Mathematics. Teachers appointed were not professionally qualified and no continuous training for upgradation of teacher’s proficiency was made. Only one time Junior Basic Training to all primary teachers appointed was done for regularize the services. At upper primary level though normal training was there but not compulsory for all.
In 1993 Yashpal committee report concerned over the curricular load. The report said that children’s non learning area of the content is the major burden for school children. So in ninetees some notable changes were made in respect to the following-

**Specially at primary level:**
- MLL and competency achievement.
- Reduction of curricular load.
- Activity based teaching.
- Child centric approach.
- Joyfull learning.

These developments made throughout the country. DPEP was launched. Then again major changes started with all new innovative ideas in the school curriculum specially at primary level mainly in language and mathematics. While looking in child’s point of view it were observed specially for Mathematics at primary level:

- The curriculum was over loaded.
- Content was not related to children’s life and were not integrated to social and cultural life.
- The approach in the textbook was extremely mechanical.
- Problem in the textbook are usually unfamiliar and uninteresting and not relevant.
- Teacher teaches the subject in a very mechanical manner without using any concrete object or TLM.
- Traditional Mathematics teaching is not related to real life.
- Rote memorization was more stressed than understanding.

So, with this observation of curriculum revision along with textbook and teaching learning process were continuously developing since 1997. In the year 1998 in our state with the outcomes of DPEP new curriculum was developed at primary level for the first time where the following were given much importance.

- Competency based approach.
- Child centric approach.
- Joyful approach.
- Activity based approach.

The primary Mathematics Curriculum was designed scientifically on the above where spiraling of the concept and day to day children life experience as well as child liking elements were given more importance.

The content load was reduced as far as possible specially at primary level.

**The primary curriculum developed in the year 1998 consisted of following:**

- Pre number concept
- Number concept
- Four operation (in spiraling order in accordance with the competency of number)
- Measurement
- Fraction
- Time
- Shape (Geometry)
- Puzzle, riddle, rhythm, etc.

All the concepts were graded in 3 phases for a particular class not in one phase only so that children of all level can learn and achieve easily as well as learning in discrete in manner.

At I & II the mathematics was totally integrated with the other subjects with focusing major 7 competencies which are:

- Listening and responding.
- Speaking and conversation.
- Reading and Writing.
- Number and counting.
- Working with materials
- Problem solving
- Exploration.

For the first time in Assam in 1998 integrated textbooks was developed where only one textbook was prescribed for Language, Mathematics, EVS and Art Education.

Mathematics concepts were incorporated through story, rhyme, picture stary picture page and others which was so designed to make the Mathematics interesting and relevant to the children.

From class I to class IV new textbooks were designed and developed in a new approach and involving teacher, teacher educator, child psychologist, illustrator in workshop mode. More emphasis was given on the presentation of Mathematical concept to link with children’s life. Each concept was introduced in such a manner that children can understand and practice the learning with curiosity.

Mass teacher training on preparation of low cost / no cost TLM, designing and organizing activities for Mathematics learning were conducted since 1999 and continued till launching of SSA in 2002. Training module along with resource materials for teachers were also developed and distributed during the training, SSA also supplied separate workbook and evaluation tool for Mathematics at elementary level.

Curriculum at U.P. level:

In continuation with L.P. level curriculum reformation was made for U.P. level also in the year 2004 in our state which was mostly on the basis of a new approach & in linkage with L.P. level curriculum.

Learner friendly Mathematics curriculum was developed keeping the fact in mind the following points:

1. Why children learn Mathematics at this stage (i.e. U.P. stage)
2. Present need of Mathematics learning for this stage.
3. The base already built in L.P. stage.
4. How Mathematics learning can be developed among the students of all levels.
UEE is a must for all categories of pupil upto the age of 14 years. Without Mathematics learning, all round development and value education can never be brought of as we all know that in Mathematics the following values are learned-

(1) Practical or utilization value.
(2) Discipline value.
(3) Economical saving value.
(4) Punctuality value.
(5) Cultural value.
(6) Patience etc.

In this stage (V to VII) Mathematics learning is not only for higher studies but also for use of the knowledge and skill of Mathematics in their life long process, to make one self sufficient, self efficient, self confident and self dependent. With these aim the curriculum was developed in our state by making the curriculum more realistic, practical, useful, suitable, justified upto the learner’s mental ability of that stage rather than stereotype, theoretical and traditional.

- To make Mathematics more understandable, enjoyable and permanently retainable in the mind, more use of TLM, practical work, project work were reflected in the curriculum specifically which need Mathematics Lab, Mathematics corner and Mathematics club in each school.
- For this teaching-learning strategies were suggested as activity based, child centered, load free, stress free, enjoyable, interesting and effective.

The content were designed in a way different from traditional one which were:

1. Computation- number concept, operation – 20%
2. Socially applicable Mathematics – 25%
3. Transaction of money and its maintenance – 10%
4. Geometry – 15%
5. Measurement – 10%
6. Preliminary Algebra (for verbal only) – 8%
7. Data Based Mathematics – 5%
8. Contribution of Mathematics – 2%
9. Use of Mathematics – 3%
10. Mathematics Magic/ Fun/ Puzzle/ Quiz, etc. – 2%

In this curriculum balance was made among K,U,S,A,Af.

Much focus was given in the curriculum for making Mathematics teaching-learning meaningful and purposeful for the learners in linkage with their life skills as well as to create interest or get an enjoyment in learning so that they can develop love and affection for the subject.

The following were suggested in the curriculum for teaching-learning process:

1. Activity based teaching-learning.
   - Group activity
2. Use of teaching-learning material.
3. Types of activities.
   - Songs, picture study, narration of events
   - Games, puzzles, quiz
   - Conversation, group discussion
   - Observation, exploration, making and studying of bills
   - Preparation of tables, charts, models, dices etc.
   - Field trips to market places, post office, bank, mela, picnic, etc.
   - Practical activities related to measurement of geometry (concept, measurement etc.)
   - Collection, study and analysis of data
   - Practice and application through logical thinking, problem solving, project work etc.

**Textbooks:**

New textbooks were developed in the latest approaches in Mathematics for class V to VII in linkage with L.P. level textbooks in the year 2004-2005. The concepts were introduced with child's life activity so that the Mathematics can be meaningful for them. A totally different types of textbooks were developed which were made different from traditional Mathematics textbooks e.g. railway journey, picnic, visited hotel and restaurant, games, history of Mathematics etc. are content of the lessons of Mathematics textbook besides rhymes, stary, puzzles etc.

These books were used till 2010.

**Development of Mathematics Curriculum as per NCF 2005 and RTE act 2009**

NCF-2005 reiterate the values enshrined in our constitution, reduction of curricular burden on children, ensuing quality education for all and systematic changes as makers of curricular reform. It recognizes the primacy of children’s experiences, their voices and their active involvement in the process of learning. Learning at school should be such that children can construct knowledge from experiences and environment.

**Guiding principles of NCF-2005**

- Connecting knowledge to life outside the school.
- Ensuring that learning is shifted away from the rote methods.
- Enriching the curriculum to provide for overall development of children rather than remain textbook centric.
- Making examination more flexible and integrated into classroom life.

For Mathematics Vision of school Mathematics has been laid in NCF-2005 as follows:

- Children learn to enjoy Mathematics rather than fear it.
- Children learn important Mathematics: Mathematics is more than formulas and mechanical procedures.
- Children see Mathematics as something to talk about, to communicate through, to discuss among them, to work together on.
- Children pose and solve meaningful problems.
- Children use abstractions to perceive relationships, to see structures, to reason out things, to argue the truth or falsity of statements.
- Children understand the basic structure of Mathematics: Arithmetic, Algebra, Geometry and Trigonometry, the basic content areas of school Mathematics, all offer a methodology for abstraction, structuration and generalization.
- Teachers engage every child in class with the conviction that everyone can learn Mathematics.

In Mathematics, the new syllabi emphasize reasoning and conceptual grasp at every stage. In primary Mathematics weightage has been projected to areas like shapes, spatial understanding, pattern, measurement and data handling. And Mathematics modeling, data analysis and interpretation provided at secondary stage set the frame to perceive Mathematics as discipline.

At higher secondary stage constructivism and problem solving form the twin objectives of syllabus. Emphasis on activity rather than rote memorization of facts and formulae continue through all stage.

As per NCF 2005, a holistic composite curriculum for entire stage of school education was developed by SCERT, Assam for the state in the year 2007. The contents were as follows:

**Major content areas class wise**

<table>
<thead>
<tr>
<th>Area</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pattern</td>
<td>I-IV</td>
</tr>
<tr>
<td>2. Geometry</td>
<td>I-X</td>
</tr>
<tr>
<td>3. Number System</td>
<td>I-VIII</td>
</tr>
<tr>
<td>5. Money</td>
<td>I-IV</td>
</tr>
<tr>
<td>6. Data-based Mathematics</td>
<td>I-X</td>
</tr>
<tr>
<td>7. Mental Arithmetic</td>
<td>I-IV</td>
</tr>
<tr>
<td>8. Socially Applicable Mathematics</td>
<td>V-VIII</td>
</tr>
<tr>
<td>9. Ratio and Proportions</td>
<td>VI-VIII</td>
</tr>
<tr>
<td>10. Algebra</td>
<td>VI-X</td>
</tr>
<tr>
<td>11. Graph</td>
<td>VIII</td>
</tr>
<tr>
<td>12. Co-ordinate Geometry</td>
<td>IX-X</td>
</tr>
<tr>
<td>13. Trigonometry</td>
<td>X</td>
</tr>
<tr>
<td>14. Computer Science</td>
<td>V-X</td>
</tr>
</tbody>
</table>

*But this curriculum could not be implemented, instead as per Govt. order in the year 2009 (State Assam has adopted NCERT Mathematics curriculum directly.*
NCERT new curriculum as per NCF-2005 consists of

(a) **For class I to V:**
- Geometry (shapes and spatial understanding)
- Number and operation
- Mental Arithmatics
- Money
- Measurement
- Data Handling
- Pattern \{ New area at L.P. level \}

(b) **For class VI to VIII:**
- Number system and playing with numbers
- Algebra (introduction and expression)
- Ratio and proportions
- Geometry (basic ideas 2D and 3D)
  - Understanding shapes
  - Symmetry
  - Construction
- Mensuration
- Data handling
- Introduction to graphs

(c) **At class IX and X:**
- Number system
- Algebra
- Co-ordinate Geometry
- Geometry
- Mensuration
- Statistics & Probability
- Trigonometry

The new sets of textbooks were developed phase wise at national level with totally latest approach specially at primary level.

However, the upper primary and secondary level textbooks were heavy in comparison with lower primary level. Teacher needs rigorous training for handling the new sets of textbooks. Almost all states including Assam has adopted NCERT Mathematics curriculum and textbook from the year 2009 to make uniformity in Mathematics learning throughout the country.

New textbooks were translated in regional languages (in 8 medium) for class I to VIII) in the year 2010 and are being used in the schools of our states under FTB Free Textbook scheme.

9. **RTE Act.**
   In the year 2009- Right to children free and compulsory education act was made, where curriculum, teaching-learning process and assessment were laid down to ensure:
   - Conformity to constitutional value
   - All round development of the child
   - Building up child’s knowledge, potentiality and talent
   - Development of physical and mental abilities to the fullest extent
- Learning through activities, discovery and exploration in a child-centered and child friendly manner
- Mother tongue as medium of introductions as far as possible
- Making child free from fear, trauma and anxiety and helping the child to express views freely.
- Provide for comprehensive and continuous assessment of ability to understand and apply knowledge

**Conclusion:**

It is observed that remarkable change had been made in the school Mathematics since independence and in great extent in last two decades to make Mathematics learner friendly as well as meaningful, purposeful, enjoyable to learners of all sections specially at elementary level so that each child can learn Mathematics easily with understanding and can apply their learning in their day to day life. Traditional fear is being replaced by joyful learning in Mathematics. For these in last few years sets of textbooks were redesigned in totally different way for which teaching-learning process required a major change to provide free and compulsory education not only upto elementary but also upto secondary level. For this teachers to be empowered with pedagogical challenges by:

- Reorientation on learners and learning.
- Holistic approach in treatments of learner’s development and learning.
- Creating an inclusive environment in the classroom for all.
- Engaging learners for construction of knowledge and fastening creativity.
- Arranging active learning through activity and other assignment.
- Upgrading upto date knowledge of concept and pedagogy, etc.

If the whole system of education changes then only goal and objective of curriculum will be achieved and then only we can provide equal right to each children for education for which effective implementation of the curriculum is a must, with proper planning right from micro level to macro level.

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