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## Secondary level mathematics curriculum of Kerala: A critical appraisal

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### Abstract

According to NCF (2005) Mathematics is a compulsory subject at the Secondary stage. Access to quality Mathematics Education is the right of every child. The document emphasizes that the main goal of mathematics education is to develop children's abilities for mathematisation. It also talks about a higher aim of School mathematics, that is, to develop the child's resources to think and reason mathematically to pursue assumptions to their logical consideration and to handle abstraction. This calls for a curriculum that is ambitious, coherent and teaching important principles of mathematics. But in the present day scenario, learning of mathematics is entirely different. Mathematics is considered as a very difficult subject and studying the subject as a herculean task. Many students hate mathematics and fail miserably in the subject. This paper attempts to find out whether the difficulty in the subject owes to the deformities in the prevailing Secondary school Curriculum of Kerala. Efforts are made to explore how far the NCF (2005) and KCF (2007) norms are followed in the current mathematics curriculum with special reference to the high school Mathematics text books. The paper also attempts to incorporate the drawbacks of the textbooks, a comparison of the old and new text books and suggestions to minimize the limitations embodied in the curriculum.

**Keywords:** Secondary level, Mathematics, Kerala

### Introduction

#### The relevance of mathematics as a discipline

Pythagoras has believed Mathematics is basis for everything and the physical world can be understood through mathematics. Success in mathematics is the best predictor for success in life Mathematics is the subject which indisputably forms the very basis of entire world's scientific, commercial and technological system. Mathematics is the most international of all curriculum subjects and mathematical understanding influences decision making in all areas of life. Mathematics serves a particular role as a social filter. Thus it is important for all students to succeed in school Mathematics regardless of back ground, gender or language.

NPE (1986) considered the importance of Mathematics and suggests that Mathematics should be visualised as a vehicle to train the child to think reason, analyse and to articulate logically. A study done by National Association for education of young children (2002) affirmed that high quality challenging and accessible mathematics education is a vital foundation for future. It emphasises that Mathematics helps children make sense of their world outside of school and help them construct solid foundation for success in school Mathematics plays an important role in the human exploration of reality both in respect of its own kind of reality and also as a heuristic tool for other kind of investigation. The Kothari commission (1964-66) emphasises the significance of Mathematics in school curriculum by asking to devote special attention to the study of mathematics.

In short, Mathematics is the alphabet with which god has written the universe. But among the school subjects, study of mathematics is considered by students as a Herculean task. A high proportion of students hate mathematics and perform very badly in mathematics examination. Mathematics is generally seen as a difficult subject and how this subject is communicated to pupils will influence how pupils learn the subject., This paper attempts to find out whether the difficulty in the subject owes to the deformities in the prevailing Secondary School Curriculum. Efforts are made to explore how far the NCF (2005) and KCF (2007) norms are followed in the current mathematics curriculum with special reference to the high school Mathematics text books. The paper also attempts to incorporate the

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### Mathematics curriculum

“Curriculum is, perhaps, best thought of as that set of planned activities which are designed to implement particular educational aims, in terms of the content of what is to be taught and the knowledge, skills and attitudes which are to be deliberately fostered together with statements of criteria for selection of content, and choices in methods, materials and evaluation”(Winch). It is supposed that any curriculum must be linked to assessment based on standards. It should provide a richly connected learning experiences for students while adding coherence to the standards and these standards must align with the curriculum rather than by a separate list of learning expectations. For more than a century, mathematics curriculum has been changing, and these changes have generated much discussion. Prompted by national reports and international assessments, attention has focused on the need to raise the quality of school mathematics programs. Curriculum has been central to many of the recent school mathematics improvement efforts. . This calls for a curriculum that is ambitious, coherent and teaches important principles of mathematics.

### National Curriculum Framework (NCF) 2005

National Curriculum Framework (NCF) 2005 owes its present shape and form to the flurry of ideas generated through a series of intensive deliberations by eminent scholars from different disciplines, principals, teachers and parents, representatives of NGOs, NCERT faculty, and several other stakeholders at various levels. The revised National Curriculum Framework (NCF) opens with a quotation from Rabindranath Tagore’s essay, *Civilisation and Progress*, in which the poet reminds us that a ‘creative spirit’ and ‘generous joy’ are key in childhood, both of which can be distorted by an unthinking adult world. The opening chapter discusses curricular reform efforts made since Independence. The National Policy on Education (NPE, 1986) proposed the National Curriculum Framework as a means of evolving a national system of education, recommending a core component derived from the vision of national development enshrined in the Constitution. The teaching of mathematics should enhance the child’s resources to think and reason, to visualise and handle abstractions, to formulate and solve problems. This broad spectrum of aims can be covered by teaching relevant and important mathematics embedded in the child’s experience. Succeeding in mathematics should be seen as the right of every child. For this, widening its scope and relating it to other subjects is essential. Developing children’s abilities for mathematisation is the main goal of mathematics education (NCF 2005). The narrow aim of school mathematics is to develop ‘useful’ capabilities, particularly those relating to numeracy—numbers, number operations, measurements, 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 the attitude to formulate and solve problems. NCF 2005 seeks to provide a framework within which teachers and schools can choose and plan experiences that they think children should have.

NCF 2005 gives us deeper insight to address the problems

Kerala encounters in the present educational scenario. NCF-2005 has incorporated the theoretical, ideological and historical approach that we had assimilated in our curriculum. This could be treated as a sign of recognition to Kerala’s vision of education.

The suggestions of the National Curriculum Framework regarding the learning of Mathematics are:

- 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 themselves, to work together on.
- Children pose and solve meaningful problems.
- Children use abstractions to perceive relation-ships, 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 generalisation.
- Teachers engage every child in class with the conviction that everyone can learn mathematics.

### Kerala Curriculum Framework 2007

The curriculum revision programme in Kerala is launched as part of an endeavour to strengthen the Primary, Secondary and Higher Secondary school education in Kerala. The curriculum revision programme in Kerala was conceptualised on the basis of the recommendations of the National Curriculum Framework (NCF 2005).

KCF 2007 has identified the need for the introduction of an issue based curricula using critical pedagogy as the base. The curriculum revision process was initiated in Kerala in 2007. Critical Pedagogy and Social Constructivism are the bases on which curriculum is rooted. On the basis of these two concepts SCERT revised the instructional material and introduced new mathematics textbooks.

At the Secondary Level, students should acquire in-depth knowledge of Mathematics and should also acquire the learning methods of the subject. The knowledge gathered should be sufficient enough to be used in daily life and it should help them obtain training in one of the vocations that would facilitate their social life. The secondary level should also help them realize their aptitudes and equip them for higher studies. The method of learning at this level can be carried out as projects or assignments training, Art Education, Physical Education and library and literary activities.

According to KCF 2007 Mathematics taught till the 10th standard has many levels.

- Mathematics that is required in daily life. E.g. basic calculations, percentage, measurements etc.
- Mathematics that is useful for higher studies. E.g. Trigonometry, statistical data interpretation, Algebra and Geometry. els.
- Ideas that go deeper into the complex details of Mathematics: e.g. Proof of geometrical principles, the latent infinite character that is inherent in irrational numbers etc.

### Comparison of old and new curriculum

- The new curriculum drastically reduces the role of the textbook, the tuition master and the parent. The crucial

role becomes that of the teacher.

- The new curriculum offers so much scope for improving the latent talents of the students, which would have otherwise remain dormant.
- The new curriculum requires the teacher to work more in order that the students can reach at the appropriate conclusions. The burden of the teachers increase in various other ways.
- The old textbooks were but a collection of essays on particular topics, for the teacher to teach and the student to memorise. In contrast, the new textbooks are a collection of material for the activity-based inquiry.

#### **Criticism to the New Mathematics Curriculum of Kerala**

With the introduction of New curriculum a lot of criticism has come from various corners especially through media and it has become a centre of discussion .Some of the criticisms felt by the investigator through document analysis of NCF 2005, KCF 2007 and the Mathematics textbooks from standard VIII to X are following below.

- There is an urgent need for continuous programme of monitoring and evaluation of the curriculum.
- The curriculum is disappointing not only to the non-participating majority, but also to the talented minority by not offering them challenges.
- The curriculum is overloaded and high emphasis is given on knowledge aspects.
- The curriculum and textbooks don't reflect the needs and aspirations of the learner.
- The ongoing curriculum doesn't help to achieve various categories of objectives in a fair manner.
- It doesn't give due importance to differentially abled children.
- Teachers don't get chances to participate in regular evaluation of curriculum.
- Curriculum is delinked with daily life skills.
- Teachers and teacher educators felt lack of involvement in the process of curriculum construction.
- The major defect of the school curriculum is lack of practical knowledge, emphasis on information rather than understanding, and it embodies a heavy load of subject matter.
- The preparation of secondary school curriculum is highly centralised at the regional government respectively to limited experts.
- The syllabus is very vast and is expected to be covered at the end of each academic year which forces the teacher to proceed whether the students understand or not.

#### **Analysis of Secondary Level Mathematics Text books**

Textbooks have always been an integral part of education. This is especially true in developing countries where it remains as the only resource material available for all learners. Mathematics remains a key subject in school education and the textbooks play an important part of school mathematics. Textbooks provide a framework for what is taught and how it is taught. Textbooks also impart a sequence that is followed in a particular subject. Given the sequential nature of mathematics, the mathematics textbook becomes a vital component for mathematics achievement. The National Policy on Education stresses on learning mathematics as a compulsory subject up to class X. It is also imperative to see to what extent the school mathematics

textbook reflects the changes in the mathematics curriculum that have taken place.

Even though in the present textbooks it is stated that all attempts have been made to reflect learner centred, activity oriented and environment oriented approach, the text books have faced several criticisms related to various aspects. So a systematic and scientific analysis of content is very essential. For the purpose of this paper the textbooks of standard 8,9 and 10 are analysed and also two theses related to content analysis of Kerala State Syllabus mathematics textbook are referred.

#### **General criticisms on new mathematics text books**

The text books for secondary classes are not effective in planning and decision making of classroom instruction.

The content in the textbooks is not appropriate for achieving the objectives framed by NCF 2005 and KCF 2007.

- The content is not logically organised according to the difficulty level.
- Activities are given in the textbooks .but the activities are not so much interesting or thought provoking.
- The data given in the side boxes are very useful but due to lack of time or heavy work load the teacher it is not able to transact in the classroom. Also the information provided is not timely updated.
- Not enough explanations are given in the text book for describing the content or steps in solving problems. It creates lot of confusion among parents and make them difficult to help the children in studies.
- Even though the new textbooks are useful for understanding the need and significance of the chapter, The definitions are not given in the text books so that the children cannot get idea of the subject and they are forced to buy guides like Labour India and go for tuition. The preparation of textbook does not give the consideration for the age of students. There is incongruence between the content and level of the learner. The text book consists of various errors and redundancy and even some of the terms are difficult to the teachers themselves. The portion to be covered in one academic year is vast and teachers are forced to complete it regardless of mastery by students.
- Text books are not accompanied by basic essential pictures but it contains a lot of irrelevant cartoons.
- The chapter begins with unnecessary and irrelevant examples creates boredom in the learner.
- The arrangement of topics is not in a proper and systematic way.
- Use of sufficient terminologies in mother tongue is lacking nad it is a serious issue in mathematics class room. It is not addressed in the new textbooks. For instance, the Malayalam terminology come under Trigonometry section appears in side boxes.

#### **Suggestions to minimise the limitations in the curriculum**

- Changes in curriculum should not be something synonymous with a change of government.
- The regional education bureau should design a mechanism whereby teachers opinions are included in the preparation of the syllabus and text books. Through this involvement, problems related to syllabus such as its vastness, relevance to daily life of the children, redundancy etc can be solved.
- In order to realise educational objectives, the curriculum

should be conceptualised as a structure that articulates required experiences.

- The authors of textbooks should be given directions on what the textbooks should aim at, or what the expected competencies that the students should achieve from the lessons.
- Efforts are to be made to improve the quality of mathematics textbook.
- The curriculum should be prepared with the participation of teachers, students, professionals and concerned bodies.
- Curriculum must be flexible enough for the teacher to deal with the capacity of each individual child.
- Effort should be made to bring attitudinal changes among students, teachers and parents towards learning of Mathematics.
- As teachers are those who are doing the actual work of transacting the syllabus, they should be consulted for their opinions on what the syllabus should focus and how the text books should be prepared.
- The vastness of the text book should be minimised. If relevant and required language is used for explaining the procedure it would enhance the quality of mathematics text books.
- The text books should be accompanied by pictures as the children can easily visualize and understand it more easily.
- Curriculum should be designed in such a way that the students and society can use it in their daily life and students should be aware of its practical application.

### **Conclusion**

it is clear from the present study that, the existing condition of mathematics learning owes much to the deformities in the present curriculum. The text book preparation should be done strictly based on the guidelines of NCF 2005 and the curriculum committee should take necessary steps to reform the mathematics curriculum by incorporating suggestions from various stakeholders, so that great change can take place in future in the field of mathematics education and miserable condition of students' hatredness towards mathematics can be banished a lot.

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