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Developing General Guidelines for Textbook Writing Process

Abstract

This article talks about Chhattisgarh mathematics textbook writing process for secondary grades. It investigates how the principles and framework of the textbook evolved and their alignment to the NCF-2005. This article begins with the development of common guidelines. Then it focuses how these guidelines are linked with the objective of learning of mathematics at the secondary stage and the content presented in the book. The implication of the principles is highlighted as some of the chapters are added, types of problems, and in various other ways.

Introduction:

Based on the ideas of National Curriculum Framework (NCF) -2005, NCERT, state governments have redesigned/revised their curriculum frameworks, syllabi and textbooks. NCF-2005, recommends that school life must have a connection to the Children out the school. Efforts were made to implement this idea in the textbooks and syllabus. NCERT's Mathematics textbooks of grade 6th to 8th were written in the light of same principles as suggested by NCF. They delineate from the idea of rote learning and provide students opportunities to think and explore the subject.

Similar process was initiated by Chhattisgarh government in 2013. Curriculum and textbooks of all the subjects were revised and textbooks were rewritten. The group consisted of teachers, teacher educators, subjects experts of all the subjects gathered primarily across the state and also from outside the state. They contextualized the principles of textbook and curriculum given in the NCF as per the state needs.

Here, we will first look through the process of development of common guidelines. Then, in particular we will discuss the process of mathematics textbook writing for grade 9th and 10th. In this section, we will focus on mathematics textbook principles and framework development, how they were decided, challenges and decision making process of the team.

Developing General Guidelines for Textbook Writing Process:

The group (people from all the subjects) started to brainstorm with 3 questions:

a. What does a child know when she comes to grade 9 and 10?
b. How does a child learn or build on her knowledge?
c. How this will help a teacher to best assess students' understanding? or How does a teacher can assess child's knowledge and help her to learn the concept?

These three questions were discussed in smaller groups. After a day-long discussion based on experience and their understanding, group developed a rationale for the process and mental structure of the syllabus. It was interesting to note that the ideas emerged after; about adolescent child's understanding, process of child's

learning, assessment, classroom processes were aligned to NCF-2005. Arguments, debates and discussions during this exercise helped the group to start with same idea that was useful further.

The discussion was focused on following points: (i) "In grade 9th and 10th where children reach an adolescent age have an understanding of their surroundings" (ii) They are acquainted to geographical, environmental issues and also have an idea about local governing bodies. Hence, the content has to be written so that they can build on their prior knowledge. (iii) Children at this age do daily life calculations, appreciate shapes and dimensions around. They have good command in first language; also use second language in their peer group. Next issue discussed was, how do children learn? They learn mostly by observation, group discussions, reading things, media, etc. Therefore there should be such opportunities in the textbooks.

Common/large group session was followed by subject-based session. All the groups again thought through similar questions from their subject perspective. And, this task helped the subject groups to develop an outline of subject textbooks. Let us see how things went in mathematics group.

Principles of Mathematics Textbook Process:

What are the features of a good mathematics textbook?

Position paper of the National Focus Group on Curriculum, Syllabus and Textbooks says, it is important for curriculum writers to keep a pace and alignment with the developing technology and changing world. Here the focus shifts from 'selection' and 'organization' of the information to the development of a curriculum that "manifests life in its reality'. Framework of the textbook must reflect this idea of content. Further, as per the position paper, the purpose of doing mathematics at secondary level is to think in abstraction, develop logical thinking, problem solving skills and establish inter concept linkages.

We thought through characteristics of a good mathematics textbook:

The very first principle we discussed: "*Textbook is for children to read and do*". This basic idea has direct implication on the language of the text which has to be simple and easy to understand. Hence, it was decided to avoid complex vocabulary and terms, so that the focus can remain over the concept only. Second, it is also expected that children could relate to the examples and conversations to their surroundings. Therefore, very new concepts must be introduced with appropriate context that scaffolds to the abstraction, structuration and generalization.

In continuation of the above points, textbook must not look text heavy. Illustrations can be added to make the presentation more interesting.

NCF-2005 argues that mathematics curriculum must not limit itself to procedures and algorithm. Rather it has to expand to exercise conceptual depth and capacity of reasoning of the students. To fulfill this, textbook should help students to explore the concepts and articulate definitions in their own words. Focus must not be to memorize the formulas, but to derive the formula. In secondary grades, students come with basic understanding of arithmetic; algebra and geometry. Doing proofs, generalization and to build logical reasoning are amongst major objectives of secondary stage mathematics learning. Therefore, textbooks must have enough scope where students could explore proofs and various aspects of proof construction.

Mathematics is considered as a formal ground of problem solving in the school. Students develop in-depth conceptual understanding when they understand the questions, make mental map of the solution. This process is deemed important while doing mathematics. And therefore, curriculum should offer sufficient room of exploration in answering questions. There has to be various types of questions to practice; not just questions with unique answer. We decided to keep a good mix of questions, so that every student can find challenge while solving those.

It was discussed that not only solving questions is important, but making new questions develops comprehensive understanding of the concept. Hence, textbooks should have opportunities where students can make new questions and solve them with their peer or teachers. Students must be able to articulate and explain the solution. And it is also proven that peer group-discussion fosters learning process. So, the group agreed to have sections where students will do group activity on any concept. These may either be puzzles through which students could explore the concept behind, open ended questions to discuss upon or some small project.

And it is expected that not only students can prove mathematical statements but also can make more such statements with the use of mathematical terms and symbols. Upper primary section onwards, the language of mathematics becomes formal. Students often feel uncomfortable with the use of formal signs, symbols or terms in algebra. And this makes further difficult for them to establish linkages across the different subjects. To address this point, we decided to put such opportunities may be in the form of separate chapters or practice exercises where students could use various symbols and terms, especially while doing proofs.

Many principles, we found are common to those of NCERT Math textbooks from class VI to class VII. This is how above principles were reflected in the textbook.

At secondary stage, students are expected to perceive the structure of mathematics and understand the logical connection of the mathematical statements. That is why doing proofs become significant at this stage. Earlier also we discussed that proofs, rigorous use of formal terms and symbols while writing mathematical statements is a useful tool which mathematics offers. This helps to solve many problems across the subjects. These points brought us to the decision of keeping a separate chapter on mathematical proofs. It consists of proofs from geometry, numbers, and trigonometry to highlight the usefulness of the proofs in different topics. This chapter also unwinds the logics behind the proofs of the propositions they have read in middle grades and with practice problems so that students can get comfortable with formal mathematics language and its significance while writing mathematical statements.

National Curriculum Framework also emphasizes, on mathematisation. It says that students must not follow the algorithm and find the answer in mechanical manner, but they should learn and think through different approaches to the problem and then put them in mathematical form. Students learn the most when they do the problems, discuss or explain them in peer group. That is why the textbook contains the opportunities where they are expected to do the challenging problems, or puzzles together. Further, a new chapter 'Playing with Numbers' was conceptualized where students

find out the possible unknowns in the given set of numerical condition. The idea was to foster abstract thinking by giving them questions.

Another objective of secondary stage mathematics states 'to consolidate the different topics she has learnt'. It is important to link conceptual and procedural knowledge at this stage. One of the ways is to integrate different academic areas is to ask questions which require understanding of more than one topic. Specially, numerical problems in the chapters like ratio-proportions, banking, geometrical constructions, mensuration were made more meaningful and with easy calculations. Apart from this, we also tried to link different chapters. For example, Ratio-proportion was linked in mensuration, similarity and shapes, etc.

While discussing about 3-D structure and solids, it was realized that visualization and representation of solid structures should be discussed again in this grade. Hence, solid net diagrams were repeated with few practice questions followed by a short discussion. In this manner, we built on each other's experiences.

NCF says that the level of visualization and analytical reasoning in geometry needs to be upgraded and it can be done with an appropriate tool of learning. With this idea transformation geometry was added as one chapter in the textbook. Transformation geometry deals with moving or transforming geometrical figures which learners recognize and understand their properties. Hence the chapter has opportunities for investigation of geometrical properties to be done by moving/manipulating the shapes; i.e., by translation, rotation, reflection or dilation. In the chapter while working on transforming figures, students are expected to use the concepts of similarity, symmetry and congruency.

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