Developing Textbooks for Primary Mathematics

Background to the Sikkim Classes I to III textbooks

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In 2018, Sikkim wanted to revamp their primary textbooks for language, mathematics and environmental studies (EVS). The state was not satisfied by the existing textbooks for Classes 1-5. (They used NCERT textbooks from Class 6 onwards.) Sikkim SCERT took help from Mahatma Gandhi Institute of Education for Peace and Sustainable Development (MGIEP), UNESCO and Azim Premji University for this venture. MGIEP's objective was to embed the Education for Sustainable Development (ESD) goals in textbooks. This was the first time such an embedding was attempted for primary level textbooks anywhere in the world. The state had also partnered with Jodo Gyan[1] in the past. So, most of the resource persons were exposed to both how interactive and fun mathematics can be, as well as to various teaching-learning aids. The team of authors included teacher-educators from the SCERT and DIET(s) and school teachers.

The mathematics group had 12 authors divided into three smaller equal groups for Classes 1-3. Dr. Wagner from UNESCO and two members of the Azim Premji University Resource Centre worked with these groups of authors. The first few meetings were to orient the authors to various aspects of textbook writing, giving them an understanding of ESD and also to develop a syllabus for these three classes. We met for almost a week each month once the chapter writing started. Gangtok DIET had already received a set of number kits (for whole numbers, fractions, decimals and integers) from Math Space, the mathematics laboratory of Azim Premji University.

While the authors had good command over mathematics, it was not always easy to come up with stories and examples rooted in the local contexts and with a flavor of ESD. Each example had to be thought through. Each topic had to be introduced with the

1 See https://jodogyan.org/

need for the concept, while connecting it to the life of the local people. The second challenge was to make the pedagogy constructivist – bringing in a flavor where children are encouraged to discover rather than the textbook (or an adult facilitator) telling them what to do. So, conversations among children as well as those with teachers and other adults were used often. Many a time, the initiating question would be posed by a child and the adult attempted to help the child (or children) figure things out rather than giving a direct answer. Games and activities were also included wherever possible. Many of these were done as stories, so that the teacher (and the children) could connect both to their world and to mathematics through play.

While the textbooks were based on the NCERT Math Magic series, they were modified so that the local food, fruits, trees, games, festivals and various other aspects of their culture got represented in the chapters. In addition, materials were included to explain concepts. All the authors felt the need for materials and understood the benefits they offer. We borrowed from the works of Maria Montessori, Rohit Dhankar in Digantar, Jodo Gyan and the Pullouts from the Azim Premji University and CoMaC publication *At Right Angles*.

The entire project got further enriched as we were joined by a group of designers from the state. Thanks to their efforts, the textbooks turned out to be full of colorful pictures representing the local people and their culture.

We added thematic chapters in both Class 2 and Class 3 to showcase how different mathematical concepts could be used in day-to-day lives. ESD was new for all of us. Almost all exemplars in the MGIEP guidebook involved higher level mathematics – using algebra and functions to model and optimize. So, we had to figure out what could be done with the basic concepts in the beginning years of primary mathematics. Apart from going local, we focused on fruits and vegetables rather than candies, rural situations in addition to urban ones, local measures used for weight and capacity and issues (like landslide) that people commonly face in Sikkim. Moreover, we included choices people make based on mathematics – e.g. why are wheels round, or what would happen if the football was a cube.

The best example of this effort was the following: We decided to include a child with one leg in one chapter of Class 2 to fulfill a mathematical need as well as to be inclusive. Another author liked the idea and added a child with one arm as a character in another chapter in Class 1. So, we added Braille in the patterns chapter in Class 3.

We were aware that these textbooks would be very different from the existing ones and therefore the teachers would need a lot of hand holding. We decided to address that in two ways – (i) include a "Teacher Note" wherever needed within the chapters, and (ii) add "Teacher Pages" for selected chapters in each textbook. In addition, we added a "Note for Parents and Teachers" at the beginning of each textbook to help them understand the thoughts behind the approach. The learning outcomes for the respective class were also added to each textbook. Sikkim also got the textbooks reviewed by experts from the state. Their feedback was also incorporated.

After one year of hard work, we had an orientation workshop with the teachers from 40 pilot schools, who would use these new textbooks for a year. They went through various selected portions of the textbook, many activities and uses of various materials embedded therein. They agreed that the new textbooks were very different from what they had been using so far, and that it would require them to work hard. However, they were all willing to put in the effort. And they did!

In the end, we got enriched by the experience of working deeply in primary mathematics, had the privilege to build on the work of many others, stretched our horizons w.r.t. Education for Sustainable Development and most importantly could contribute meaningfully to the lives of school children of an entire state.