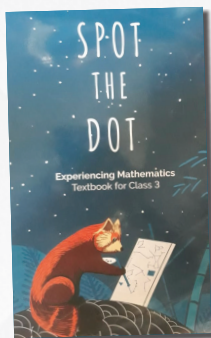


Finding Mathematics, Playing Mathematics Experiencing Mathematics

Reviewer: Padmapriya Shirali



Concealed behind children's daily activities, there is a lot of mathematics comprising counting, comparing, estimating, recognising patterns, sequencing, logical thinking, and reasoning. By including all these aspects, the Sikkim SCERT Math books make the subject more child centred, less abstract, and more appealing.

Textbooks, particularly in mathematics education, play an important role in guiding teachers in the use of effective teaching methodology. A lot of the teachers' instruction in the areas of introduction of concepts, usage of mathematical contexts, development of a topic, teaching of procedures and exposure to a variety of problems and skill building are directly drawn from the text. Young students who are not yet literate are guided through the text by the teacher apart from drawing the students' attention to the illustrations and pictures. Sadly, mathematics is often taught in a dry and uninspiring way at school, usually with an emphasis on computations. Through illustrations, dialogs, activities, games, puzzles and stories, this set of books will engage children in enjoying learning mathematics.

By drawing from the local culture and environment in Sikkim, and by using stories and contexts relating to sustainable development, the authors have brought an integrated approach which is definitely the need of the day.

Keywords: textbooks, pedagogy, sustainable development, child-centric, local context

Organisation

The books are divided into several small chapters, each falling into one of three main categories: number, shape, and measurement.

The Standard I book teaches numbers, shapes, measurement, time telling, money, and graphs.

The Standard II book teaches addition and subtraction with exchange, place value, measurement, money, time telling, graphs, and geometric shapes.

The Standard III book has more advanced work on the three arithmetic operations, measurement, graphs, time, and geometry.

The authors have been able to meet several guidelines that had been laid out in the initial note.

- **From the foreword:** “The content of the books is embedded in the socio-cultural context and experiences of the children.” Anyone going through this book will also learn about the culture and the distinctive characteristics of this beautiful state.
- **From the note to teachers and parents:** “It aims to help children engage with mathematics, construct their own knowledge and think mathematically.” The text makes good usage of number lines for operations, bamboo strips for building multiplication tables and other materials in geometry and measurement topics.

Teacher support features

There is also a note to parents and teachers that outlines the vision of mathematics education and the underlying thinking behind the organisation of this book, and a list describing the expected learning outcomes. The teacher pages for selected chapters are well written and provide ample suggestions in the usage of manipulatives.

At several places in the text, there are pointers for the teachers that provide suggestions. For example: “Teacher’s Note: Get the children to find out – How many members are there in your family? Who is the shortest among them? Who

is the tallest in your family?” By acting on these, teachers can help children link the concepts learnt in the classroom to home situations.

Student centred features

- The material makes connections to students’ prior knowledge, skills, experiences, and interests.
- It consists of various forms of representations, diagrams, graphs, models, tables, pictures, manipulatives and symbolic expressions that define mathematical relationships in order to help students organize their thinking and interpret mathematical situations.
- The language used is simple and clear, and within the grasp of students. The fonts used are large and readable, and the books have been designed with an appealing cover. Basic mathematical vocabulary has been introduced with nice illustrations in the Grade 1 book.
- Understanding of concepts precedes the ability to write the signs and symbols and it is good to see that words like more and less have been used before the usage of symbols like $<$, $>$.
- Familiar games like *Pittu* have been used to talk about small numbers and operations with small numbers.
- Themes like Neeraj’s kitchen garden provide scope for building various mathematical problems. A lot of mathematical discussion can happen around these pictures. A good teacher can use the illustrations in these books in creative ways to help children to think further.
- Open-ended questions have been incorporated in various places.
- Word problems are incorporated at all levels and require the students to develop facilities with mathematical language in real life contexts. By repeatedly encountering mathematical language, children will be able to express their understanding and communicate in precise terms.
- There is also sufficient variety in the word problems to apply different concepts so that

the students reflect on the context and do not solve them mechanically.

- Activities have been incorporated at appropriate places to demonstrate concepts and help in building skills.
- It is difficult to teach someone the joy of something until they experience it themselves. There are various fun problems throughout the book for the students to solve. Students of a wide range of mathematical abilities will be able to find activities and tasks that interest them, and which they can engage with productively. There are many worked examples to build confidence in the students. There is enough scope for mathematics concepts to be communicated through representation, discussion and drawings.
- Students also see multiple ways of solving problems. There are also questions that get students to do some problems in different ways. 'Fingers: Can you show 8 in another way?'
- Thematic problem solving has been used in all the books (for example, *MeghaMela*), and several concepts have been covered under each theme. This is an attractive replacement for normal review exercise and reinforces the concepts and skills covered.
- The intention of any mathematics course is to get children to think mathematically rather than just having them memorize the mechanics of problem solving. A good attempt has been made by requiring students to experiment, observe and reason things in measurement, geometry, shapes, etc. Reasoning and understanding are critical to the learning of mathematics.

Suggestions

- While place value has been explained well through the usage of various materials, more work in preceding numbers and more emphasis on transition of numbers to the nearest tens and hundreds would have helped in the Class 3 book. Transition points such as the passage from 299 to 300 or 419 to 420 (understanding the manner in which digits

change) are always tricky areas for students. Introduction of hundred and other hundreds could have emphasised the relationship of tens to hundreds.

- A discussion on how to find the greatest number could have helped. Problems which require ordering of number sets such as 101, 9, and 45 would have tested the students' understanding of place value.
- For young children, a program needs to lay a solid foundation for conceptual understanding using a three-step process. It should take the children from concrete, to pictorial, and finally to the abstract form. This order could have been maintained in the book by having exercises linked to concrete material precede problems involving abstraction. For example, in Book 2, *churpis* (nuggets of local cheese) could have been used before discussing number charts and the number line.
- In Book 2, the topic of number line addition could have been built up gradually: adding single digit numbers, followed by double digit and single digit numbers, followed by double digit and multiples of ten, and finally by double digit and double digit. The same holds for *Ganitamala* exercises.
- Subtraction could have started with usage of concrete materials before being demonstrated on a number line. Again on the number line, it would have been good to build up the topic gradually, using both forward counting and backward counting.
- A fundamental principle involved in teaching mathematics is to derive new facts from known ones. Understanding the relationship of addition and subtraction processes strengthens the ability of the child to do problem solving in addition and subtraction. A little more emphasis could have been given to the fact that each addition fact gives rise to two subtraction facts.
- Missing digit problems in vertical addition and subtraction problems of 3 digits would have been a good challenge.

The text stresses conceptual understanding over math-fact drill at this level. Teachers may need to supplement the text with additional exercises in some of these areas to provide the necessary level of practice.

Closing remarks

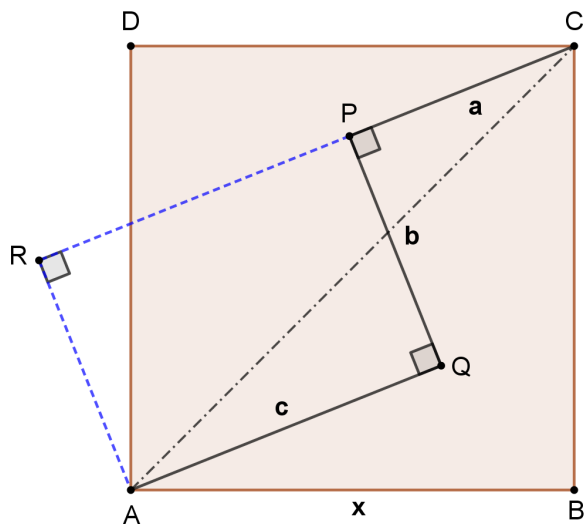
On the whole, this set of three books has been successful in making an attractive presentation of the various mathematical concepts from which all students will benefit. The concrete

introduction of each concept makes new units approachable even without complete memorization of math facts. The attractive pictorial layout will draw students into the lessons, and make learning enjoyable.

It is commendable that the books have been designed both pictorially and in content in an appealing manner for children. They are the kind of books that children would be happy to leaf through on their own.

Here is our solution to the Think Out of the Box problem from the July 2020 issue.

Special thanks to reader Tejash Patel who sent in a solution based on Coordinate Geometry.



CP = a
PQ = b
AQ = c
AB = x

Extend CP.
Draw a perp to CP from A
Let it meet CP extended at R
PQAR is a rectangle
PR = c, CR = c+a, AR = b
AC is hypotenuse of rt triangle ARC

$$AC^2 = b^2 + (a + c)^2, \therefore x^2 = \frac{b^2 + (a + c)^2}{2}$$