## Dimension 4: Student Tasks

A successful math curriculum is achieved with an appropriate balance of mathematical tasks, including the practice of skills, application of procedures, and rich problem solving. This balance is determined by curriculum expectations/outcomes and the needs of the students. And, even if students have not mastered basic skills, they should still have opportunities to engage in rich tasks.

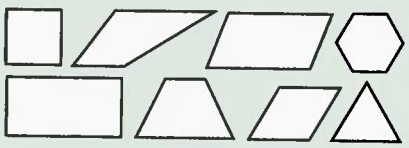
### RICH TASKS

Rich tasks have many of the following characteristics. They

- are problem based, that is, present students with a problem to solve
- allow for multiple possible solutions and/or multiple answers
- enable all students to participate at their own level
- allow students to generate and select appropriate problem-solving strategies and/or procedures to solve problems
- involve multiple representations or models, such as manipulatives, drawings, numbers, or words
- present math in a context that makes connections to other math topics, other math strands, other subjects areas, and the real world
- lead students to consider important mathematical ideas
- expect students to reflect on and communicate their thinking
- often result in unexpected and ingenious solutions

*Not every mathematical task must be rich, but all students should have regular opportunities to respond to rich tasks.*

One way to understand the difference between a skill-based and rich task is to take the same "content" and shape it in both ways. Compare these tasks:

| Skill-based task | Rich task |
|---|---|
| a) Colour all the quadrilaterals blue.<br>b) Draw stripes on all the rectangles.<br>c) Put dots on all the trapezoids.<br>  | Paul is building a pen with 4 straight sides for his rabbits. He cannot decide on what shape it should be.<br>a) Create four different possible pens.<br>Only one can be a rectangle.<br>Use a geoboard or cut straws for side lengths.<br>Draw each shape on grid or dot paper.<br>Name each shape.<br>b) In what ways are your pens the same? different?<br>c) Which shape of pen do you think he should build? Give a reason for your answer. |

Both tasks address identifying quadrilaterals; however, the depth of coverage differs. The second task is richer because

- it is problem-based
- multiple solutions and answers are possible
- higher-order thinking is involved (comparing and contrasting)
- students represent or model quadrilaterals
- students communicate their reasoning
- a meaningful context is used

*The focus should be more on the solution and the process followed rather than on getting the right answer.*

## ENGAGING SKILL-BASED AND PROCEDURAL TASKS

Although rich tasks include opportunities for students to practise skills and apply procedures, there is still a need to assign skill-based and procedural tasks for skill development. These tasks should be made as engaging and meaningful as possible through the use of contexts, games, and puzzles.

### Using Games and Puzzles

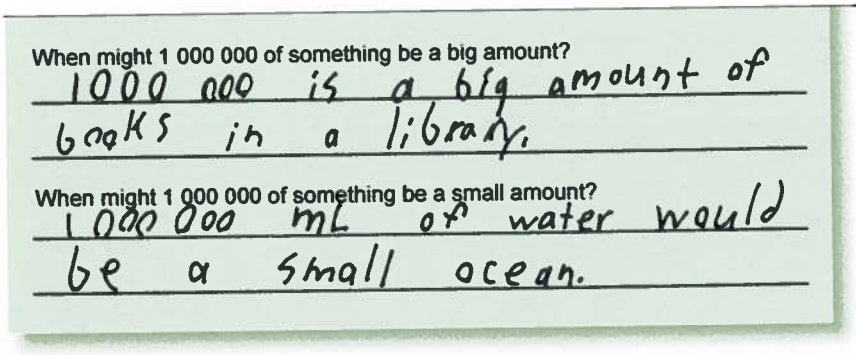
Although playing a game or completing a puzzle does not make the mathematics more "important," it does make the practice of skills more interesting and results in a higher level of participation. In a relatively short period of time, students can practise many math skills in a game or puzzle situation (often without paper and pencil).

## CONTEXT

The use of context can make any task engaging whether it is skill-based and procedural or rich. Some possibilities are

- contexts in the child's world, for example, collections and friends
- cross-cultural contexts related to students' cultural backgrounds
- contexts that are whimsical, fanciful, or silly, like superheroes
- contexts in the grown-up world, such as, what adults do with math
- contexts in other subject areas, for example; symmetry in art, half, quarter, and eighth notes in music
- children's literature that has mathematical value

*If math is to be a tool to be used in other discipline areas and in real life, students must learn math in those contexts.*




***Student Response***
*This student knows that context is what gives meaning to numbers.*

## REPRESENTATION AND MODELLING

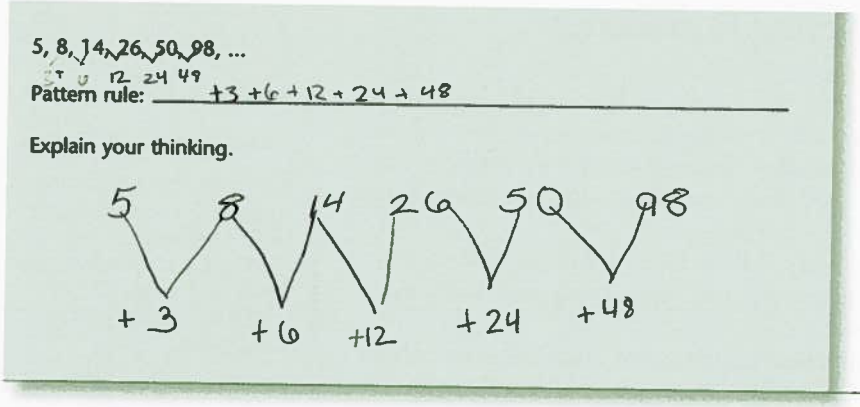
In the rich quadrilateral task described on page 25, students were able to solve the problem by representing quadrilaterals, in this case, by creating them on a geoboard or using straws to represent the sides (concrete representations) and by drawing diagrams on grid or dot paper (a pictorial representation).

Students can use representations to solve problems, understand concepts and procedures, provide a record of their thinking, and to communicate their solutions (see the **Student Response** on the next page). While primary students might use concrete materials such as counters or hand-drawn diagrams, older students would be expected to use more abstract representations such as equations and graphs (although it is important to stress that older students continue to need the support of concrete representations, particularly for new concepts and procedures). What is important is that students be given opportunities to construct and choose their own representations to support their learning.

**REPRESENTATIONS**

Representations that make abstract mathematical ideas tangible include

- concrete materials such as manipulatives
- diagrams
- tables, charts, and graphs
- words and numbers
- graphic organizers such as Venn diagrams




***Student Response***
*This student has used numbers in an effective way to explain and model a pattern rule.*

## HOMEWORK

Some teachers are quite comfortable assigning rich tasks for homework, while others prefer to have students work on rich tasks at school and assign more skill-based and procedural tasks for homework. Some teachers feel rich tasks are generally more suitable for the classroom, where teacher and peer support are available, although there may be aspects of a rich task that might be assigned as homework either prior to the start of the task or as follow-up. For example, if students were to be engaged in a rich task involving symmetry, students might be asked to look for symmetrical shapes at home the night before. There is no right or wrong approach here, as long as students receive an appropriate balance of skill-based, procedural, and rich tasks in their overall math program, which includes homework.

***It is important that students have the appropriate amount of support and preparation if rich tasks are assigned for homework or they can become a source of frustration for both children and parents.***

## HOW THE ADMINISTRATOR CAN SUPPORT THE TEACHER

The administrator can help the teacher in this dimension by

- providing resources that include rich tasks
- providing opportunities for teachers to share rich tasks
- informing parents on the value of rich tasks
- commenting positively on student work where nonconventional, but appropriate, representations are used
- ensuring there are ample materials available (including manipulatives) for students to use for representation
- encouraging and supporting professional development activities that focus on the use of rich tasks and the role of representation

**PRIMECONNECT**

*Background and Strategies*

This book in each mathematics strand of PRIME contains support for teachers with respect to problem solving (rich tasks) and the use of context and games in mathematics instruction.

(See page vii.)

## LINKING THE NCTM PRINCIPLES AND STANDARDS

This dimension links most strongly to the following NCTM principles and standards (see pages 4–7 in Section 1):

- *Equity* by ensuring all students are successful at rich tasks; rich tasks allow for high-achieving students to extend themselves but should be accessible to low-achieving students
- *Curriculum* by ensuring math instruction is important and meaningful
- *Teaching* by supporting student learning by engaging them in activities that will motivate their interest and challenge them
- *Problem solving* by providing rich problem-solving tasks
- *Connections* by using interesting contexts that make connections among strands, with other subjects, and with the real world
- *Communication* by expecting communication of solutions and discussion and interaction among students to share strategies and solutions
- *Representation* by using modelling to represent math concepts and procedures and to solve problems and communicate solutions