steps
PROFESSIONAL DEVELOPMENT

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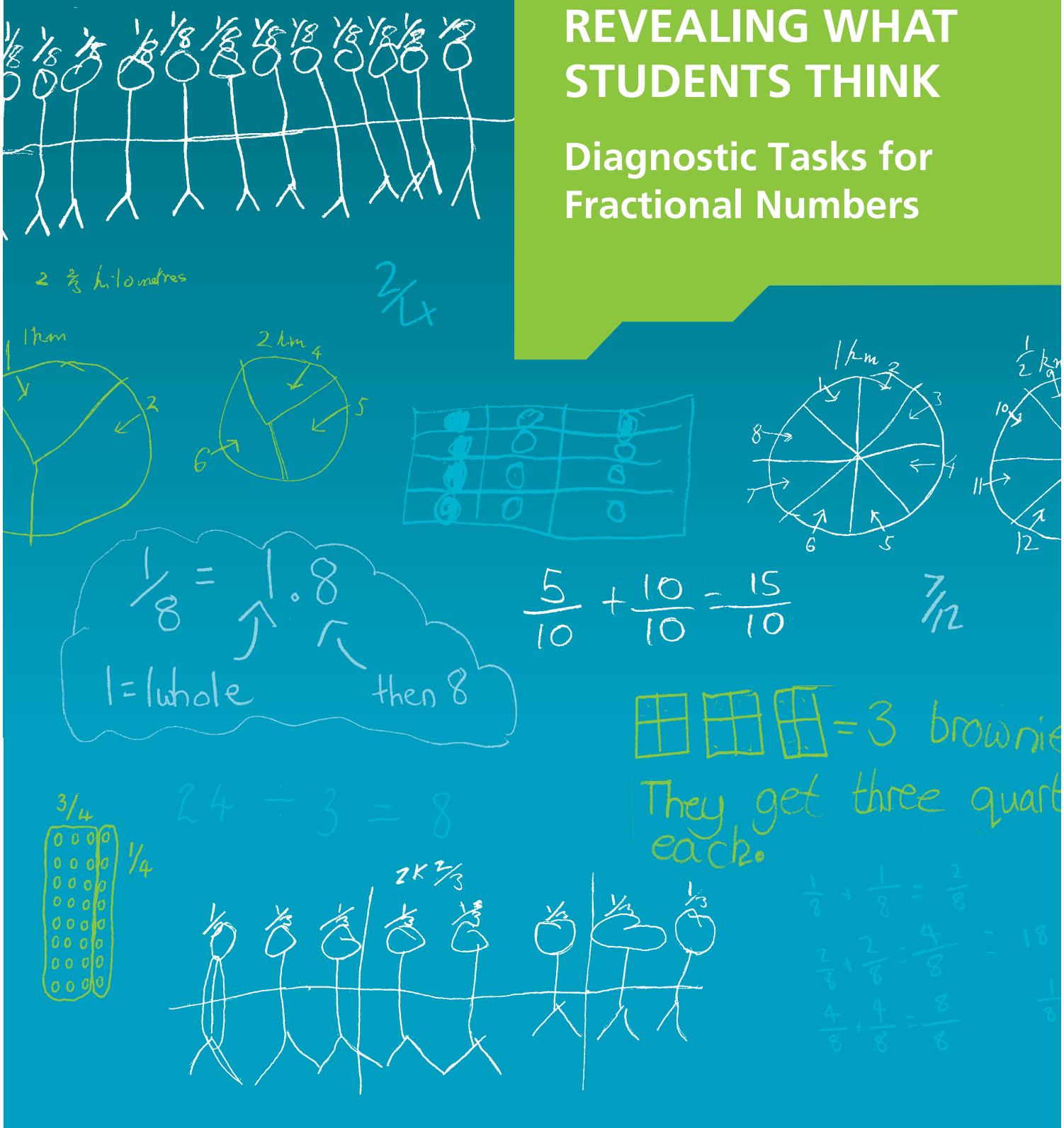
REVEALING WHAT STUDENTS THINK

Diagnostic Tasks for Fractional Numbers



Purpose of this Book

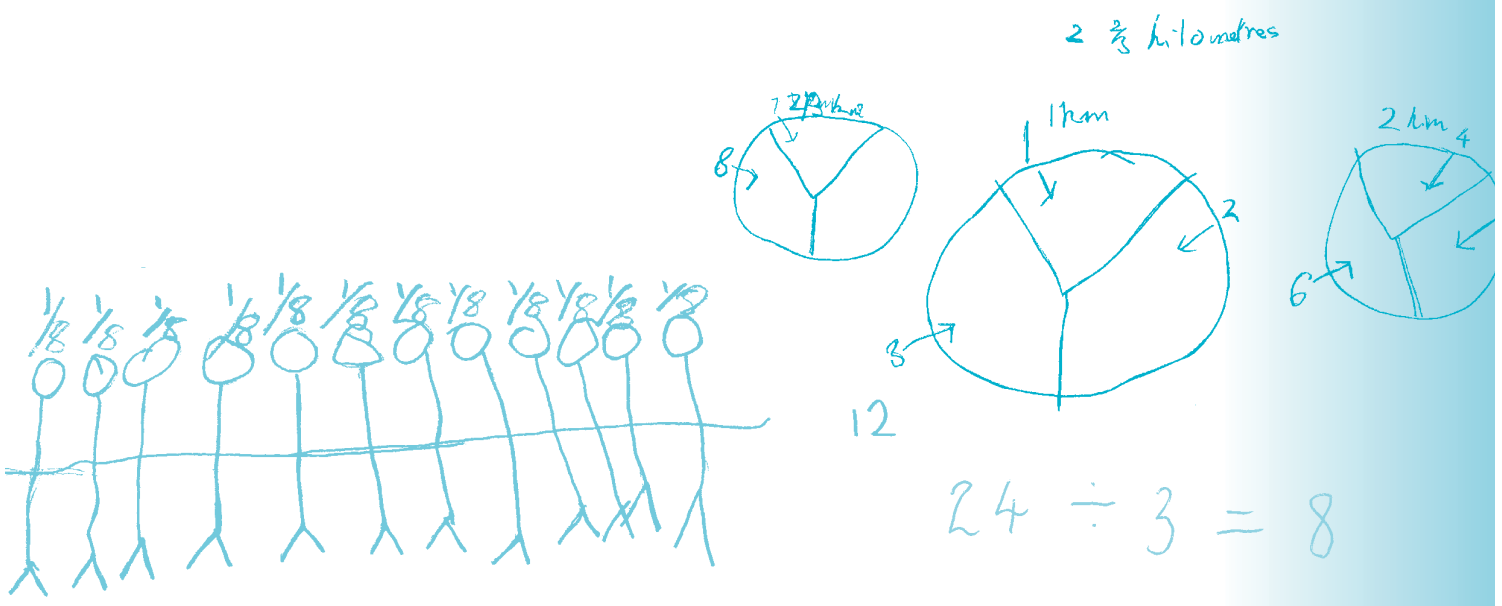
Many students will get the right answers to typical fraction tasks but for the wrong reason – that is, they have learned a procedure for getting the right answer, but may not have a robust understanding of the mathematics underpinning this procedure. The Diagnostic Tasks in this book are designed to reveal what students really think and understand about fractions.

- Students can get the right answer for the wrong reason.

The tasks will help you to find out the depth of students' understanding of fractions – their preconceptions, partial conceptions and any misconceptions they will develop along the way. The aim is to investigate students' higher order thinking rather than whether they use particular routines to find the answers.

This material is based on international research (see Bibliography) in relation to fractions. Each task has been subjected to a rigorous trial process, and revised where necessary. Students' work samples have been included to demonstrate the range of responses that may be found in any classroom.

- Diagnostic Tasks are based on research.



When to Use the Diagnostic Tasks

These Diagnostic Tasks are designed to help you find out what your students know and do not know about fractions. Ideally, the tasks should be used before you start a set of work, to identify a starting point for planning a focussed program.

Alternatively, they could be used at the completion of a series of lessons, to find out what students have learned and what they are yet to learn.

► Use Diagnostic Tasks as a starting point for planning a focussed program of work.

Nature of the Tasks

Some of the tasks are in the form of individual interviews, which are normally administered to one student at a time. Proforma sheets are provided to help record what students say and do during the interview.

Alternatively, a small group of students could be interviewed, with the proforma sheets used to monitor individuals within the group.

► Proforma sheets are included for recording responses in interviews.

Most of the tasks are work sheets, which can be given to a whole class. At times, students' written explanations of their thinking may not provide sufficient information for you to really understand what they are thinking. In these cases, a follow-up interview would be helpful.

► You may need to interview some students to clarify what they are thinking.

Is One Task Enough?

You might find out enough information from one task to begin planning an appropriate program of work. However, you might not find out the upper or lower limit of some students' understanding with one task. In this case, it will be appropriate to use a couple of different tasks to work this out. This will then give you a more detailed profile of what students know and what they need to learn.

By using different tasks, you will, over a period of time, build up a comprehensive picture of what students know and do not yet know about fractions.

► Over time, build a profile of student understandings and misunderstandings about fractions.

Task 1 Licorice

Purpose

Part One: The purpose is to find out whether students understand that a half means one out of two parts, where the two parts are of equal quantity. Many young students will share each strip of licorice into two lengths and not attend to the equality of the shares.

Part Two: This part will show whether students have generalised their understanding of halves and use the word 'half' to mean one piece out of two equal-sized pieces.

This task is suitable for students aged five to nine years.

Adapting the Task to Accommodate Students' Background Experiences

The context given in the task could be changed if your students are not familiar with licorice; for example, string or ribbon could be used. Try to find something that is long, as it helps them to think of folding and/or cutting. The item could be displayed on the desk in front of students for them to manipulate.

If students do not attempt to share the licorice evenly in Part One of the task, do not proceed with the rest of the task. If they find the task too easy, use Task 2, Zoo Animals, to see whether they have generalised their understanding of halves to collections.

This task focusses on the attribute of length. Asking children to find half of other attributes – for example, mass, a lump of play dough; capacity, a cup of rice – could extend the task.

Interpreting Students' Responses

Students need time to develop their ideas about halves. Initially, students might have a social understanding of fractions and think that half means any-sized piece, so long as the object is cut into two. They may not realise that, mathematically speaking, each piece has to be exactly the same size. You may see evidence of this sort of thinking when you ask students to find half of the licorice. Do they attend to the 'exactness' of their halving?

After they have developed the idea of equal parts, they need to extend their understanding to recognise that half means one part out of any two parts (where the two parts are exactly the same size). Later they need to extend this further to the idea that the size of the half depends on the size of the whole.

Some students may have difficulty with the first part of this task, sharing the piece of licorice into two portions without attending to the need for the parts to be equal. Other students will be able to do the first part of the task but will show confusion when faced with the two different-sized halves and so revert to the idea of halves being two pieces. Other students will not be confused by the two different-sized halves and will explain that this is possible because they started with two different-sized wholes.

Task 1 Licorice

NAME:	DATE:

This task is an interview. Record student responses on this sheet.

	COMMENTS
Part One Give the student a strip of licorice that is approximately 30 cm long. Ask: ***Can you find half of this piece of licorice?*** Does the student: Break or cut it into two pieces? Yes No Attend to the size of the pieces? Yes No Use up the whole licorice? Yes No	

If the answer to the above questions is Yes, then continue.

	COMMENTS
Give the student a piece of licorice that is approximately 10 cm long. Ask: ***Can you find half of this piece of licorice?*** Does the student: Break or cut it into two pieces? Yes No Attend to the size of the pieces? Yes No Use up the whole licorice? Yes No	

Part Two

Ask the student to compare the two halves that they have made by lining them up.

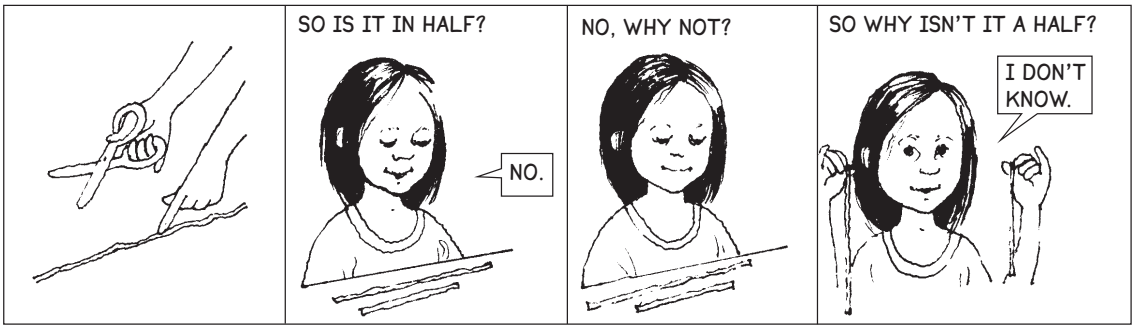
Say: ***This piece is a half and this piece is a half. How can they both be a half when they are not the same size?***

Task 1 Licorice

Tori, Year 3

String was used in this interview as a substitute for licorice.

Tori estimated where half was, placed her finger on the spot and then cut the string. She then placed the two pieces side by side and found one was longer than the other. She knew that the pieces were not halves but could not explain why.

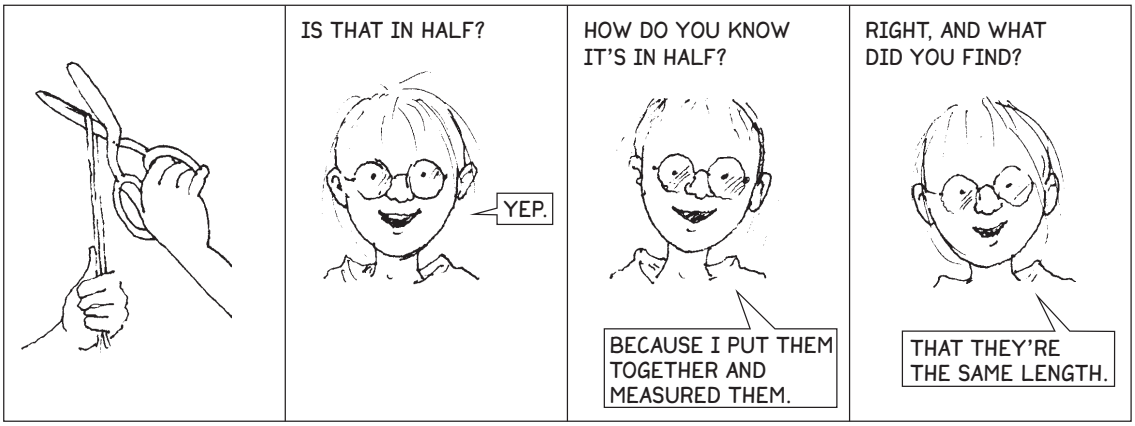


Interview was suspended at this point.

Tori knows that halving is related to making two pieces from one object, but she does not attend to the exactness of the halves, instead finding half by estimating where the middle is.

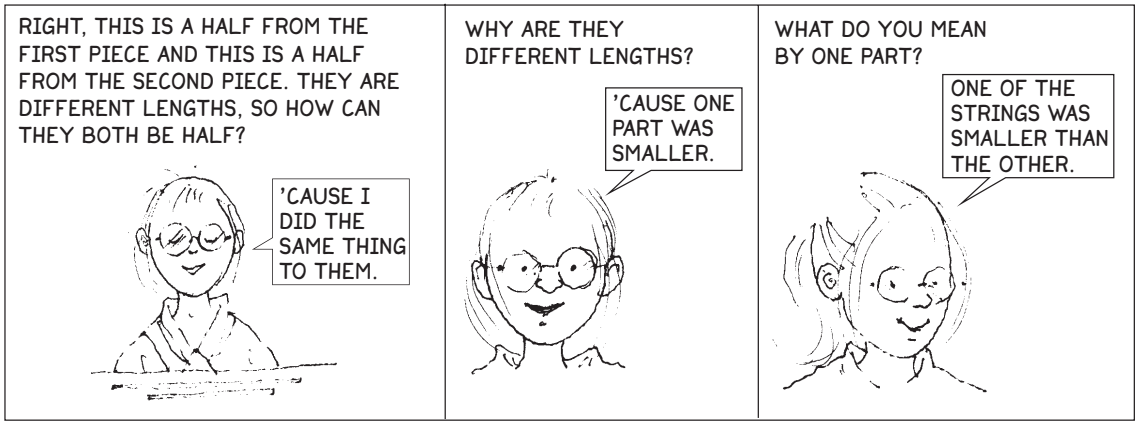
Khaila, Year 3

Khaila found half by carefully folding a length of string, matching the ends together and then cutting at the fold.



She understands that the two halves she makes from the whole must be the same length.

In the second part of the task, the two different length halves do not distract Khaila.



She knows that different-sized wholes will make different-sized halves.

Planning for Learning

Activities that encourage Tori to use a variety of strategies to partition objects and collections into two equal shares would help. For example, she could be asked to find half of a variety of different attributes: mass, capacity, area. She should be encouraged to make the shares equal-sized – for example, ask: *Have you made the shares fair? Does it matter if they are not the same size? Why/why not? How can we make the two shares the same size?*

This task looks at halving a single item. It would be helpful to find out whether Khaila can also find half of a collection (use Task 2, Zoo Animals). If she can, then Khaila would benefit from activities that involve using continuous halving of a variety of objects and collections to find other fractions such as quarters and eighths.