first steps®

First Steps in Mathematics

Canadian Edition

A research-based diagnostic framework:

- describing the developmental phases all students pass through as they learn mathematics
- including validated diagnostic tasks that accurately identify student progress
- outlining learning activities that target developmental triggers proven to advance student learning

Helping teachers see mathematics through the eyes of a learner.

PEARSON

From Research to the Classroom

In 1995, a team of university researchers and elementary classroom teachers were commissioned to develop a professional development resource that shows teachers how students learn mathematics. The development team began with an extensive review of international research, which represents thousands of student samples, cited in a 60-page bibliography. After augmenting this research with more than 10 000 of their own student samples, two key ideas became clear:

1) **Students all over the world are experiencing the same mathematical misconceptions.**
2) **Big conceptual "phases" underpin the behaviours and understandings commonly held by all students.**

In 2004, the development team published *First Steps in Mathematics* (FSiM) to describe these misconceptions and provide Diagnostic Tasks to expose them. FSiM outlines not only the conceptual phases but also key understandings and activities to advance students through them. Two thousand additional work samples were part of its validation process and, in 2005, its findings were replicated with 500 Canadian students. FSiM provides teachers with strategies proven around the world to advance student learning. It's research that makes a difference.

First Steps in Mathematics Components

- ✓ **Professional Development**
  - 2-4 Day Coach Courses
  - 4-7 Day Facilitator Courses
  - 1-Day Administrator Course
- ✓ **Teacher Resource Books**
  - Diagnostic Map
  - Key Understandings
  - Sample Learning Activities
- ✓ **Course Books**
  - Diagnostic Tasks
  - Student Samples
  - Course Notes and Activities
- ✓ **Illustrated Poster of Diagnostic Map**

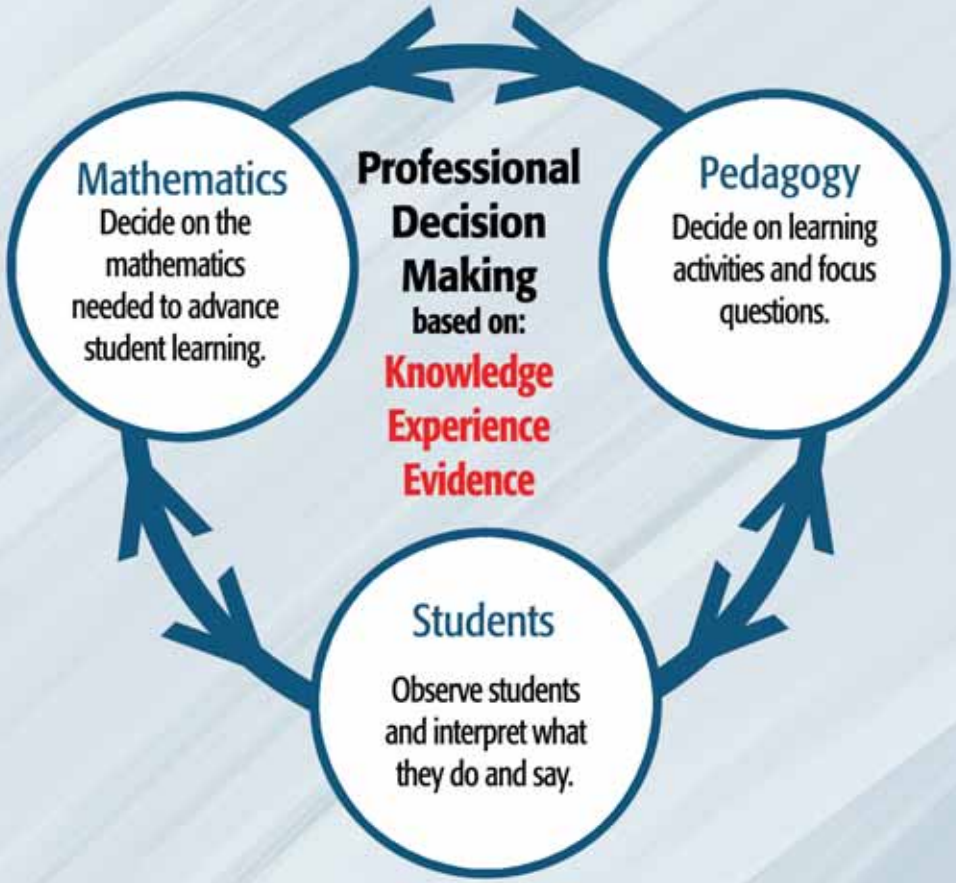
t that Makes a Difference

Empowering Teachers with the Power of Research

Every day, teachers make countless decisions that significantly impact student learning — decisions around *Mathematics, Pedagogy* and *Students*: What should I focus on when teaching mathematics? How should I teach it? What learning do students really need?

Research has the power to shape good decisions. The more *Knowledge* teachers have, the more *Experiences* they assimilate. The more sophisticated their methods for accumulating and evaluating *Evidence*, the greater the impact the teachers' decisions will have.

The research presented through *First Steps in Mathematics* enables teachers to make better decisions — informed decisions that ensure all students achieve deep understanding in mathematics. Decisions that will make a real difference.



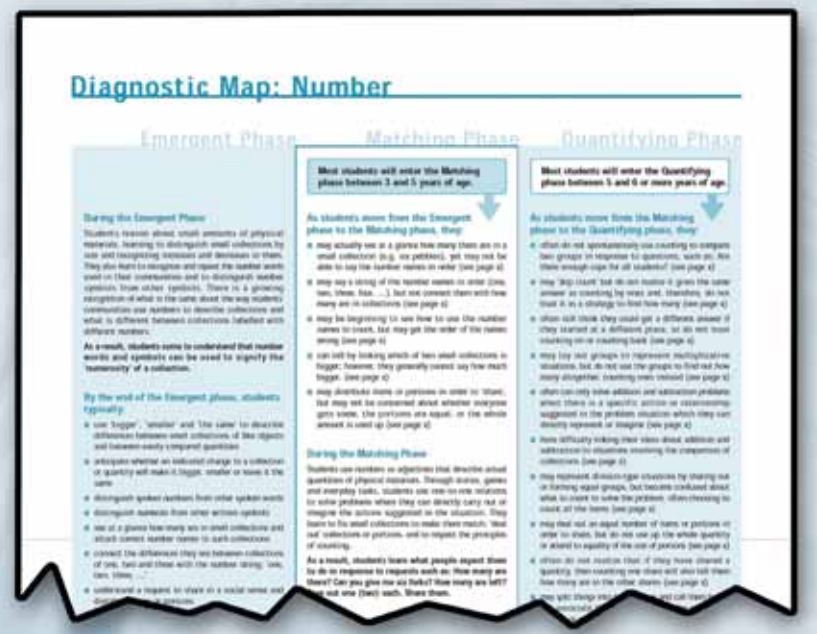
Research from *First Steps in Mathematics* impacts all aspects of decision-making

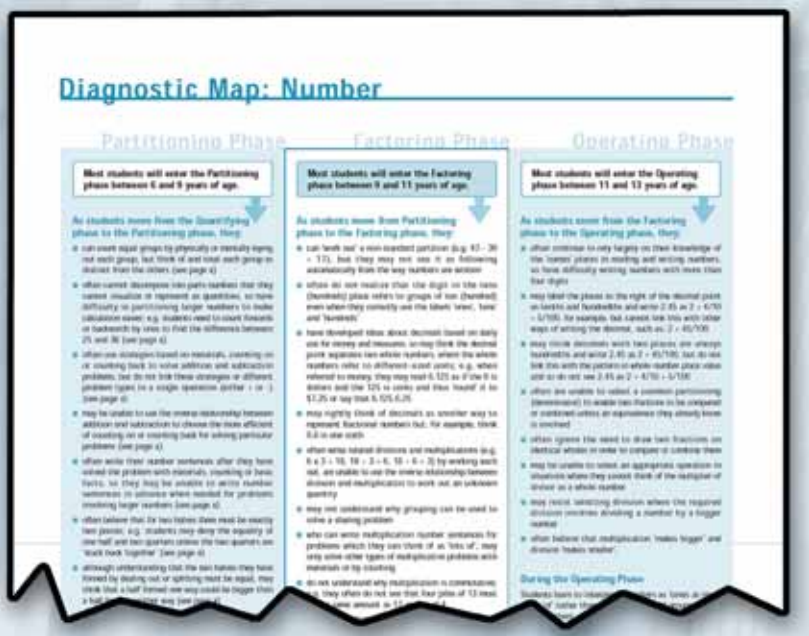
First Steps in Mathematics helps teachers answer three main questions:

1. What is the path students travel as they learn mathematics?
2. How can teachers accurately diagnose student learning?
3. How can teachers advance student learning?

A Diagnostic Map that A

Question 1:
What is the path students travel as they learn mathematics?





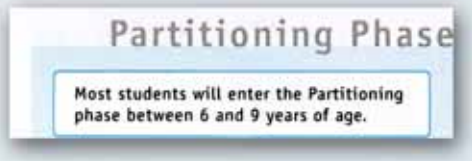
While analyzing student work, the *First Steps in Mathematics* research team identified that students move through predictable phases when they learn mathematics. These developmental phases were then organized and described in a Diagnostic Map.

The Diagnostic Map details the developmental phases that help teachers understand:

- **why students seem to be able to do some things and not others**
- **why some students may be experiencing difficulty while others are not**
- **why some students have been successful in the past but suddenly experience difficulty**
- **how a student's response fits within the larger learning continuum**
- **what learning opportunities students need to move their thinking forward, refine their preconceptions, and overcome any misconceptions**

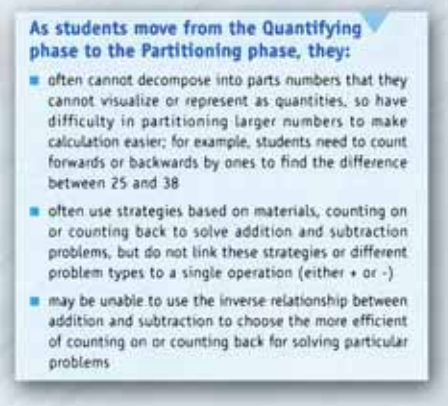
The Diagnostic Map outlines the key indicators and the consequences of a student's understanding and growth. This information is crucial as teachers make decisions about what to teach, to whom, and when to teach it.

Assesses... and Instructs



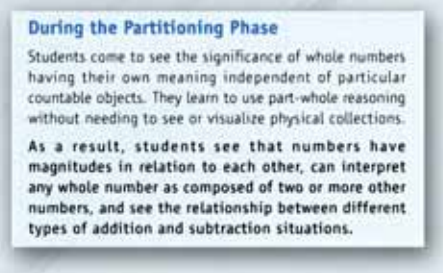
Each developmental phase has three sections

Beginning



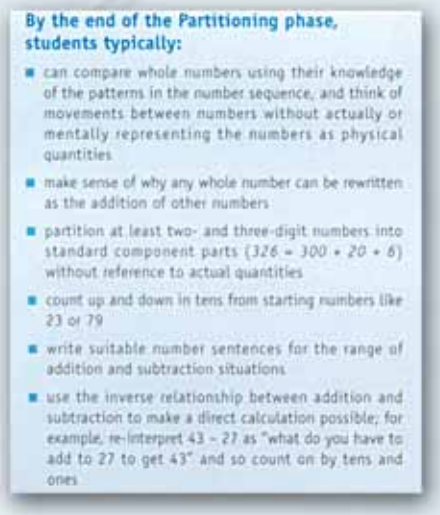
The first section outlines the preconceptions, partial conceptions, or misconceptions that may exist as students move from the previous phase and enter the current one. These become the teaching emphases and learning challenges needed to progress through this phase.

During



The second section describes the ideas students are coming to understand during the phase. It shows what students are thinking and doing, and why.

At the End

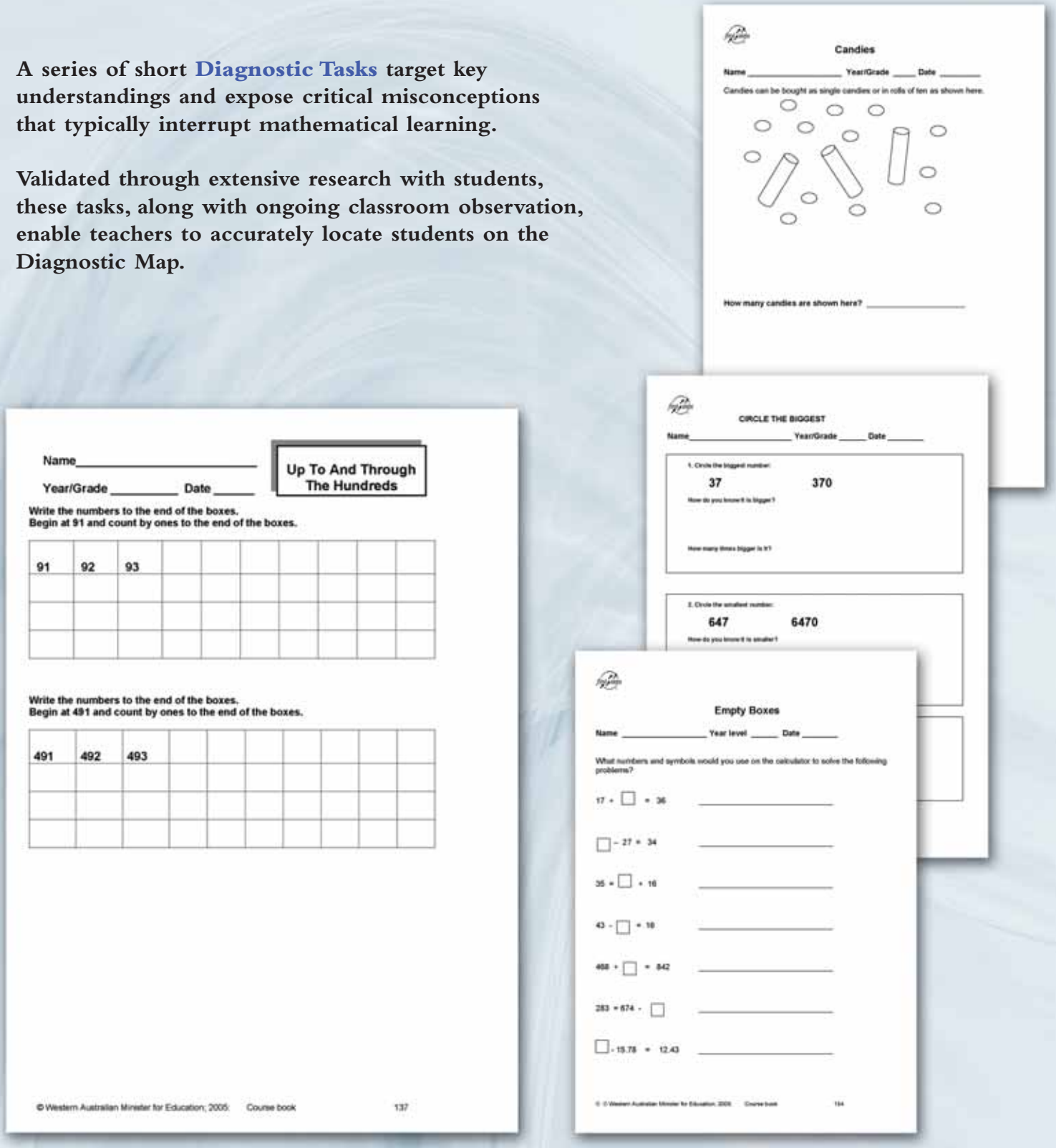


The third section details the typical thinking and behaviours of students at the end of the phase. Together with the Beginning section of the next phase, these indicators help teachers identify the next steps needed to advance learning.

Question 2:
How can teachers accurately diagnose student learning?

A series of short Diagnostic Tasks target key understandings and expose critical misconceptions that typically interrupt mathematical learning.

Validated through extensive research with students, these tasks, along with ongoing classroom observation, enable teachers to accurately locate students on the Diagnostic Map.

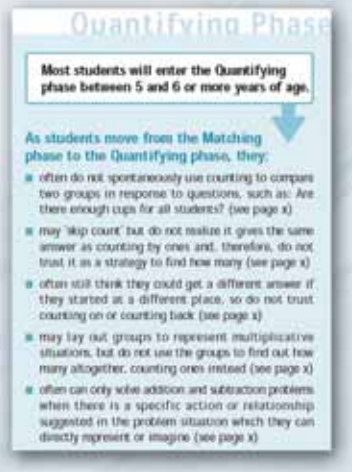


Question 3:

How can teachers advance student learning?

The fundamental goal of *First Steps in Mathematics* is to improve student learning. The various elements of the resource work together to link assessment with instruction, providing targeted intervention that effectively and efficiently advances student learning.

Why?


Quantifying Phase

Most students will enter the Quantifying phase between 5 and 6 or more years of age.

As students move from the Matching phase to the Quantifying phase, they:

- often do not spontaneously use counting to compare two groups in response to questions, such as: Are there enough cups for all students? (see page x)
- may 'skip count' but do not realize it gives the same answer as counting by ones and, therefore, do not trust it as a strategy to find how many (see page x)
- often still think they could get a different answer if they started at a different place, so do not trust counting on or counting back (see page x)
- may lay out groups to represent multiplicative situations, but do not use the groups to find out how many altogether, counting ones instead (see page x)
- often can only solve addition and subtraction problems when there is a specific action or relationship suggested in the problem situation which they can directly represent or imagine (see page x)

The Diagnostic Map highlights the critical misconceptions and partial learnings students typically carry with them as they move into a new phase.

These challenges shape the teaching emphasis and provide the "Why?" behind an activity.

What?


Key Understanding 2

The Key Understandings describe the critical mathematical ideas students must own and show how these ideas develop across the phases. As students understand these ideas they confront their own misconceptions and reconstruct the concept.

The Key Understandings provide a powerful backdrop to the Diagnostic Map, and describe the essential "What?" of learning mathematics.

How?


Sample Learning Activities

The Sample Learning Activities and Case Studies target developmental "triggers" that unmask critical misconceptions, develop key understandings and thereby advance learning in all students.

Organized into three grade groupings, these activities provide the "How?" behind advancing student learning and demonstrate ways teachers can draw out mathematical ideas from any good learning activity. Research shows them to be very effective and efficient at closing gaps in learning.

What Canadian participants are saying

about their *First Steps in Mathematics* Professional Development experience

"First Steps in Math training has changed my thinking about the way students learn mathematics. No longer do I identify students in a split grade mathematics class as grade 3 or grade 4 students. I now identify each student with the phase of development they are currently in and understand what mathematics is needed to teach and move them along through the next phase.

First Steps in Math provides each student with the opportunity to address each misconception by challenging their current knowledge and understanding of mathematics, while providing meaningful mathematical experiences directly related to their individual needs."

Tim Eirich
Curriculum Consultant
Prairie South School Division #210

First Steps in Mathematics

Professional Development Courses

For Kindergarten through Grade 8 Educators

Coach Course

- Provides in-depth coverage of the First Steps® in Mathematics instructional framework
- Builds capacity in coaches and teacher leaders, as they support teachers in effective instruction, and in the implementation of First Steps®
- Two or four days depending on strand
- Upon completion, coaches will be certified as users and providers of ongoing support in First Steps® and be able to model the use of the First Steps® resources within their district
- Coaches are entitled to order additional resource books at a 20% discounted price

Facilitator Course

- Develops teacher leaders to provide First Steps® professional development sessions to other teachers within their district.
- Introduces participants to the resource first as a learner, then as a facilitator
- Four or seven days depending on strand.
- Upon completion, facilitators will be certified as users, presenters, and providers of ongoing support in First Steps®.
- Facilitators are entitled to order additional resource books at a 20% discounted price

1-Day Administrator Course

This course, designed specifically for Administrators, outlines the foundational beliefs of *First Steps in Mathematics* and provides an overview of how the components work together for a strand. In addition, it offers practical strategies and activities Administrators can use to support and maximize the impact of the resource.

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