



Introduction

Two children eating dinner at a kitchen table argue about whose plate has more peas on it. A man in a checkout line thumbs through the money in his wallet, deciding whether he has enough cash to pay for his groceries. A woman filling the gas tank of her car wonders how many miles she drives per gallon. A student taking a test estimates a reasonable solution to $\frac{8}{9} + \frac{7}{8}$. A teenager glances at the clock: does he have time to stop by his friend's house before heading home for dinner?

Solving these sorts of everyday problems requires number sense. Number sense is extremely important to our mathematical thinking and reasoning. Starting from a very young age, we're confronted with situation after situation in which we need to think about and use numbers.

Number sense is a broad idea that covers a range of numerical thinking. Although the concept can be difficult to pinpoint, we recognize number sense when we see our students use it.

Our students with number sense understand the relationships between and among numbers. They think flexibly about numbers, are able to break numbers apart and put them together in a variety of ways. They are also familiar with the properties of single-digit numbers and can use this information to calculate efficiently using larger numbers.

Students with number sense also understand the effects operations have on numbers. They see connections between the different operations and have a firm grasp on which operation or series of operations to employ in a given situation. They are able to articulate why they choose a particular operation and how it will help them solve the problem.

Another component of number sense is mental computation. Students with number sense can manipulate numbers in their head. They have strategies they use to think about numbers and operations. They do not need to rely solely on paper and pencil,

their fingers, or a calculator. Also, students with number sense have effective ways to estimate. They can approximate calculations and use familiar benchmarks to gauge unknown amounts.

While there is no simple checklist of skills that number sense encompasses, we recognize its components and its effects. We see our students use their number sense when they are confronted with numerical situations. We hear them describe their number sense when they explain how they solved a problem. As Paul R. Trafton puts it, “A person who possesses number sense might be said to have a well-integrated mental map of a portion of the world of numbers and operations and is able to move flexibly and intuitively throughout the territory” (“Using Number Sense to Develop Mental Computation and Computational Estimation,” paper presented at a conference entitled Challenging Children to Think When They Compute, Queensland University of Technology, Brisbane Australia, August 9–11, 1991).

This book shows some of the ways we have attempted to help students “move throughout the territory.” It offers practical and worthwhile ideas for helping students think about numbers. It will help you understand number sense and find innovative ways to promote it in your classroom.

Over a two-year span, we taught each of these activities in an intermediate classroom. In most instances, we taught the activity more than once, to different grade levels, in order to refine and polish it and

determine how to modify or adapt it to meet the needs of different-aged students. We have integrated assessment ideas into the activities because we recognize that teachers assess their students continually. In these pages we share what we learned from the students during the activities and how we feel the activities helped the children enhance their number sense.

The activities in the book are grouped into four sections: Mental Computation, The Basics and More, Navigating the Number System, and Estimation. A brief introduction to each section highlights the key number-sense ideas that group of activities is intended to develop.

The activities are of several different types. Some are games that the teacher introduces to the whole class and then has the students play in pairs or in small groups. Some are investigations that are introduced to the whole class, after which students carry them out individually, in pairs, or in small groups. Some activities don't lead to individual or small-group work but are whole-class experiences only.

Each activity has three components:

1. A concise summary.
2. An extended vignette that describes how we taught the activity in a classroom.
3. Answers to one or more reflective questions.

There is no prescribed way to use the book or the activities: this is not a program, curriculum, or sequential

unit. Rather, it is a spectrum of ways to foster number sense in the intermediate grades. If you are just beginning to focus on number sense in your classroom, we hope you will find here practical ideas and insights into the richness and power of number sense. If you are already focusing on number sense, we hope you will find

some activities and perspectives to add to your repertoire. We encourage you to use the activities in ways that best meet the needs of your students, and we'd appreciate hearing about your experiences and any adaptations you try as you go about bringing number sense to the forefront of your mathematics instruction.