

## Foreword

Proportionality may be the most important connecting idea in all of school mathematics. However, there was a time when I didn't even realize what I didn't know about this critical and powerful topic. I had learned lots of mathematics on my way to a degree in the subject from an engineering institution. Yet none of my mathematics courses had helped me think deeply about the fundamental notions of proportional relationships that deepen our understanding of numbers and lead to making sense of algebra. When I began teaching junior high school mathematics forty years ago, I dutifully taught the unit on ratios, proportions, and percent without thinking too much about the underlying ideas. I was perfectly content to teach my students how to cross-multiply to solve a proportion and how to solve three types of percent problems.

At some point in my continued learning and my work with other teachers, I started hearing conversations about “big ideas” in mathematics. I liked the possibility that we could zoom out from the day's lesson to look at ideas that might cross multiple topics and could even connect apparently different mathematical skills with each other. And when the subject of proportional relationships was used as an example of this kind of connecting thread, I'm sure I physically hit my forehead with my hand in disbelief that I had gone so long not seeing what now seems obvious about the central role proportionality can play in a person's development of mathematical thinking and proficiency. As Carmen relates in “About This Resource,” I, too, wanted a “do-over” with my former students—I realized that I could teach middle school mathematics much more effectively building on a broader and deeper way of thinking about the development of proportional understanding.

Proportionality starts small and just keeps getting bigger. Even though we focus on the development of proportional understanding at middle school, its seeds appear in the elementary grades as students notice patterns in the multiplication tables or make generalizations about relationships, like observing that for each candy bar they sell, their band fund grows by \$2. As students work with fractions, the role of proportionality becomes more central in exploring how to represent a fraction with equivalent names. Then in middle school, suddenly proportional relationships are everywhere—in working with commissions, taxes, scale drawings, similarity, and the list goes on. The big payoff comes when students can take what they know about proportionality and use it to make sense of linear relationships in algebra, understanding the fundamental proportionality represented in a constant rate of change. This understanding of *slope* helps students start to explore and separate different types of functions, realizing that some are based on a constant rate of change and some are not. It may not be an exaggeration to suggest that, with this

understanding, a door to higher-level mathematics can open for many students, as linear relationships underlie many advanced mathematical ideas all the way to calculus. And along this journey, helping students “get” proportionality can keep them more engaged in the mathematics they are learning as we challenge them and help them make sense of connections that link what they learn today with what they learned last week. Wow.

Carmen Whitman is one of the best connectors of ideas that I have ever met. She not only sees how the mathematical pieces fit together, she helps the rest of us make sense of those connections. Most of all, Carmen is the ultimate teacher. She is as committed to her own continued learning as she is to that of her students. She has great intuition with students and, like a great teacher, she listens to her students and she seems to know the right questions to ask to get them thinking just a bit harder. In this wonderful book, Carmen offers us our own opportunity to think just a bit harder and to put into practice what we learn so that students can realize their potential in the mathematical learning that comes from “getting” proportionality. I’m absolutely delighted to see some of Carmen’s wisdom shared in this way, and I know you will enjoy this wonderful learning adventure!

—Cathy Seeley

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