PARTITIONING INTRODUCTION

Partitioning, the study of part-whole relationships, is an important yet complex area of mathematics. Many mathematical concepts depend on a thorough understanding of fractions, right through to algebra and beyond. Equally, many of the texts encountered in everyday life and work require some knowledge of fractions, decimals, percents, ratios, and proportions.

Partitioning is one of those areas in mathematics where students can no longer *assimilate* new learning into existing mental schemas (Piaget, 1977, in Fosnot, 1996). Because of fraction concepts that run contrary to the patterns of whole numbers (e.g., the greater the denominator, the smaller the part), students need to be helped to *accommodate* their schemas to make room for such differences. One common misconception is for students to apply their knowledge of whole numbers to fractions and decimals. For example, they frequently say that ⅙ is greater than ⅕ because 6 is greater than 5. Likewise, they think that 0.45 is greater than 0.5 because 45 is greater than 5. This is a classic example of where making conceptual understandings explicit can help students to address misconceptions.

Young children generally come to school with concepts of a half and readily learn quarters/fourths, even thirds and fifths — both the meaning and the naming. Counting fractions leads naturally to adding and subtracting fractions with the same denominator. What complicates the issue is when fraction notation is introduced. You can't add the numbers the way you do with whole numbers: the denominator needs to be viewed as a name, not a number, a *name* that derives from the total *number* of parts, but a name nonetheless. For this reason, fractions are introduced in Phase 1 earlier than some curricula do so that students can spend time immersed in making, naming, and comparing equal parts of a whole *before* symbolic notation is introduced. When students have lots of practical experience with fractions, this will prepare them for the apparent anomalies of fraction notation.

Learning engagements that engage students in productive exploration support them in constructing durable part-whole understandings. In this regard, activities such as coloring in parts of a pre-partitioned fraction diagram or filling in numbers on a pre-formatted number line do not engage students fully in the complexities of fractions (Lamon, 2007). When students create their own representations of fractions, they must deal with *all* the relevant aspects: the whole, the total number of equal parts, the size of each part, and the number of parts needed. Folding paper in half and half again is a good way to start,
exploring different ways to make the same fractional parts. Students can make their own fraction strips to play games with. Making their own measuring tapes by repeatedly folding strips of paper cut from cash register rolls and naming the fractions they make each time they fold is an ideal way for students to become familiar with fractions on a number line (Boaler et al., 2017, p. 118).

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Partitioning Introduction

Fractions have close connections to other areas of maths, in particular Shape and Measurement, both in terms of their regular use in everyday life and as helpful contexts in which students learn and apply important maths concepts.

Decimals are important in many areas of life: statistics, precision measurement, finance, and interpreting outputs on calculators and spreadsheets. Although they have traditionally been taught separately, “decimals” is, of course, an abbreviation of decimal fractions as they are a special subset of fractions — special because their use of powers of 10 as denominators (10, 100, 1000, etc.) means they can operate within our place value system, unlike fractions. Resources that are useful in developing a conceptual understanding of decimals include ten frames and hundreds charts, as well as base 10 blocks, which can be repurposed such that the 100 block becomes 1 whole, and so on.

One of the most important ways to build strong connections to fractions is to encourage students to read decimals as fractions: 0.48 is read as “48 hundredths” rather than as “point four eight.” Working out the decimal equivalent of common fractions is a good way to extend students’ number sense to decimals.

Number sense is as important with fractions and decimals as it is with whole numbers. Students can develop a sense of the magnitude of fractions in a variety of ways, including creating their own models and using patterns in the notation to relate them to referents such as 0, ½, and 1. Knowledge of the magnitude of individual fractions is proven to correlate with later success in adding, subtracting, multiplying, and dividing fractions and even algebra (Lortie-Forgues et al., 2015).

Percentages are used widely in society as they use whole numbers to show relative size and proportion as well as change over time. They are also easy to estimate with. When students learn percentages in the context of decimals, especially hundredths, they quickly realize that “percent is merely a new notation and terminology, not a new concept” (Van de Walle et al., 2019, p. 446).

Students will refine and reinforce their understanding of decimals and percentages best within contexts and problem situations from the Measurement and Statistics & Probability strands of the mathematics curriculum.

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References

Boaler, J., Munson, J., & Williams, C. (2017). *Mindset mathematics: Visualizing and investigating big ideas, Grade 4.* Jossey-Bass.

Lamon, S. (2007). Rational numbers and proportional reasoning: Towards a theoretical framework for research. In Lester, F. (Ed.). Second handbook of research on mathematics teaching and learning: A project for the National Council of Teachers of Mathematics (pp. 629–667). Information Age.

Lortie-Forgues, H., Tian, J., & Siegler, R. S. (2015). Why Is Learning Fraction and Decimal Arithmetic So Difficult? Developmental Review, 38, 201-221.

Piaget, J. (1977). In Fosnot, C. (1996). Constructivism: Theory, perspectives and practices (p. 17). Teachers College Press.

Siemon, D. (2004). *Partitioning: The missing link in building fraction knowledge and confidence.* Paper presented at the Australian Association of Mathematics Teachers virtual conference. https://www.eduweb.vic.gov.au/ edulibrary/public/teachlearn/student/partitioning.pdf

Van de Walle, J.A., Karp, K.S., & Bay-Williams, J.M. (2020). Elementary and middle school mathematics: Teaching developmentally (10th ed.). Pearson.

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