Research Informed Instructional Considerations for Representing Fractions

The teacher should	It allows students to	References
• introduce learners to fractions through a context of fair sharing, partitioning with a focus on fairness and number of shares.	• construct connection between fractions, multiplication, and division through exploration in context of fair sharing. • compare fractional amounts using concrete materials. • construct unit fractions and common fractions within a context. • avoid the misconception about fractional size that a larger denominator means a larger amount.	• Fosnot (2007) • Fosnot & Dolk (2002) • Van de Walle
• engage students in reasoning with repeated halving before creating o equal even numbered partitions (e.g., 10) o odd numbered partitions (e.g., 7) o composition (e.g., 12 can be constructed using a 3x4 array)	• develop an understanding of the representation of fractions first as they can more readily model the mathematics using an appropriate model • apply their understanding to increasingly complex partitioning situations. • use their multiplicative understanding to partition wholes for denominators which can be factored (composition).	• Petit, Laird, Marsden • Stiff
• use examples and non examples as representations of fractions.	• think about what fractions are NOT. • surface misconceptions.	• Smith • Van de Walle
• allow students to select their own tools and representations.	• share their thinking through the representation, including drawings, and therefore facilitate reasoning. This allows teachers to build upon the students' prior knowledge in meaningful ways. • arrive at the conclusion that the parts must be equal in area. Sometimes pre-made partitioned models prevent discovery of such misconceptions. • share and refine their understanding of the multiple meanings of fractions, including as parts of a set. • think about fraction as part of a whole. Sometimes with pre-partitioned shapes, they rely on counting of partitions instead. • construct mental referents which allow them to perform fraction tasks meaningfully. For example, recognize that ¼ is less than ½ or that 4/3 is greater than 1. • select manipulatives to model a fraction, which they may find easier to use if they lack the fine motor skills necessary to accurately partition a whole.	• Bezuk & Cramer • Bruce & Flynn • Bruce & Ross • Empson & Levi • Petit et al • Stiff • Van de Walle
• encourage multiple strategies to explain thinking.	• explain their thinking using different strategies, deepening their understanding and use of increasingly precise vocabulary. • develop a strong conceptual understanding of the connections between and among representations and strategies, aiding in subsequent learning. • make connections to other mathematical concepts, including their knowledge of algebraic relationships.	• Bruce & Flynn • Empson & Levi • Meagher
• make precise decisions about the models used and share the rationale with students.	• understand that some representations work better in one context than another. The usefulness of a representation is dependent upon the context.	• Bruce • Petit et al

Research Informed Instructional Considerations for Representing Fractions (continued)

The teacher should:	It allows students to:	References
• incorporate a variety of models and contexts into their instruction	• make strong connections between physical models and mathematical concepts. • move beyond rote, mechanical manipulations of one manipulative. • focus on the important components of fractions (i.e., identify the whole, consider what composes 'equal parts', establish the meaning of the fraction in the given model/context). • make connections between different representations, which may uncover inaccurate generalizations or conceptual misunderstandings.	• Petit et al
• restrict denominators to 12 and less.	• work with familiar numbers. • easily model the fraction in a variety of ways.	• Bezuk & Crame r • Van de Walle
• engage students in counting by unit fractions (e.g., 1/8, 2/8, 3/8,...).	• recognize that the top number counts, while the bottom number tells us what is being counted. • consider the part to whole relationship. • deepen understanding of a fraction as a single number.	• Emperson & Levi • Petit et al • Van de Walle
• monitor understanding of notation and part-whole relationships separately.	• investigate the relationships between the fraction concepts and fraction notation. • distinguish their level of understanding of each.	• Saxe
• use models where a region is shaded (without partitions) and ask students to estimate about how much is represented.	• develop a sense of what fractions are. • think of a fraction as one idea, rather than two numbers. • consider the whole region, rather than the individual parts, which minimizes the potential for confusion between whole numbers (the number of parts, the number of shaded parts) and fractions.	• Meagher • Petit et al • Small (2001) • Van de Walle
• require students to partition an area model to represent a specific fractional value.	• refine and/or communicate their understanding of the necessity of congruent pieces for fraction representation. • strengthen their understanding of the part-to-whole relationship	• Anderson & Wong • Petit et al
• sequence shading of models so the number of parts in the model equals: o the denominator o a factor of the denominator o a multiple of the denominator of the shaded area	• identify the whole unit (and consider how it can change in different contexts). • identify the meaning of the equal parts (and consider how they can change in different models).	• Petit et al
• include different orientations, and also separate the shaded areas, when using area models.	• generalize part to whole relationships.	• Gould & Outhred • Small (2010)

Research Informed Instructional Considerations for Representing Fractions (continued)

The teacher should:	It allows students to:	References
• include models with a perceptual distracter (a visual that does not match the task – e.g., Shade one-third of this circle. )	• apply their fraction knowledge. • distinguish fractions from whole numbers (i.e., can't just count the correct number of segments).	• Case & Moss • Petit et al
• have students break fractions into parts (e.g., 5/4 = ¼ + 4/4 or ¾ + ½, etc)	• increase flexibility with number. • compose and decompose fractions to make them friendly. • view a fraction as a single numeric value.	• Empson & Levi • Fosnot & Dolk (2002) • Petit et al • Van de Walle
• engage students in activities which extend their concept of unit (e.g., if the yellow trapezoidal pattern block is a whole, then what is the value of a green triangle? Also, if this area represents 3/5, draw the whole.)	• develop flexibility of unit. • reinforce their concept of unit. • deepen understanding of equivalence and relative size.	• Bezuk & Cramer • Petit et al • Van de Walle
• ask students to represent fractions using a variety of number lines	• consolidate their understanding of fraction as number (although they may first revert to whole number reasoning). • connect fractions to their understanding of measurement. • apply proportional reasoning to the location of fractions on a number line. • connect the area representation to the number line by possibly constructing area models underneath and aligned with the number line.	• Petit et al