A close and santisi, 2003; moss

Life, Relationships

A fractionis a number which can tell us about the relationship between two quantities.

These two quantities provide information about the parts, the units we areconsidering and the whole. Moseley and Okamoto (2008) found that, unlike top achievers, average and high achieving students are not developingthese multiple meanings of rational numbers, resulting in a student focus onsurface similarities of the representations rather than the numerical meaning. Furthermore, Moseley (2005) demonstrated that students who were familiar withboth the part-part and part who interpretations had a deeper understanding ofrational numbers.

Fractions are difficult to learn becausethey require deep conceptual knowledge of part-whole relationships (how much ofan object or set is represented by the fraction symbol), measurement (fractionsare made up of numbers that can be ordered on a number line) and ratios (Hecht, Close & Santisi, 2003; Moss & Case, 1999). The following specific challenges faced bylearners are discussed in this section: difficulties understanding andrepresenting fraction relationships, confusion about the roles of the numeratorand the denominator and the relationship between them, use of a ' gap thinking'approach, lack of attention to equivalence and equi-partitioning. Students gasp and misconceptions arepowerfully revealed through their drawn representations of fractions, andstudies in this area provide evidence to suggest that the multitude ofrepresentations used, some of which are potentially distracting representations, do not help students build deepunderstanding (Kilpatrick, Swafford, & Findell, 2001). Circularrepresentations are problematic because partitioning circles equally is moredifficult for odd or large numbers. Students frequently conceive a fraction asbeing two separate whole numbers (Jigyel & Afamasaga-Fuata'i, 2007) andconsequently apply whole number reasoning when working with fractions. Huinker(2002), as cited in Petit et al.

, (2010) states that ' students who cantranslate between various fraction representations " are more likely to reasonwith fraction symbols as quantities and not as two whole numbers" when solvingproblems'. Students must also understand that the numerator and denominatorhave different roles within the fraction and that the interpretations varydepending on the role. Further confusion about the role of the numerator anddenominator arises with a premature introduction to fraction notation and/orthe inadvertent use of imprecise language. Without the requisite conceptual understandingsuch as the importance of equivalence, estimation, unit fractions, andpart-whole relationship, students struggle to complete calculations withfractions. As referenced in Kong (2008, p.

246), Huinker (1998), Niemi (1996b)and Pitkethlyn & Hunting (1996) all confirm that " learners seldomunderstand the procedural knowledge associated with fractional operations suchas addition and subtraction" and this is strongly connected to their lack offoundational understanding of the meaning and ways of thinking about fractions. Hasemann (1981) provide several possibleexplanations for why children find simple fractions so challenging, including: 1.) fractions are not obviated in daily life, but instead are hidden incontexts that children do not recognize as fractions situations; 2.) thewritten notation of fractions is relatively complicated; and 3.) there are manyrules associated with the procedures of fractions, and these rules are morecomplex than those of natural numbers.

Moss & Case (1999) agree thatnotation is a challenge for students, but they also suggest several otherpedagogical complications; to begin, when rational numbers are first introducedto students they may not be sufficiently differentiated from whole numbers, neglecting the importance of the relationship that a fraction names (Kieren, 1995). When we add or subtract fractions, we haveto find a common denominator, but not when we multiply or divide. And once weget a common denominator, we add or subtract the numerators, but not thedenominators, despite the fact that when we multiply, we multiply both thenumerators and denominators, and when we divide, we divide neither thenumerators nor the denominators (Siebert & Gaskin 2006, p.

394). These “ rules” might make sense to those whoalready conceptually understand fractions operations, but they do not help tosupport students who are just learning how to work with operations that includefractions. Unfortunately, students are often presented with wordy rules forprocedures, such as the example above, that are difficult to understand and getconflated with definitions of what it means to perform an operation. To furthercomplicate matters, Foundations to Learning and Teaching Fractions: Additionand Subtraction Page 19 of 53 spontaneous or invented strategies for adding andsubtracting fractions are typically discouraged, inadvertently discouragingstudents from sense making (see Confrey, 1994; Kieren, 1995; Mack, 1993; Sophian & Wood, 1997).