"Fractions decimals and percentages"

Through the key insights regarding fractions, decimals and percentages gained from current literature and research, teachers can be support in developing an effective pedagogy. These concepts can also inform us on how students from prep to year six develop their own understandings. However, there are a number of misconceptions and difficulties that tend to arise for students, which need to be identified by teachers in order to overcome them. With an aim of developing a deep conceptual understanding of fractions, decimals and percentages, including their multiple representations and connections with each other, a range of implications arise for teachers for how they might go about achieving this.

Due to the challenging nature of teaching and learning fractions, decimals and percentages across all year levels, many researchers stress the need for adequate time and experiences to develop a deep conceptual understanding (Van de Walle, Karp & Bay-Williams, 2010; Lamon, 2005; Powell & Hunting, 2005). Contrary to current curriculums, Powell & Hunting (2003) argue that fraction concepts are actually developmentally appropriate for children from as young as four years old. Right from the beginning, Kieren (cited in Clarke, Roche & Mitchell, 200) identifies several different constructs of fractions that students need to explore. These include part-whole; such as partitioning a set of objects into equal sets, measure; measuring a quantity relative to one unit of that quantity, quotient (division); equal sharing, operator; on the unit and as a ratio. All contribute towards building a holistic understanding of fractions.

In developing these, a review of fraction literature (e.g. Lamon, 2005; Watanabe, 2002; Morge, 2011) suggests decimals and percentages should be intertwined with fractions, in which Clarke et al (2008) contend that this occurs far earlier than what many curriculums suggest. As decimals are simply another way of writing fractions, through connecting both, students can work towards a flexible application between the two (Van de Walle, 2010). However, it is important to note that
understanding decimals has been found to be more difficult than fractions, and therefore must be carefully developed (Maritine, cited in Van de Walle et al, 2010).

In exploring these types of constructs, a range of 3-dimensional, 2-dimensional 1-dimensional models and representations have proven useful. After exploring and contracting models such as fraction walls and paper strips, Clarke et al (2008) suggests that number lines can be an effective means to relate fractions with decimals and percentages, which can also illustrate equivalences between different types of representations (Clarke et al, 2008). Working with blank hundreds charts has also been noted as helpful in developing student’s concept of percent as students work through ways to think about fraction-to-percent relationships (Zambo, 2008). Moody (2011) offers another insight, believing that ‘decipipes;’ a representational model can be used to develop conceptual understanding of decimal place value and decimal notation (Moody, 2011).

The ability to draw upon number sense and think proportionally is recognised to be of great value, and believed are best developed through student’s forming their own vocabulary and flexible strategies (Lamon, 2005). A sound number sense will also form the basis for fraction computation in the later years. The types of strategies that have proven to be both effective and meaningful in their application include benchmarking and residual thinking (Clarke et al, 2008). Through using familiar fractions, decimals and percentages such as ‘half’ (1/2, 0.5 and 50%), students can make comparisons and develop the thinking of building up to the whole. It is widely recognised that students need opportunities to develop their understanding before learning specific procedures (Lamon, 2005; Clarke et al, 2008). Sharing strategies with each other through group work alongside putting these into contexts that are relatable and meaningful helps students develop a stronger understanding (Morge, 2011; Lamon, 2005).

Throughout developing new knowledge of fractions, decimals and percentages, a range of difficulties and misconceptions may arise. Many researchers identify how these concepts can be both challenging to learn and teach as it involves quite abstract ideas (Clarke et al, 2008; Van de Walle, 2010). A key
misconception that student’s hold stems from applying ideas formed with whole numbers.

**Understanding the relationship between the numerator and denominator** for instance, can be quite difficult, with students often thinking of each as a separate value. This is where partitioning and iterating can be useful for understand the meaning these (Van de Walle et al, 2010). Students also tend to believe that 1/5, for instance, is smaller than 1/10 as 5 is a smaller number, which may be addressed through the use of fraction walls (Clarke et al 2008; Van de Walle et al, 2010). With an unclear foundation in number and place value, decimals can be particularly difficult to grasp; misconceptions may arise with ordering decimals if base-ten concepts are not clear.

In becoming aware of these misconceptions and drawing upon the key insights discussed, there are many practical implications for teachers. Exploring these topics in a variety of contexts and connecting to real life experiences as much as possible is key (Van de Walle et al, 2010). Therefore, teachers will need to spend time exploring and assessing student’s prior knowledge, and be aware of relevant experiences and interests of the students. A particular focus might be on assessing whole number concepts and place value, which are important for bridging into fractions, decimals and percentages (Van de Walle et al, 2010).

As the use of models and other representations can support connections between fractions, decimals and percentages; teachers can consider which types of these will be relevant for their students. With the emphasis on creating meaningful understandings, teachers should not rush into algorithms (Van de Walle, 2010). As a result, planning for learning needs to include adequate time for open-ended activities that are student driven (Van de Wale. 2008). Teachers will therefore need to consider the balance between the explicit instructions they provide and opportunities for student lead learning.

Incorporating collaboration into the pedagogy calls for careful consideration into the way groups are structured, such as mixed ability groups. The learning environment will play a key role fostering students learning, so how the collaborative learning space will be set up, with what resources and visual models, and how students can access these will need to be planned for (Morge, 2011).
Overall, it appears fundamental for both teachers and students to link fractions, decimals and percentages wherever possible. Developing connections and fluency between different representations takes time; however, is valuable for student’s development (Clarke et al, 2008; Lamon, 2005). Experiences with multiple interpretations built upon prior knowledge embody the key insights found regarding the way fractions, decimals and percentages can be taught and understood.

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Learning trajectory;

Exploring equivalence in fractions, decimals and percentages

(Adapted from AusVELS and NCTM curriculum)
References


