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Investigating the teaching of fractions across the Intermediate Phase(Grade 4 to Grade 6): what range of sub-constructs is made available, and how are these connected?

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Abstract

This study was focused on the textbook presentation and teaching of fractions across the Intermediate Phase (Grade 4 to Grade 6) in one South African school. I investigated the teaching of fraction with a focus on the fraction sub-constructs identified in the literature (part-whole, quotient, measure, operator and rate and ratio) that are made available to learners, as well as how these sub-constructs are connected within teaching through the inclusion of what the fraction literature describes as fraction 'unifying elements' (partitioning, unitizing and notation of quantity). The motivation for the study was linked to the importance of fractions in the mathematics curriculum coupled with evidence of an emphasis in fractions teaching on disconnected procedures.

This research contributes to the existing research and literature by considering what fraction knowledge is made available for learners in terms of sub-constructs, unifying elements and cognitive demands. In the study, higher cognitive demand tasks were interpreted on the basis of tasks in which multiple sub-constructs were involved or where sub-constructs were connected with unifying elements. An in-depth analysis of textbook and enacted tasks across the three Intermediate Phase Grades 4-6 in one school focusing on fraction sub-constructs, the unifying elements and cognitive demands provided an understanding of what was made available to learn during fraction instruction.

Both the textbook and enacted task analyses revealed an overreliance on the part-whole sub-construct with pre-partitioned area models, tasks focused on single sub-constructs with little or no reference to the unifying elements, and limited numbers of tasks involving combinations of different sub-constructs. The written tasks made available to learners seldom or never included work with the unifying elements. This resulted in a large proportion of lower cognitive demand tasks in the textbooks and enacted tasks across the Grades. These findings suggest that if fraction instruction is to support learners to develop a connected, robust and complete understanding of fraction concepts, greater emphasis needs to be placed on the different sub-constructs and unifying elements in both textbooks and enactments. The fraction sub-constructs and the unifying elements play a vital role in developing this connected, robust and complete understanding of fractions.