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Baker, William J.; Czarnocha, Bronislaw; Dias, Olen; Doyle, Kathleen; Kennis, James R.; Prabhu, Vrunda

Procedural and conceptual knowledge: adults reviewing fractions.

Adults Learn. Math. 7, No. 2, 39-65 (2012).

Summary: In the United States a majority of the students who enroll in community colleges require a review of secondary math before they are eligible for college level mathematics. In the pre-algebra course, that has a high drop-out rate, the most difficult topic for students is fractions. In order to better understand the fraction concept Kieren separated it into five related sub-constructs. In Kieren's model the foundational sub-construct of part-whole provides a path to the sub-constructs of ratio, operator, quotient and measure. This model was previously investigated and found effective by Charalambous and Pitta Pantazi with children and Baker, Dias, Doyle, Czarnocha and Prabhu with adults. This article extends the earlier study of *W. Baker et al.* [Didactica Mathematicae 32, 5–41 (2009; ME 2013d.00404)] with adults by considering an alternate pathway to competency with operator and measure through multiplication and addition of fractions. This path is based upon Piaget's theories in which concepts develop through reflection upon corresponding procedures. The goal is to show that the path through direct extension of part-whole knowledge and the path through procedural knowledge work together and complement one another in explaining students' competency with operator and measure. An open question of whether measure is part of the multiplicative structure of fractions is also addressed using a mixed methodology of quantitative and qualitative analysis.

Classification: F48 C38

Keywords: adult education; research; teaching; learning; fractions; sub-constructs; operator; measure; part-whole concept; concept formation; conceptual knowledge; procedural knowledge; Piagetian theory; Kieren-Behr model; APOS; concept development; measurement; multiplicative reasoning
<http://www.alm-online.net/images/ALM/journals/almij-volume7-2-dec-2012.pdf>