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The rational number sub-constructs as a foundation for problem solving.

Summary: One of the many roles of two year community colleges in the United States is to bridge the gap between secondary school and college for students who graduate from high school with weak mathematics skills that prevent them from enrolling in college level mathematics courses. At community colleges remedial or developmental mathematics courses review the pre-algebra and/or algebra skills required for college level mathematics. Fractions are often cited as the most difficult topic for students due to their abstract nature. This study with adult pre-algebra students is based upon a teaching research experiment in which the Kieren's fraction sub-constructs of part-whole, ratio, operator, quotient, measure and the fractional equivalence were used as foundational concept knowledge during problem solving. In the first quantitative part of this study, students' proficiency with Kieren's rational number sub-constructs are used as independent variables in a multiple linear regression model to predict or explain students' competency in formal problem solving. This part of the study supplies hypothetical or statistical suggested pathways for students learning and transition from fraction concepts to proportional reasoning. Then in the second qualitative part of this study, transcripts from classroom lectures during the teaching research experiment are reviewed in order to understand how students used these rational number sub-constructs during problem solving with ratio, quotient, proportion, and percent.