Mathematics Assessment along Pre-K to Primary Learning Trajectories: From Rasch to Rule Space Models

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We describe the development and evaluation of a sequence of theoretically-based, empirically tested instruments designed to measure the mathematical knowledge and skills of children from 3 to 8 years of age. The first disseminated version was developed and evaluated via submission to the Rasch model. After using the data to refine the instrument, it fit the model well, with high reliability. These data also provided empirical support for the developmental progressions for most topics. Analyses lead to a second version, the TEAM, that was shorted and used computer-assisted administration and scoring. The third is a short form taking only a few minutes that resulted in similar satisfactory psychometrics and high correlations with the full instrument. Finally, we are presenting conducting cognitive and statistical analyses of this assessment using Q-Matrix theory, the Rule Space Method, and poset-based adaptive testing methodologies. We will produce a reduced and adaptive assessment that will take less than one-half the time to administer and yet will yield more useful and detailed information about children’s knowledge of mathematics, including their level of thinking along multiple empirically-validated developmental progressions and detailed cognitive profiles. In accomplishing this, we will evaluate, refine, and elaborate these cognitive developmental progressions; operationally define the cognitive attributes (e.g., concepts and skills) that constitute each levels of thinking in those progressions; and empirically evaluate the theoretical model that includes these attributes.