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The relative importance of two different mathematical abilities to mathematical achievement.

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Summary: Background: Two distinct abilities, mathematical reasoning and arithmetic skill, might make separate and specific contributions to mathematical achievement. However, there is little evidence to inform theory and educational practice on this matter. Aims: The aims of this study were (1) to assess whether mathematical reasoning and arithmetic make independent contributions to the longitudinal prediction of mathematical achievement over 5 years and (2) to test the specificity of this prediction. Sample: Data from Avon longitudinal study of parents and children (ALSPAC) were available on 2,579 participants for analyses of KS2 achievement and on 1,680 for the analyses of KS3 achievement. Method: Hierarchical regression analyses were used to assess the independence and specificity of the contribution of mathematical reasoning and arithmetic skill to the prediction of achievement in KS2 and KS3 mathematics, science, and English. Age, intelligence, and working memory (WM) were controls in these analyses. Results: Mathematical reasoning and arithmetic did make independent contributions to the prediction of mathematical achievement; mathematical reasoning was by far the stronger predictor of the two. These predictions were specific in so far as these measures were more strongly related to mathematics than to science or English. Intelligence and WM were non-specific predictors; intelligence contributed more to the prediction of science than of maths, and WM predicted maths and English equally well. Conclusions: There is clear justification for making a distinction between mathematical reasoning and arithmetic skills. The implication is that schools must plan explicitly to improve mathematical reasoning as well as arithmetic skills.

Classification: C30 C80

Keywords: intelligence; achievement; prediction; educational practices; short term memory; arithmetic; thinking skills; longitudinal studies; science achievement; English; tests; primary education

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