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Visuospatial Encoding in Algebraic Processing: Evidence from a Dual-Task Study

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Abstract

Algebraic competence is a critical foundation for advanced mathematical reasoning and success in STEM disciplines. However, whether algebraic processing relies on phonological or visuospatial encoding remains a central debate in cognitive psychology. We investigated the representational format of algebraic knowledge using a dual-task paradigm with 50 adult participants performing an algebra task concurrently with either a phonological or a visuospatial working memory (WM) task. While algebraic performance remained resilient under load, results revealed a selective interference effect on the secondary WM task: algebra significantly impaired visuospatial, but not phonological, WM performance. This impairment on visuospatial WM performance only suggests that algebra and visuospatial processing compete for a shared cognitive pathway, providing robust evidence for the visuospatial grounding of algebraic thinking.