

Memorizing Mathematics: The Failure to Apply Mathematical Axioms Within Restrictive Models

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Abstract: Arithmetic, along with all mathematics, is built on axioms. Mathematical education, however, favors mathematical models or algorithms without appeal to the axioms they depend on. Our series of studies demonstrate adult subjects' inability to take advantage of the knowledge embodied in arithmetic axioms. It is likely that students' ability to master generative proofs is related to the reliance on restrictive models.

Our first set of studies focused on subjects' ability to apply the addition-rule (mutually exclusive events) and the multiplication-rule (independent events) with multiple rational number representations (percentages, decimals, fractions, etc.). A second set of studies tested the understanding of group theory properties, exploiting the effect of the order of numbers (commutativity) and the effect of the digit zero (additive identity) on the long multiplication model (LMM). All studies conducted revealed participants ability to accurately perform arithmetic on chosen representation, but poor performance on choosing representation.